GEMEINSAME JAHRESTAGUNG
Österreichische und Schweizerische Physikalische Gesellschaft

18. - 22. August 2025, Universität Wien

JOINT ANNUAL MEETING
Austrian and Swiss Physical Society

18 - 22 August 2025, University of Vienna

Tagungsprogramm - Conference Program

INTERNATIONAL YEAR OF
Quantum Science
and Technology

Danksagungen - Acknowledgements

Wir danken...

- der Universität Wien als Gastgeberin der gemeinsamen Jahrestagung, der Fakultät für Physik und dem lokalen Organisationsteam für die Unterstützung.
- der Stadt Wien für die Unterstützung des Konferenzdinners.
- der Akademie der Naturwissenschaften Schweiz (SCNAT) für die Unterstützung der Tagungen und anderer Aktivitäten der SPG.
- der Schweizerischen Akademie der Technischen Wissenschaften (SATW) für die Unterstützung diverser Aktivitäten der SPG..
- den Stiftern der folgenden Preise:

  ABB Schweiz AG
  (SPG Preis in allgemeiner Physik)

  IBM Research Rüschlikon
  (SPG Preis in Physik der kondensierten Materie)

  Eidgenössisches Institut für Metrologie METAS
  (SPG Preis mit Bezug zur Metrologie)

  COMSOL Multiphysics GmbH
  (SPG Preis in computergestützter Physik)

  Hitachi Energy Switzerland AG
  (SPG Preis mit Bezug zur Energietechnik)

  Sensirion AG
  (SPG Preis auf dem Gebiet der Sensorik, Detektion und Überwachung)

  ID Quantique
  (SPG Preis auf dem Gebiet der Quantenwissenschaften und -technologie)

- den Firmen, die durch Inserate, Beilagen oder durch ihre Präsenz an der Ausstellung die Tagung unterstützen (S. 10 - 11).
- den Institutionen, die finanziell oder anderweitig zum Gelingen der Konferenz beitragen (S. 11).
- der Universität Basel für die durch die SPG genutzte Infrastruktur.

We thank...

- the University of Vienna as host of the Joint Annual Meeting, the Faculty of Physics and the local organizing team for the support.
- the City of Vienna for supporting the conference dinner.
- the Swiss Academy of Sciences (SCNAT) for the support of the conferences and further activites of the SPS.
- the Swiss Academy of Technical Sciences (SATW) for the support of various activities of the SPS.
- the sponsors of the following awards:

  ABB Schweiz AG
  (SPS Award in General Physics)

  IBM Research Rüschlikon
  (SPS Award in Condensed Matter Physics)

  Federal Institute for Metrology METAS
  (SPS Award with relation to Metrology)

  COMSOL Multiphysics GmbH
  (SPS Award in Computational Physics)

  Hitachi Energy Switzerland AG
  (SPS Award with relation to Enery Technology)

  Sensirion AG
  (SPS Award in the field of Sensing, Detection and Monitoring)

  ID Quantique
  (SPS Award in the field of Quantum Science and Technology)

- the companies supporting the conference by advertisements, supplements or their presence at the exhibition (p. 10 - 11).
- .the institutions contributing financally or by other means to the success of the conference (p. 11).
- the University of Basel for the SPS being able to use the infrastructure.

GEMEINSAME JAHRESTAGUNG

Österreichische und Schweizerische Physikalische Gesellschaft

18. - 22. August 2025, Universität Wien

JOINT ANNUAL MEETING

Austrian and Swiss Physical Society

18 - 22 August 2025, University of Vienna

Kurzprogramm - Short Program

in Zusammenarbeit mit - in collaboration with

universität wien

TECHNISCHE UNIVERSITÄT WIEN

ÖAW ÖSTERREICHISCHE AKADEMIE DER WISSENSCHAFTEN

Institute of Science and Technology Austria

Bulletin SPG / SSP Vol 41, 2025, ÖPG Tagungsband Nr. 74

Navigation
Vom Inhaltsverzeichnis gelangen Sie durch klicken auf eine Seitenzahl direkt zur gewünschten Stelle. Umgekehrt führt ein Klick auf eine Seitenzahl im Kopf wieder zurück zum Inhaltsverzeichnis.

Navigation
Clicking on a page number in the table of contents brings you directly to the respective page. Vice versa, clicking on a page number in the header leads back to the table of contents.

Letzte Aktualisierung des Programms - Last update of the program

21.08.2025

Tagungsorganisation

SPG: *S. Albietz, T Montaruli*, sowie die Leiter der Fachsektionen
CHIPP: *A. Benelli*

ÖPG: *C. Teichert*, *A. Bonanni* sowie die Leiter der Fachausschüsse
Lokale Organisation: *A. Stepper*, *M. Aspelmeyer*

Inhalt - Content

Allgemeine Tagungsinformationen - General Conference Information

Konferenzwebseite und Anmeldung
www.sps.ch , oepg-sps-meetingvienna2025.univie.ac.at

Tagungsort
Universität Wien, Hauptgebäude, Universitätsring 1, 1010 Wien

Tagungssekretariat
Das Tagungssekretariat befindet sich im 1. Stock beim Durchgang zum großen Festsaal.
Öffnungszeiten:

Mo 18.08. + Mi 20.08.	08:00 - 16:00
Di 19.08 + Do 21.08.	08:00 - 18:00
Fr 22.08.	08:00 - 13:00

Das Programm am Montag 18. August ist von der Konferenzgebühr ausgenommen. Für die anderen Tage gilt: Alle Tagungsteilnehmer melden sich bitte zwingend vor dem Besuch der ersten Veranstaltung beim Sekretariat an, wo sie ein Namensschild und allfällige weitere Unterlagen erhalten sowie die Tagungsgebühr bezahlen.
Wichtig: Ohne Namensschild ist kein Zutritt zu einer Veranstaltung möglich.

Hörsäle
In allen Hörsälen stehen Projektoren zur Verfügung. Sie können direkt Ihre eigenen Mobilrechner anschließen. Die gängigen Adapter (HDMI, VGA, ...) sind vorhanden. Bringen Sie ggf. Adapter und USB Stick mit.

Postersitzung
Die Postersitzung findet am am Mittwoch Nachmittag im Arkadenhof statt. Die Posterwände sind entsprechend diesem Programm numeriert, sodaß jeder Teilnehmer "seine" Wand leicht finden sollte.

Poster können entweder bereits am Montag oder Dienstag am Tagungssekretariat abgegeben werden oder am Mittwoch während der Mittagspause bis spätestens Beginn der Sitzung selber aufgehängt werden. Es darf ausschließlich das vor Ort verfügbare doppelseitige Klebeband benutzt werden. Die Poster müssen während der ganzen Sitzung ausgestellt bleiben und zwingend an deren Ende wieder entfernt werden. Nicht abgenomme Poster werden ohne Rücksprache entsorgt.

Conference web site and registration
www.sps.ch , oepg-sps-meetingvienna2025.univie.ac.at

Location
Universität Wien, Hauptgebäude, Universitätsring 1, 1010 Wien

Registration Desk
The registration desk is situated on the first floor, in the hall leading to the "Großer Festsaal".
Opening Hours:

Mon 18.08. + Wed 20.08.	08:00 - 16:00
Tue 19.08. + Thu 21.08.	08:00 - 18:00
Fri 22.08.	08:00 - 13:00

The program on Monday 18 August is exempt from the conference fees. On all other days: All participants must imperatively report at the registration desk before visiting any session. You will receive your name badge, possible further documents and can pay still due conference fees.
Attention: Without badge, entry to the lecture rooms will be refused.

Lecture Rooms
All rooms are equipped with projectors. You may connect your own laptop. The most common adapters (HDMI, VGA, ...) are available. If need be, bring your own adapter and USB-key.

Postersession
The postersession will take place on Wednesday afternoon in the Arkadenhof. The poster boards are numbered according to this program, so every participant will find their board easily.

Posters can already be deposited on Monday or Tuesday at the registration desk, or be mounted by yourself on Wednesday during lunch break, at latest before the begin of the session. Only the provided double-sided tape is allowed. The posters are expected to be on display during the whole session and must be unmounted imperatively at its end. Remaining posters will be disposed of without further consultation.

Preise gültig bei Zahlung nach 01. Juli - Fees valid for payments done after1 July	
Kategorie - Category	**EUR**
Einzelmitglieder von SPG, ÖPG, CHIPP - Individuels members of SPS, ÖPG, CHIPP	200.-
Studenten (Mitglieder) VOR Master/Diplom Abschluß - Student members BEFORE master/ diploma degree	120.-
Nicht-Mitglieder - Non-members	280.-
Studenten (Nichtmitglieder) VOR Master/Diplom Abschluß - Students BEFORE master/diploma degree	200.-
Plenarsprecher, Eingeladene Sprecher, Preisträger - Plenary and invited speakers, awardees	0.-
Konferenz Abendessen - Conference Dinner	80.-

Maximale Postergröße: A0 Hochformat.

Die besten Poster werden am Freitag um 12:30h in einer kleinen Zeremonie ausgezeichnet.

Zahlung

Wir bitten Sie, die Tagungsgebühren im Voraus zu bezahlen. Sie verkürzen damit die Wartezeiten am Tagungssekretariat, erleichtern uns die Arbeit und sparen darüber hinaus noch Geld !
Die Angaben zur Zahlung werden während der Anmeldung direkt auf der Webseite angezeigt.

Am Tagungssekretariat kann nur mit Kreditkarte bzw. online bezahlt werden.

ACHTUNG: Die Rückerstattung von Tagungsgebühren kann nur gemäß den Konditionen, die in der Anmeldebestätigung angegeben sind, erfolgen.

Kaffeepausen, Mittagessen

Die Kaffeepausen finden im Kleinen Festsaal bei der Händlerausstellung statt. Der die Postersitzung begleitende Apéro (Mittwoch) wird im Arkadenhof abgehalten. Diese Leistungen sind in der Konferenzgebühr enthalten.
Für das Mittagessen können umliegende Restaurants oder "Barke's Audimax Café" genutzt werden.

Konferenz-Abendessen

Das Abendessen findet am Donnerstag im Wappensaal des Rathauses Wien im Anschluß an die Parallelsitzungen statt. Der Preis beträgt EUR 80.- pro Person (beinhaltet, 3-Gänge Menü und Getränke). Die Anzahl der Plätze ist limitiert, bitte registrieren Sie sich unbedingt im Voraus, damit wir disponieren können. Eine Anmeldung vor Ort ist nicht möglich !

Maximum poster size: A0 portrait.

The winners of the best poster prizes will be awarded on Friday 12:30h in a small ceremony.

Payment

We ask you to pay the conference fees in advance. This way you shorten waiting time at the registration desk, facilitate our work and save even money!
Payment details are shown directly during registration on the conference website.

At the registration desk you can pay only with credit cards or online.

ATTENTION: Refunding of conference fees is only possible according to the conditions mentioned in the registration confirmation.

Coffee Breaks and Lunch

The coffee breaks will take place in the Kleine Festsaal near the industrial exhibition. The aperitif accompagnying the postersession (Wednesday) will be situated in the Arkadenhof. These services are covered by the conference fee.
Nearby restaurants or "Barke's Audimax Café" are at your disposal for lunch.

Conference Dinner

The dinner will take place on Thursday in the Wappensaal of the City Hall Vienna after the parallel sessions. The fee is EUR 80.- per person (including 3-course meal and drinks). The number of places is limited. Please register in any case in advance so we can plan accordingly. A registration on site is not possible!

Anreise und Unterkunft

Alle Informationen zur Anreise und Hotelreservation finden Sie auf der Konferenz-Webseite.

Internet

Während der gesamten Konferenz steht für die Teilnehmer Internet Zugang über das ***eduroam*** Netzwerk bereit.
Personen ohne Zugang zu ***eduroam*** erhalten Gutscheine mit WLAN Anmeldedaten am Tagungssekretariat.

Young Minds Get-together

Die ÖPG *Young Minds* veranstalten am Mittwoch Abend ein Get-together, welches den Konferenztag gebührend ausklingen und Gespräche aus der Postersitzung in einer netten Bar "um die Ecke" fortsetzen lässt. Die Besucher erwartet ein unterhaltsames (freiwilliges) Pub-Quiz, und angemeldete Mitglieder von ÖPG und SPG erhalten ein Gratis Getränk (Gutscheine sind am Tagungssekretariat erhältlich).

Der Anlass findet in der *underdog.bar*, Schlösselgasse 24, 1080 Wien statt, Beginn 20:00h.

Laborbesichtigungen

Am Freitag Nachmittag werden nach Konferenzende von der Fakultät für Physik der Universität Wien noch Laborbesichtigungen angeboten. Weitere Informationen und Anmeldelisten für die verschiedenen Führungen sind am Tagungssekretariat verfügbar.

Arrival and Accomodation

All information on arrival and hotel reservation can be found on the conference webpage.

Internet

During the whole conference the ***eduroam*** wireless network is available for the participants.
Persons without access to ***eduroam*** will obtain vouchers with WIFI access data at the registration desk.

Young Minds Get-together

The ÖPG *Young Minds* organise on Wednesday evening a Get-together, which allows to put a great end to the conference day and continue the chats started during the postersession in a nice bar "around the corner". The visitors can expect a fun (voluntary) pub-quiz, and registered members of ÖPG und SPS will receive a free drink (vouchers can be obtained at the registration desk).

The event will take place in the *underdog.bar*, Schlösselgasse 24, 1080 Wien. Begin 20:00h.

Lab Tours

On Friday afternoon after the conference end the Faculty of Physics of the University of Vienna offers several Lab tours. Further Information and admission lists for the various tours are available at the registration desk.

Aussteller - Exhibitors

mechOnics ag
DE-33100 Paderborn
www.mechOnics.de

Menlo Systems GmbH
DE-82152 Martinsried
www.menlosystems.com

Oxford Instruments GmbH
DE-65205 Wiesbaden
www.oxinst.com

Pfeiffer Vacuum Austria GmbH
AT-1150 Wien
www.oxinst.com

Springer Verlag GmbH
DE-69115 Heidelberg
www.springer.com

TOPTICA Photonics AG
DE-82166 Gräfelfing
www.toptica.com

Zurich Instruments AG
CH-8005 Zürich
www.zhinst.com

Inserate und Unterstützer - Advertisements and Supporters

Allectra GmbH
DE-16567 Schönfliess
www.allectra.com

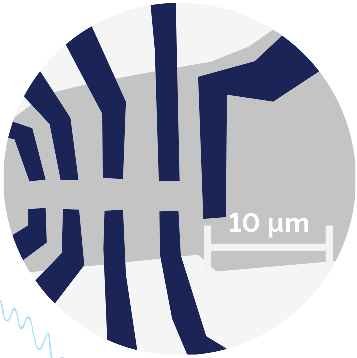
attocube systems AG
DE-85540 Haar
www.attocube.com

teltec systems AG
CH-5620 Bremgarten
www.teltec.ch

Wiley-VCH GmbH
DE-69469 Weinheim
advanced.onlinelibrary.wiley.com

TeslatronPT Plus

Open-Architecture Low Temperature Measurement System



Measurement.
Made Simple

Measurement.
Made Flexible

Measurement.
Made Future-proof

Visit: nanoscience.oxinst.com/products/teslatronptplus

Tagungsübersicht - Conference Overview

Generalversammlungen - General Assemblies

Montag 18. August 2025, 18:00h - Monday 18 August 2025, 18:00h

ÖPG	SPG - SSP - SPS
HS 31	***HS 30***

Preisverleihungen - Award Ceremonies

ÖPG Preise, SPG Preise, Charpak-Ritz Preis
ÖPG Awards, SPS Awards, Charpak-Ritz Award

Dienstag 19. August 2025, 11:00h, Großer Festsaal -
Tuesday 19 August 2025, 11:00h, Großer Festsaal

Preise für die besten Poster - Best Poster Awards

Freitag 22. August 2025, 12:30h, Großer Festsaal -
Friday 22 August 2025, 12:30h, Großer Festsaal

Montag, 18. August 2025 - Monday, 18 August 2025

TIME	Rooms: Großer Festsaal	Senatssaal		TIME
08:00				08:00
08:15				08:15
08:30				08:30
08:45	**Energy Day**			08:45
09:00	1 Anna Fontcuberta i Morral (p)			09:00
09:15				09:15
09:30				09:30
09:45	2 Bruno Michel (i)			09:45
10:00				10:00
10:15				10:15
10:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	10:30
10:45				10:45
11:00	3 Siegfried Höfinger (i)			11:00
11:15				11:15
11:30	4 Valentin Hirschbrich (i)			11:30
11:45				11:45
12:00	5 Panel Discussion	**Women in Physics**		12:00
12:15		**Career Symposium**		12:15
12:30	***Lunch***	*Fingerfood for participants of the*	***Lunch***	12:30
12:45		*Symposium*		12:45
13:00				13:00
13:15		21 Francesca Primas (p)		13:15
13:30	**Symposium**			13:30
13:45	**100 Years of Quantum Physics**			13:45
14:00	11 Christoph Lehner (p)	22 Beatrix Hiesmayr (i)		14:00
14:15				14:15
14:30		23 Kimberly Modic (i)		14:30
14:45	12 David Kaiser (p)			14:45
15:00		24 Interactive Career Workshop		15:00
15:15		with Francesca Primas		15:15
15:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	15:30
15:45	***Welcome Reception***	***Welcome Reception***	***Welcome Reception***	15:45
16:00	13 Alyssa Ney (p)	Workshop continued		16:00
16:15				16:15
16:30				16:30
16:45	14 Beatrix Hiesmayr (p)			16:45
17:00		25 Anna Spindelberger (i)		17:00
17:15				17:15
17:30	***Welcome Reception***	26 Rachel Grange (i)		17:30
17:45				17:45
18:00		***Welcome Reception***		18:00
18:15				18:15
18:30				18:30
18:45	**Public Evening Talk**			18:45
19:00	15 Thomas Feurer (p)			19:00
19:15				19:15
19:30				19:30
19:45				19:45
20:00				20:00
20:15				20:15

(p) = Plenary Talk, (i) = Invited talk

TIME	Rooms		TIME
	HS 30	HS 31	
08:00	**SPS Board Meeting**	**ÖPG Board Meeting**	08:00
08:15			08:15
08:30			08:30
08:45			08:45
09:00			09:00
09:15			09:15
09:30			09:30
09:45			09:45
10:00			10:00
10:15			10:15
10:30	***Coffee Break***	***Coffee Break***	10:30
10:45			10:45
11:00			11:00
11:15			11:15
11:30			11:30
11:45			11:45
12:00			12:00
12:15			12:15
12:30	***Lunch***	***Lunch***	12:30
12:45			12:45
13:00			13:00
13:15			13:15
13:30			13:30
13:45			13:45
14:00			14:00
14:15			14:15
14:30			14:30
14:45			14:45
15:00			15:00
15:15			15:15
15:30	***Coffee Break***	***Coffee Break***	15:30
15:45	***Welcome Reception***	***Welcome Reception***	15:45
16:00			16:00
16:15			16:15
16:30			16:30
16:45			16:45
17:00			17:00
17:15			17:15
17:30			17:30
17:45			17:45
18:00	**SPS GENERAL ASSEMBLY**	**ÖPG GENERAL ASSEMBLY**	18:00
18:15			18:15
18:30			18:30
18:45			18:45
19:00			19:00
19:15			19:15
19:30			19:30
19:45			19:45
20:00			20:00
20:15			20:15

Dienstag, 19. August 2025 - Tuesday, 10 August 2025

TIME	Rooms			TIME
	Großer Festsaal	Senatssaal	Erika Weinzierl Saal	
08:00	*Registration*			08:00
	PLENARY SESSION			
	Conference Opening			
09:00	31 Caslav Brukner (p)			09:00
09:15				09:15
09:30				09:30
09:45	32 Daniel Loss (p)			09:45
10:00				10:00
10:15				10:15
10:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	10:30
10:45				10:45
11:00	**AWARD CEREMONY**			11:00
11:15				11:15
11:30				11:30
11:45				11:45
12:00	33 Nicolas Sangouard (i)			12:00
12:15				12:15
12:30	34 Paul Worm (i)			12:30
12:45				12:45
13:00	***Lunch***	***Lunch***	***Lunch***	13:00
13:15				13:15
13:30				13:30
13:45				13:45
	FAKT – TASK I	**FAKT – TASK III**	**History and Philosophy of Physics**	
14:00	301 Johannes Alexander Jaeger	321 Saba Parsa	61 Sonja Draxler	14:00
14:15	302 Gian Luca Caratsch	322 Jan Kunzmann	62 Heinz Krenn	14:15
14:30	303 Lea Segner	323 Vedantha Kasturi	63 Marina Passaro	14:30
14:45	304 Nikolaus von Schickh	324 Gloria Senatore	64 Guy Hetzroni	14:45
15:00	305 Pranas Juknevicius	325 Jeremy Atkinson	65 Ion Mihailescu	15:00
15:15	306 Bastien Lacave	326 Jens Burkhart	66 *cancelled*	15:15
15:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	15:30
15:45				15:45
	FAKT – TASK II	**FAKT – TASK IV**	**Accelerator Science and Technology**	
16:00	312 Anastasia Doinaki	331 Felix Wagner (i)	481 Bernhard Auchmann	16:00
16:15	313 Alina Weiser	332 Maximilian Fahrecker	482 Joep van den Eijnden	16:15
16:30	314 Carina Killian	333 Richard Diurba	483 Matteo Crescenti	16:30
16:45	315 Marcus Bumbar	334 Garance Lankester-Broche	484 Milica Rakic	16:45
17:00	316 Martin Simon	335 Luisa Hötzsch	485 Matthias Kausel	17:00
17:15	317 Francesco Lancellotti	336 Mariano Cababie	487 Jesus Avila Pulido	17:15
17:30	318 *cancelled*	337 Dominik Fuchs	488 Simon Buijsman	17:30
17:45		338 Lucas Mollier	489 Lode Vanhecke	17:45
18:00		339 Sana Ouahada		18:00
18:15	***Transfer to ÖAW***			18:15
18:30				18:30
18:45	**Public Evening Talk**			18:45
19:00	35 Claus Beisbart (p)			19:00
19:15				19:15
19:30				19:30
19:45				19:45
20:00				20:00
20:15				20:15
20:30				20:30

(p) = Plenary talk, (i) = Invited talk

311 *cancelled*

486 *cancelled*

TIME	HS 30	HS 31	HS 33	TIME
	Rooms			
08:00	Registration			08:00
09:00				09:00
09:15				09:15
09:30				09:30
09:45				09:45
10:00				10:00
10:15				10:15
10:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	10:30
10:45				10:45
11:00				11:00
11:15				11:15
11:30				11:30
11:45				11:45
12:00				12:00
12:15				12:15
12:30				12:30
12:45				12:45
13:00	***Lunch***	***Lunch***	***Lunch***	13:00
13:15				13:15
13:30				13:30
13:45				13:45
	Physics at Neutron and Synchrotron Sources	**KOND I**	**KOND III**	
14:00	781 Florian Lachaume	101 Karel Vyborny (k)	111 Luca Banszerus (k)	14:00
14:15	782 Heinz Amenitsch			14:15
14:30	783 Fareeha Hameed	102 Amalio Fernandez-Pacheco (i)	112 Vikas Remesh (i)	14:30
14:45	784 Rainer T. Lechner			14:45
15:00	785 Matthias Weinberger	103 David Santos-Cottin	113 David García Pons	15:00
15:15	786 Roland Resel		114 Umair Javed	15:15
15:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	15:30
15:45				15:45
	Energy, Sustainability & Environment	**KOND II**	**KOND IV**	
16:00	501 Yunfei Teng (i)	105 Mirta Herak (k)	121 Fabian Natterer (k)	16:00
16:15				16:15
16:30	502 Karin Hain	106 Juraj Krempasky (i)	122 Toma Susi (i)	16:30
16:45	503 Vito Fabian Pecile			16:45
17:00	504 Felix Korbelius	107 František Herman (i)	123 Christian Teichert (i)	17:00
17:15	505 Luisa Stöckl			17:15
17:30	506 Stephan Preisinger	108 Jonas A. Krieger	124 Petra Đurkas Grozić	17:30
17:45	507 Christoph Reichl	109 Matija Culo	125 Konrád Kandrai	17:45
18:00				18:00
18:15	***Transfer to ÖAW***			18:15
18:30				18:30
18:45				18:45
19:00				19:00
19:15				19:15
19:30				19:30
19:45				19:45
20:00				20:00
20:15				20:15
20:30				20:30

(k) = Keynote, (i) = Invited talk

TIME	Rooms		TIME
	Elise Richter Saal	HS 27	
08:00	*Registration*		08:00
09:00			09:00
09:15			09:15
09:30			09:30
09:45			09:45
10:00			10:00
10:15			10:15
10:30	***Coffee Break***	***Coffee Break***	10:30
10:45			10:45
11:00			11:00
11:15			11:15
11:30			11:30
11:45			11:45
12:00			12:00
12:15			12:15
12:30			12:30
12:45			12:45
13:00	***Lunch***	***Lunch***	13:00
13:15			13:15
13:30			13:30
13:45			13:45
	Applied Physics I	**Physics and School I**	
14:00	551 David Krebs	71 *ABA – Preisträgervorträge 2025 der ÖPG **	14:00
14:15	552 Filipp Lausch		14:15
14:30	553 Karin Hain		14:30
14:45	554 Jakub Jurczyk	72 *Vorstellung IYPT Tournament*	14:45
15:00	555 Alexander Redl	73 *Vorstellung Physikolympiade*	15:00
15:15	556 Michael Goddijn		15:15
15:30	***Coffee Break***	***Coffee Break***	15:30
15:45			15:45
	Applied Physics II	**Physics and School II**	
16:00	561 Kristýna Davídková	74 Rahel Schmid (i)	16:00
16:15	562 Stefania Isceri		16:15
16:30	563 Juan David Munoz Bolanos	75 Hans Peter Dreyer	16:30
16:45	564 David Breitenmoser (i)	76 Andreas Eggenberger	16:45
17:00		77 Henrik Siboni	17:00
17:15	565 Carlos Vivo-Vilches	78 Christian Binder	17:15
17:30	566 Sergio Garcia Herreros	79 Ille C. Gebeshuber	17:30
17:45	567 Alysée Khan		17:45
18:00	568 Jean-Pierre Eckmann		18:00
18:15	***Transfer to ÖAW***		18:15
18:30			18:30
18:45			18:45
19:00			19:00
19:15			19:15
19:30			19:30
19:45			19:45
20:00			20:00
20:15			20:15
20:30			20:30

(i) = Invited talk, * = 50 min

TIME	Rooms: HS 2	Rooms: HS 7	TIME
08:00	*Registration*		08:00
09:00			09:00
09:15			09:15
09:30			09:30
09:45			09:45
10:00			10:00
10:15			10:15
10:30	***Coffee Break***	***Coffee Break***	10:30
10:45			10:45
11:00			11:00
11:15			11:15
11:30			11:30
11:45			11:45
12:00			12:00
12:15			12:15
12:30			12:30
12:45			12:45
13:00	***Lunch***	***Lunch***	13:00
13:15			13:15
13:30			13:30
13:45			13:45
	Surfaces, Interfaces and Thin Films I	**KOND V**	
14:00	701 David Rath (i)	131 Andrey Mishchenko (i)	14:00
14:15			14:15
14:30	702 Ulrike Diebold	132 Gheorghe Lucian Pascut (i)	14:30
14:45	703 Francesco Presel		14:45
15:00	704 Jan Balajka	133 Arjun Dey	15:00
15:15	705 David Kugler	134 Zoran Rukelj	15:15
15:30	***Coffee Break***	***Coffee Break***	15:30
15:45			15:45
	Surfaces, Interfaces and Thin Films II	**KOND VI**	
16:00	711 Martin Sterrer	141 Danko Radić (k)	16:00
16:15	712 Maximilian Laßhofer		16:15
16:30	713 Giada Franceschi	142 Denis Karl Sunko (i)	16:30
16:45	714 Sarah Tobisch		16:45
17:00	715 Sumea Klokic	143 Zurab Guguchia (i)	17:00
17:15	716 Sarang Bhasme		17:15
17:30	717 Faith Lewis	144 Sophie Beck	17:30
17:45	718 Ali Rafsanjani-Abbasi	145 Viktor Christiansson	17:45
18:00	719 Tetiana Zakusylo		18:00
18:15	***Transfer to ÖAW***		18:15
18:30			18:30
18:45			18:45
19:00			19:00
19:15			19:15
19:30			19:30
19:45			19:45
20:00			20:00
20:15			20:15
20:30			20:30

(k) = Keynote, (i) = Invited talk

Mittwoch, 20. August 2025 - Wednesday, 20 August 2025

TIME	Rooms Großer Festsaal	TIME
08:00	*Registration*	08:00
	PLENARY SESSION: Symposium ERC Funding in Quantum Science	
08:30	*Opening Remarks*	08:30
09:00	36 Francesca Ferlaino (p)	09:00
09:15		09:15
09:30		09:30
09:45	37 Yiwen Chu (p)	09:45
10:00		10:00
10:15		10:15
10:30	***Coffee Break***	10:30
10:45		10:45
11:00	38 Jaksa Vucicevic (i)	11:00
11:15		11:15
11:30	39 Dragan Mihailović (i)	11:30
11:45		11:45
12:00	40 Shahal Ilani (i)	12:00
12:15		12:15
12:30	***Lunch***	12:30
12:45		12:45
13:00		13:00
13:15		13:15
13:30		13:30
13:45		13:45
	PLENARY SESSION: Symposium ERC Funding in Quantum Science	
14:00	41 Serge Haroche (p)	14:00
14:15		14:15
14:30		14:30
14:45	*42 Panel discussion: "From blue sky research to quantum technologies"*	14:45
15:00		15:00
15:15		15:15
15:30		15:30
15:45	Exhibitor Presentation Session	15:45
16:00	***Poster Session and Apéritif***	16:00
16:15		16:15
16:30		16:30
16:45		16:45
17:00		17:00
17:15		17:15
17:30		17:30
17:45		17:45
18:00		18:00
18:15		18:15
18:30		18:30
18:45		18:45
19:00		19:00
19:15		19:15
19:30		19:30
19:45		19:45
20:00	*Young Minds Get-together*	20:00
23:00		23:00

(p) = Plenary talk, (i) = Invited talk

Donnerstag, 21. August 2025 - Thursday, 21 August 2025

TIME	*Rooms* Großer Festsaal	Senatssaal	Erika Weinzierl Saal	TIME
08:00	*Registration*			08:00
	PLENARY SESSION	**FAKT – TASK VIII**		
09:00	43 Martin Hoferichter (p)			09:00
09:15				09:15
09:30				09:30
09:45	44 Clemens Rössler (p)			09:45
10:00				10:00
10:15				10:15
10:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	10:30
10:45				10:45
11:00	45 Urban Senica (i)	371 Jona Motta		11:00
11:15		372 Una Alberti		11:15
11:30	46 Marco Coraiola (i)	373 Silke Möbius		11:30
11:45		375 Valentin Hirschi		11:45
12:00	47 Gabriele Pasquale (i)	376 Giovanni Celotto		12:00
12:15		377 Fanqiang Meng		12:15
12:30	***Lunch***	***Lunch***	***Lunch***	12:30
12:45				12:45
13:00				13:00
13:15				13:15
13:30				13:30
13:45				13:45
	FAKT – TASK VI	**FAKT – TASK IX**	**Gravitational Waves I**	
14:00	351 Filip Bilandzija	381 Rita De Sousa Ataide Da Silva	461 G. Inguglia, S. Schramm *	14:00
14:15	352 Jona Motta	382 Thomas Bergauer	462 Ulyana Dupletsa *	14:15
14:30	353 Silke Möbius	383 Jou An Chen		14:30
14:45	354 Thomas Christian Senger	384 Sebastian Onder	463 Steven Schramm *	14:45
15:00	355 Aravindhan Venkateswaran	385 Bernd Carmann	464 Gianluca Inguglia *	15:00
15:15	356 Joachim Bosina	386 Kerim Guseinov		15:15
15:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	15:30
15:45				15:45
	FAKT – TASK VII	**FAKT – TASK X**	**Gravitational Waves II**	
16:00	361 Gernot Eichmann	391 Alexandre Brea Rodríguez	466 Stefan Strub *	16:00
16:15	362 Thomas Ranner	392 Nikolaus Schneider	467 Niklas Houba *	16:15
16:30	363 Kayran Schmidt	393 Xiafei Chang		16:30
16:45	364 Florian Lindenbauer	394 Pasquale Andreola	468 Michele Vallisneri *	16:45
17:00	365 Rudi Rahn	395 Dimitrios Kaminaris		17:00
17:15	366 Andre Hoang	396 Pierre Mayencourt		17:15
17:30	367 Axel Maas	397 Luis Miguel Garcia Martin		17:30
17:45	368 Ali Riahinia	398 Raphael van Laak		17:45
18:00				18:00
18:15	***Transfer to Dinner***			18:15
18:30				18:30
18:45				18:45
19:00	***Conference Dinner***			19:00
19:15				19:15
22:00				22:00

(p) = Plenary talk, (i) = Invited talk, * = 20 min talk

374 *cancelled*	465 *cancelled*

TIME	HS 30	HS 31	HS 33	TIME
	Rooms			
08:00	Registration			08:00
	FAKT – TASK V	**KOND VII**	**KOND X**	
09:00				09:00
09:15				09:15
09:30				09:30
09:45				09:45
10:00				10:00
10:15				10:15
10:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	10:30
10:45				10:45
11:00	341 Florian Hechenberger (i)	151 Matjaž Gomilšek (k)	181 Nada Mrkyvkova (k)	11:00
11:15	342 Jonas Mager			11:15
11:30	343 Emilis Kaziukenas	152 Levente Rózsa (i)	182 Kurt Hingerl	11:30
11:45	344 Ettore Zaffaroni		183 Juan Felipe Pulgarin Mosquera	11:45
12:00	345 Seraphine Marti	153 Sebastian Knauer	184 Rajdeep Adhikari	12:00
12:15	346 Manbing Li	154 Fabian Majcen	185 Johannes Aberl	12:15
12:30	***Lunch***	***Lunch***	***Lunch***	12:30
12:45				12:45
13:00				13:00
13:15				13:15
13:30				13:30
13:45				13:45
	Progress in Material Sciences – from Lab to Industry I	**KOND VIII**	**KOND XI**	
14:00	81 Doris Steinmüller-Nethl * (i)	161 Dávid Szaller (k)	191 Jeroen Custers (i)	14:00
14:15	82 Georgios Christides * (i)			14:15
14:30		162 Yona Soh (i)	192 Johan Chang (i)	14:30
14:45	83 Stephan Wirths * (i)			14:45
15:00	84 Andreas Kretschmer *	164 Pietro Brighi	193 Valeska Zambra	15:00
15:15			194 Leonardo Martinelli	15:15
15:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	15:30
15:45				15:45
	Progress in Material Sciences – from Lab to Industry II	**KOND IX**	**KOND XII**	
16:00	85 Wooseok Choi * (i)	171 Peter Nemes-Incze (k)	201 Jiří Chaloupka (k)	16:00
16:15	86 Arno Plankensteiner * (i)			16:15
16:30		172 Mario Novak (i)	202 Mihael S. Grbic (i)	16:30
16:45	87 Barbara Stadlober * (i)			16:45
17:00	88 Clemens Ostermaier * (i)	173 Gaurav Pransu	203 Nicholas Plumb (i)	17:00
17:15	89 Marcus Jahn * (i)	174 Petar Popčević		17:15
17:30		176 Carlos Antonio Fernandes Vaz	204 Pavol Neilinger	17:30
17:45				17:45
18:00				18:00
18:15	***Transfer to Dinner***			18:15
18:30				18:30
18:45				18:45
19:00	***Conference Dinner***			19:00
19:15				19:15
22:00				22:00

(k) = Keynote, (i) = Invited talk, * = 20 min talk

163	*cancelled*
175	*cancelled*

TIME	Elise Richter Saal	HS 27	TIME
	Rooms		
08:00	*Registration*		08:00
09:00			09:00
09:15			09:15
09:30			09:30
09:45			09:45
10:00			10:00
10:15			10:15
10:30	***Coffee Break***	***Coffee Break***	10:30
10:45			10:45
11:00			11:00
11:15			11:15
11:30			11:30
11:45			11:45
12:00			12:00
12:15			12:15
12:30	***Lunch***	***Lunch***	12:30
12:45			12:45
13:00			13:00
13:15			13:15
13:30			13:30
13:45			13:45
	Atomic Physics and Quantum Optics I		
14:00	601 Jodok Happacher (i)		14:00
14:15			14:15
14:30	602 Tobias Kehrer		14:30
14:45	603 Johannes Krondorfer		14:45
15:00	604 Antonin Jaros		15:00
15:15	605 Aleksei Konovalov		15:15
15:30	***Coffee Break***	***Coffee Break***	15:30
15:45			15:45
	Atomic Physics and Quantum Optics II	**Correlated Quantum Materials and Solid State Quantum Systems**	
16:00	611 Helmut Ritsch	871 Silke Bühler-Paschen	16:00
16:15		872 Frederic Bippus	16:15
16:30	612 Richard Ferstl	873 Federico Mazza	16:30
16:45	613 Fabian Maier	874 Priyanka Reddy	16:45
17:00	614 Severin Sindelar	875 Chao Shen	17:00
17:15	615 Mathias Kolb	876 Hamza Nasir	17:15
17:30	616 Rafael T. Winkler	877 Maksim Borovkov	17:30
17:45	617 Hannah Foltas	*Discussion*	17:45
18:00			18:00
18:15	***Transfer to Dinner***		18:15
18:30			18:30
18:45			18:45
19:00	***Conference Dinner***		19:00
19:15			19:15
22:00			22:00

(i) = Invited talk

618 *cancelled*

TIME	Rooms		TIME
	HS 2	HS 7	
08:00	Registration		08:00
	Surfaces, Interfaces and Thin Films III		
09:00			09:00
09:15			09:15
09:30			09:30
09:45			09:45
10:00			10:00
10:15			10:15
10:30	***Coffee Break***	***Coffee Break***	10:30
10:45			10:45
11:00	721 Anna Niggas (i)		11:00
11:15			11:15
11:30	722 Florian Simperl		11:30
11:45	723 Martina Fellinger		11:45
12:00	724 Máté Podráczki		12:00
12:15			12:15
12:30	***Lunch***	***Lunch***	12:30
12:45			12:45
13:00			13:00
13:15			13:15
13:30			13:30
13:45			13:45
	Surfaces, Interfaces and Thin Films IV	**Quantum Information and Quantum Computing I**	
14:00	731 Johannes Brötzner	801 Florian Meier	14:00
14:15	732 Markus Kratzer	802 Pharnam Bakhshinezhad	14:15
14:30	733 Markus Valtiner	805 Lukas J. Fiderer	14:30
14:45	734 Chiara Wagner	806 Tom Rivlin	14:45
15:00	735 Elahe Akbari	807 Christopher Popp	15:00
15:15			15:15
15:30	***Coffee Break***	***Coffee Break***	15:30
15:45			15:45
	Surfaces, Interfaces and Thin Films V	**Quantum Information and Quantum Computing II**	
16:00	741 Simon Jöhr	811 Nicky Kai Hong Li	16:00
16:15	743 Muhammad Zubair Khan	812 Florian Kanitschar	16:15
16:30	744 Reshma Peremadathil Pradeep	813 Mohammad Mehboudi	16:30
16:45	745 Leonard Verhoff	814 Julia Mathe	16:45
17:00	746 Wenfeng Wu	815 Tobias Christoph Sutter	17:00
17:15		816 Sina Zeytinoglu	17:15
17:30		817 Shuheng Liu	17:30
17:45		818 Martin J. Renner	17:45
18:00			18:00
18:15	***Transfer to Dinner***		18:15
18:30			18:30
18:45			18:45
19:00	***Conference Dinner***		19:00
19:15			19:15
22:00			22:00

(i) = Invited talk

742 *–> moved to 719*	803 *cancelled*
	804 *cancelled*

Freitag, 22. August 2025 - Friday, 22 August 2025

TIME	Großer Festsaal	Senatssaal	Erika Weinzierl Saal	TIME
	Rooms			
08:00	*Registration*			08:00
	PLENARY SESSION	**FAKT – TASK XI**	**Coherent Optical Metrology Beyond Electric-Dipole-Allowed Transitions**	
09:00	48 Roberto Cerbino (p)			09:00
09:15				09:15
09:30				09:30
09:45	49 Andreas Heinrich (p)			09:45
10:00				10:00
10:15				10:15
10:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	10:30
10:45				10:45
11:00	50 Sveva Castello (i)	401 Stefan Nellen Mondragón	671 Mikhail Maslov	11:00
11:15		402 Robert Waddy	672 Georgios Koutentakis	11:15
11:30	51 Tamás Simon (i),	403 Elizaveta Dourassova	673 Monika Bahl	11:30
11:45	Hannes Ischinger (i)	404 Viktoria Kraxberger	674 Vinzenz Stummer	11:45
12:00	52 Claas Abert (i)	405 Michael Bacak		12:00
12:15		406 Sergey K. Ermakov		12:15
12:30	**POSTER AWARD CEREMONY**			12:30
12:45	***Lunch***	***Lunch***	***Lunch***	12:45
13:00				13:00
13:15				13:15
13:30				13:30
13:45				13:45
		FAKT – TASK XII	**KOND XVII**	
14:00		411 Charlotte Cavanagh	251 Igor Vaskivskyi (k)	14:00
14:15		413 Anna Mascellani		14:15
14:30		414 Zhibin Yang	252 Andrej Pustogow (i)	14:30
14:45		415 Cristhian Ricaurte		14:45
15:00		416 Gauri Napoletano	253 Peter Hartmann (i)	15:00
15:15				15:15
15:30			254 Jakov Budić	15:30
15:45			255 Souren Majani	15:45
16:00	***END***	***END***	***END***	16:00
16:15	***Transfer to Physics Institute***			16:15
16:30	***Lab Tours***			16:30
16:45				16:45
17:00				17:00
17:15				17:15
17:30				17:30
17:45				17:45
18:00	***END***			18:00

(p) = Plenary talk, (k) = Keynote, (i) = Invited talk

412 *–> moved to 377*

TIME	Rooms			TIME
	HS 30	HS 31	HS 33	
08:00	Registration			08:00
	Biophysics and Soft Matter I	**KOND XIII**	**KOND XV**	
09:00				09:00
09:15				09:15
09:30				09:30
09:45				09:45
10:00				10:00
10:15				10:15
10:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	10:30
10:45				10:45
11:00	901 Erik Reimhult	211 Martin Gmitra (k)	231 Elsa Abreu (k)	11:00
11:15				11:15
11:30	902 Kerstin G. Blank	212 Katharina Burgholzer (i)	232 Serena Nasrallah	11:30
11:45	903 Vincent Hickl		233 Yuki Utsumi Boucher	11:45
12:00	904 Giacomo Chizzola	213 Laszlo Szunyogh (i)	234 Bence Szász	12:00
12:15	905 Tayebeh Saghaei		235 Pratyay Ghosh	12:15
12:30				12:30
12:45	***Lunch***	***Lunch***	***Lunch***	12:45
13:00				13:00
13:15				13:15
13:30				13:30
13:45				13:45
	Biophysics and Soft Matter II	**KOND XIV**	**KOND XVI**	
14:00	911 Peter D. J. van Oostrum	221 Tina Arh (i)	241 Aline Ramires (k)	14:00
14:15	912 Bernhard Baumann			14:15
14:30	913 André Stefanov	222 Rostyslav Serha (i)	242 Carina Karner	14:30
14:45	914 Limin Wang		243 Christian Binder	14:45
15:00	915 Anna-Lee Jessop	223 Sabri Koraltan (i)	244 Eric Jacob	15:00
15:15	916 Konstantin Nikolaus Beitl		245 Christian Schäfer	15:15
15:30		224 Jan Dzian	247 Juraj Krsnik	15:30
15:45		225 Khrystyna Levchenko		15:45
16:00	***END***	***END***	***END***	16:00
16:15	***Transfer to Physics Institute***			16:15
16:30	***Lab Tours***			16:30
16:45				16:45
17:00				17:00
17:15				17:15
17:30				17:30
17:45				17:45
18:00	***END***			18:00

(k) = Keynote, (i) = Invited talk

246 –> *moved to 164*

TIME	Rooms: Elise Richter Saal	HS 2	HS 7	TIME
08:00	*Registration*			08:00
			Quantum Information and Quantum Computing III	
09:00				09:00
09:15				09:15
09:30				09:30
09:45				09:45
10:00				10:00
10:15				10:15
10:30	***Coffee Break***	***Coffee Break***	***Coffee Break***	10:30
10:45				10:45
11:00			821 Jan Mandrysch	11:00
11:15			822 Paolo Abiuso	11:15
11:30			823 Lin-Qing Chen	11:30
11:45			825 Andrea Caprotti	11:45
12:00				12:00
12:15				12:15
12:30				12:30
12:45	***Lunch***	***Lunch***	***Lunch***	12:45
13:00				13:00
13:15				13:15
13:30				13:30
13:45				13:45
	Atomic Physics and Quantum Optics III	**Young Minds**	**Quantum Information and Quantum Computing IV**	
14:00	621 Alexander Preimesberger	991 Markus Wallerberger (i)	831 Philipp Koller	14:00
14:15	622 Ekaterina Fedotova		832 Giuseppe Vitagliano	14:15
14:30	623 Lucas Winter	992 Dorian Schiffer (i)	833 Paul Erker	14:30
14:45	624 Martin Fasser	993 Laura Wolfthaler (i)	834 Vikas Remesh	14:45
15:00	625 Gian-Luca Schmid	994 Fabian Majcen (i)	835 Sudhan Bhadad	15:00
15:15	626 Ivor Kresic		836 Stefan Aimet	15:15
15:30	627 Fabian Schaden		837 Dorian Schiffer	15:30
15:45	628 Manel Bosch Aguilera		838 Martin Mauser	15:45
16:00	***END***	***END***	***END***	16:00
16:15	***Transfer to Physics Institute***			16:15
16:30	***Lab Tours***			16:30
16:45				16:45
17:00				17:00
17:15				17:15
17:30				17:30
17:45				17:45
18:00	***END***			18:00

(i) = Invited talk

824 –> *moved to 807*

Postersitzung, 20. August 2025 - Postersession, 20 August 2025

Postersession: Wed: 16:00 - 19:00

It is expected that ALL posters are on display during the whole session !

KOND	**Energy, Sustainability & Environment**	**Physics at Neutron and Synchrotron Sources**
261 Subhrangsu Sarkar	521 Martin Buessler	791 Benedetta Marmiroli
262 Satar Almazyoudawi	522 *–> moved to 587*	792 Herwig Michor
263 Anshuman Tripathi	523 Jochen Wagner	793 Johannes Schilberg
264 Ignac Fejes	524 Christoph Reichl	794 Christoph Grüner
~~265~~ *cancelled*		795 Daniel Aziz
266 Pietro Borchia		
267 Jyothi Bhasu Anjali	**Applied Physics**	
268 Sophia Hollweger		**Quantum Information and Quantum Computing**
269 Ivan Jakovac	581 Riccardo Morgan	
270 Clemens Schmid	582 Benjamin Brown	841 Xinhe Jiang
271 György Kálvin	583 Dominik Schramm	842 Johannes Kerber
272 Stáňa Tázlarů	584 Martin Schmidt	843 Amin Babazadeh
273 Emil Tafra	585 Levente Hegyessy	844 Dimpi Thakuria
274 Domitille Baux Remini	586 Alberto Jose Saavedra Garcia	845 Bhargava Thyagarajan
275 Jana Dzibelova	587 Leopold Unterweger	846 Mehdi Rizvandi
276 Michal Hubert		847 Bruna Sahdo
277 Filip Chudoba		848 Christoph Grüner
278 Gergely Babcsán	**Atomic Physics and Quantum Optics**	849 Nicky Kai Hong Li
279 Ryan Thompson		850 Florian Kanitschar
280 Gulnaz Rakhmanova	641 Murad Abuzarli	851 James Bate
281 David Schmoll	642 Johannes Schabbauer	852 Martin Zemlicka
282 Giuliano Esposito	643 Johannes Krondorfer	
283 German Cancino	644 Simon Panyella Pedersen	
284 Dóra Varga	645 Shreyas Gulhane	**Correlated Quantum Materials and Solid State Quantum Systems**
285 Premysl Marsik	646 David Steiner	
286 Sebastian Hepp	647 Michael Bartokos	881 Monika Luznik
287 Patrik Papac	648 Ira Morawetz	882 Diana Kirschbaum
288 Luka Aksamovic	649 Suyash Gaikwad	~~883~~ *cancelled*
289 Yuriy Dedkov	650 Iurie Coroli	884 Nikolas Reumann
290 Elena Voloshina		885 Gwenvredig Le Roy
291 Xunyang Hong		886 Shiva Safari
292 Kevin Jaksetič	**Coherent Optical Metrology Beyond Electric-Dipole-Allowed Transitions**	887 Lukas Fischer
293 Jana Mužević		888 Thanh Duc Phan
294 Maria Čebela	681 Timo Gaßen	
295 Diana Csontosova	682 Tom Jungnickel	
296 Carlos Antonio Fernandes Vaz	683 Mateja Hrast	**Biophysics and Soft Matter**
	684 Mikhail Lemeshko	
		931 Mahdi Khodadadi Karahroudi
FAKT - TASK		932 Alexander Einschütz López
	Surfaces, Interfaces and Thin Films	933 Jose Luis Toca-Herrera
431 Federico Ronchetti		934 Eva Hudec
432 David Höhl	751 Luis N. Ponce-Gonzalez	935 Jasmin Di Franco
433 Anni Kauniskangas	752 Robert Heller	936 Sakshi Khandelwal
434 Ross Sheldon	753 Matthew Timm	937 Parvathy Anoop
435 Matti Cerwenka	754 Florian Dörr	~~938~~ *cancelled*
436 Luz Sanchez-Real Zielniewicz	755 Wisnu Sudjarwo	939 Konstantin Nikolaus Beitl
437 Eslam Shokr	756 Andrea Conti	
438 Liane Backfried	757 Dominik Brandstetter	
439 Rebecca Gartner	758 Maximilian Alexander Molnar	
440 Rahul Singh	759 Andreas Kretschmer	
441 Victoria Helm	760 Stefan Müllegger	
	761 Olga Resel	

Sitzungen - Sessions

Energy Day

Monday, 18.08.2025, Room Großer Festsaal

Time	ID	ENERGY DAY *Chair: Tomoko Muranaka, EPFL; Stephan Wirths, Hitachi Energy*
09:00	**1**	**Renewable energy production and sustainable material design** *Anna Fontcuberta i Morral, EPF Lausanne* The transition to sustainable materials is essential for advancing renewable energy technologies, particularly solar energy conversion, as well as information technologies. III-V semiconductors currently offer the highest efficiency in photovoltaics and quantum information systems but rely on scarce, hard-to-extract elements. In this work, we present our pathway toward alternative materials that hold strong potential as sustainable candidates for these applications, combining high performance with greater material abundance and improved environmental compatibility: zinc phosphide solar cells and germanium nanowires for spin qubit devices. Finally, we will demonstrate the results on the device efficiency and functionality.
09:45	**2**	**Efficiency in Computing and Energy Conversions** *Bruno Michel, Energy Efficiency Consultant, IEEE Fellow, Member of US National Academy of Engineering* Increasing negative impacts of human energy use render investment into efficiency improvements and fast deployment of novel efficient bio-inspired micro- and nano-technologies urgent. Results are shown of massive efficiency improvements in datacenters with hot water cooling and in computers with more compact designs based on reduced thermal- and mass-transport resistances. Efficiencies of thermally mediated energy conversion were improved by reducing thermal resistances in high concentration photovoltaic thermal systems, heat-driven heat pumps, and rapid thermal swing adsorption carbon capture. A universal recognition efficiency measurement was demonstrated to accelerate development of AI towards higher efficiency. Important for this more efficient “Green” AI are reduced data movements, better computers and accelerators, as well as better ways of training and inference.
10:30		***Coffee Break***
		Chair: Robert Hauser, FH Kärnten; Christoph Reichl, AIT
11:00	**3**	**Energy Efficient HPC in the Exascale Era** *Siegfried Höfinger, Markus Hickel, Austrian Scientific Computing Research Centre* With the advent of true exascale computing the power demand of supercomput- ers has risen to the 20 MW level. Mission critical applications from science and research together with an ever increasing demand for AI have led to this devel- opment and the trend is likely to continue. However, electricity prices have risen dramatically in recent times. It is therefore of utmost importance to operate such supercomputers in the most energy efficient way possible. Austria’s largest HPC facility is operated by the ASC Research Centre where energy efficiency has always been a key concern. Here we discuss relevant settings of VSC-5 and/or MUSICA, ie the latest additions to the national HPC infrastructure and highlight important design choices that make these systems particularly energy efficient. In addition, general trends in current HPC architectures of top level installations shall be described and analyzed in terms of energy efficient system architecture. Moreover, the results of a recent survey concerning user awareness regarding energy efficient HPC shall be presented and lessons learned there be brought up for discussion and further dissemination.

<table>
<tr><td>11:30</td><td>4</td><td>
Energy Efficiency and Cooling Strategies at ASC

Valentin Hirschbrich, Austrian Scientific Computing Research Center

As high-performance computing (HPC) systems become increasingly central to academic research, the challenge of managing their escalating energy consumption and heat output has never been more critical. This talk explores the pivotal role of energy efficiency in the operation of a university-run HPC data center in Austria, with a particular focus on the evolution from oil immersion cooling to the current implementation of direct water cooling.

The Importance of Energy Efficiency in HPC
HPC clusters are among the most energy-intensive infrastructures in academia, driven by the relentless growth in computational demands from fields such as physics, climate modelling, and artificial intelligence. With energy costs rising and sustainability targets tightening, optimizing energy use is both an economic and environmental imperative. Efficient cooling is a cornerstone of this effort, as traditional air-based systems are no longer viable for the high power densities of modern HPC hardware.

From Oil Immersion to Direct Water Cooling: Lessons Learned
Previous VSC cluster generations utilized oil immersion cooling, a technique that submerges servers in dielectric fluid to absorb and dissipate heat. Oil immersion offers significant energy savings and supports high-density deployments, but presents challenges in terms of maintenance complexity, fluid management, and integration with standard hardware ecosystems.
The currently operational clusters leverage direct water cooling, circulating water through cold plates attached to CPUs, GPUs, and other heat-generating components. This approach capitalizes on water's superior thermal conductivity and lower viscosity compared to oil, enabling more efficient heat removal with less energy expended on pumping and circulation.
Direct water cooling supports higher rack densities while simplifying maintenance and integration with existing infrastructure.

Opportunities for Future Improvement
Despite these advances, further gains are possible. Integrating energy reuse systems—such as capturing waste heat for campus heating—can boost overall site efficiency.
Enhanced monitoring and AI-driven optimization of cooling and workload scheduling can further reduce energy consumption. As compute densities continue to rise, ongoing research into new cooling fluids, modular cooling architectures, and hardware-level energy management will be essential.

Conclusion
For physicists and academic stakeholders, understanding the interplay between cooling strategies and energy efficiency is vital for the sustainable growth of computational research. By embracing direct water cooling and continually seeking innovative improvements, university HPC data centers can lead the way in responsible, high-performance computing.
</td></tr>
<tr><td>12:00</td><td>5</td><td>Panel Discussion

Moderation: Herbert Störi, TU Wien</td></tr>
<tr><td>12:30</td><td></td><td>END; Lunch</td></tr>
</table>

Public Symposium: 100 Years of Quantum Physics & Public Lecture

Monday, 18.08.2025, Room Großer Festsaal

Time	ID	100 YEARS OF QUANTUM PHYSICS *Chair: Jérôme Baudry, EPF Lausanne*
14:00	**11**	**The Tangled Tale of Entanglement: New Discoveries from Schrödinger's Research Notes** *Christoph Lehner, Max-Planck-Institut für Wissenschaftsgeschichte Berlin* Today, entanglement is commonly accepted as the most striking and characteristic phenomenon of quantum mechanics. But this realization was slow to emerge, in the early years of quantum mechanics, entanglement was just seen as a normal statistical correlation. Only with Einstein, Podolsky and Rosen's "Can quantum mechanical description of reality be considered complete?"(1935) and Schrödinger's "Die gegenwärtige Situation in der Quantenmechanik" (1936) did the phenomenon come into focus as a central and puzzling feature of quantum mechanics. However, not much has been known about the prehistory of these papers. Jos Uffink and me were able to trace the development of both Einstein's and Schrödinger's thought, using Schrödinger's correspondence and especially his extensive research notes. We especially found that they both got important input from Leo Szilard, who proposed in 1931 a thought experiment that is a direct precursor to the EPR experiment and a quantum mechanical state that is essentially identical to the EPR state.
14:45	**12**	**Scenes from the Quantum Century: From Curious Hippies to Novel Tests of Bell's Inequality** *David Kaiser, Department of Physics, MIT* The hundredth anniversary of quantum mechanics in 2025 offers opportunities to consider the history of quantum theory and ask how some of our core ideas were introduced, debated, tested, and ultimately accepted. One of the most central conceptual ingredients of quantum theory is entanglement, nowadays so important to the burgeoning field of quantum information science and technology. Yet the history of quantum entanglement---and of physicists' efforts to understand whether entanglement is a robust feature of the world rather than merely an intriguing hypothesis---has been far from straightforward. In this talk I will describe how a colorful group of physicists during the 1970s wrestled with entanglement and with John Bell's now-famous inequality, exploring the subtle interplay between quantum nonlocality and relativity amid the California counterculture scene. More recently, retracing the history of efforts to conduct experimental tests of Bell's inequality helped to catalyze novel tests, which have aimed to close a series of loopholes, including the recent "Cosmic Bell" experiments. These experiments provided compelling evidence for quantum entanglement while constraining certain classes of alternative models – which exploit a particularly subtle loophole – more thoroughly than ever before.
15:30		***Coffee Break***
		Chair: Christian Wüthrich, Université de Genève
16:00	**13**	**Philosophy of Quantum Mechanics Beyond the Measurement Problem** *Alyssa Ney, LMU München* One hundred years after Heisenberg's discovery of quantum mechanics, there is still no consensus over even basic facts about its interpretation. One reason for this impasse can be traced to a disagreement in the first place about the role of the observer in quantum physics. Since the development of the Copenhagen interpretation in 1927, observers and measurements have been central elements in orthodox presentations of quantum mechanics. And yet in the philosophy of physics, there is a persistent narrative that such interpretations face a "measurement problem," that references to observers or measurements should not be included in presentations of our

		fundamental physical theories, but rather such phenomena should be regarded as emergent from more fundamental ontologies described by the quantum wave function or other parameters. This paper proposes a way of reconciling this disagreement by developing the ideas of John Archibald Wheeler. It finds particular inspiration in the reaction of Wheeler, over several decades, to the interpretation of his doctoral student, Hugh Everett, which later became the many worlds interpretation
16:45	**14**	**Wolfgang Pauli's and Erwin Schrödinger's Insights from the Perspective of a Modern Quantum Technologist** *Beatrix Hiesmayr, Universität Wien* This lecture examines the scientific insights of Wolfgang Pauli and Erwin Schrödinger—two outstanding yet very different personalities—from the perspective of current research. It addresses both their ideas, which are now considered universally accepted knowledge, and their misconceptions. A particular focus is placed on how the scientific discourse distinguishes between "right" and "wrong" and how the daily life of researchers has changed compared to the past.
17:30		***END, Welcome Reception***
18:00		***General Assemblies of ÖPG * and SPS ****
		Public Lecture *Chair: Michel Calame, Empa & Universität Basel*
19:00	**15**	**The European X-Ray Free Electron Laser** *Thomas Feurer, European XFEL GmbH, Holzkoppel 4, DE-22869 Schenefeld* X-ray Free Electron Lasers (XFELs) have greatly enhanced our ability to observe transient nuclear and electronic motions in real time at atomic resolution, thereby deepening our fundamental understanding of matter across different disciplines. Moreover, XFELs offer several significant advantages in High Energy Density (HED) science, which deals with matter under extreme conditions of temperature and pressure. For instance, XFELs can probe structure and ionization dynamics in warm dense matter, a regime between solid and plasma states, investigate material response to ultra-high pressures, help refine models of radiation transport at extreme conditions, and recreate and study conditions inside gas giants or white dwarfs. Most XFELs today generate pulses that consist of amplified noise, leading to significant shot-to-shot fluctuations. While these pulses exhibit high transverse coherence, their longitudinal coherence remains very low. In this talk, I will present two methods for controlling longitudinal coherence and demonstrate their application in X-ray spectroscopy. Such experiments are made possible only by the resulting exceptional spectral brilliance of XFEL sources. Specifically, I will discuss a nuclear clock transition in one of the scandium isotopes. By controlling the nonlinear phase-space dynamics of ultrashort electron bunches, undulators can be made to emit pulses as short as attoseconds. Such pulses are ideal for probing electron dynamics on their natural timescales. In this presentation, I will highlight applications where attosecond pulses are used to create transient population inversion in inner-shell electrons. Lastly, I will discuss several applications of XFELs in the area of high energy density science. For example, I will present the first experimental evidence of liquid carbon, formed by shock-compressing graphite with a high-energy laser and probing it transiently using ultrashort XFEL pulses. Additionally, I will show the first experimental observation of plasma compression driven by relativistic currents in a cylindrical geometry; this effect was predicted over two decades ago but never confirmed until now. These experiments underscore the transformative impact of XFELs on advancing inertial fusion energy research.
20:15		***END***

* ÖPG: Room HS 31, ** SPS: Room HS 30

Women in Physics Career Symposium

This event is supported by SPS, ÖPG, Universität Zürich, PSI Villigen, SCNAT, Université de Genève, SFB BeyondC and Soroptimistinnen Wien-Belvedere.

Monday, 18.08.2025, Room Senatssaal

Time	ID	Women in Physics Career Symposium
12:30		***Fingerfood for participants of the symposium***
		Chair: Philipp Schmidt-Wellenburg, PSI Villigen
13:15	21	**ESO engagement in Equity, Diversity and Inclusion** *Francesca Primas, ESO* The European Southern Observatory (ESO) is the pre-eminent intergovernmental science and technology organisation in astronomy. Its mission is to design, build and operate the most advanced observatories on the ground, and to foster international collaboration for astronomy. The work carried out at ESO leads to invaluable scientific and technological progress and contributes to social and environmental sustainability, as well as to peaceful scientific cooperation, in line with several of the United Nations (UN) Sustainable Development Goals. Gender equality, and particularly the advancement of women in science, has been a priority at ESO since the kick-start project “Status of women at ESO” (Primas 2007), that found female employees accounting for only 18% of the total staff members. About fifteen years later, the fraction of female employees has reached 26,1%, but we aim at more! Following a data-driven and goal-oriented approach, ESO has developed an action plan to improve equality overall and to make the working environment more inclusive. Three high-level strategic priorities were chosen, each with its defined targets, strategies and future actions. In this keynote talk, I will describe ESO’s core values and plans to continue improving the working environment for its staff and impacting its astronomical community, highlighting successes and pitfalls.
		Chair: Ille Gebeshuber, TU Wien
14:00	22	Career Talk 1:*Beatrix Hiesmayr (i)*
14:30	23	Career Talk 2: *Kimberly Modic (i)*
15:00	24	*Interactive Career Workshop with Francesca Primas*
15:30		***Coffee Break***
		Chair: Tobias Golling, Université de Genève
16:00		*Workshop continued*
17:00	25	Career Talk 3: *Anna Spindelberger (i)*
17:30	26	Career Talk 4: *Rachel Grange (i)*
18:00		***END***
18:00	***General Assemblies of ÖPG * and SPS ****	
19:00		***Public Lecture***

Plenary Session

Tuesday, 19.08.2025, Room Großer Festsaal

Time	ID	OFFICIAL CONFERENCE OPENING
08:50		**Welcome Note** *Manuela Baccarini, Vice-Rector Research, University of Vienna;* *Alberta Bonanni, ÖPG President; Teresa Montaruli, SPS President;*
		PLENARY SESSION I *Chair: Markus Aspelmeyer, Universität Wien*
09:00	31	**The Next 100 Years of Quantum Mechanics** *Caslav Brukner, Universität Wien* Over the past century, much of the foundational work in quantum mechanics was driven by attempts to resist its revolutionary message—seeking to restore classical notions of reality and test quantum theory against them. This journey culminated in the decisive, loophole-free Bell experiments of 2015, which confirmed the predictions of quantum mechanics and ruled out classical alternatives. Looking ahead, it is time to fully embrace quantum mechanics and explore its profound implications for a non-classical understanding of space-time, reference frames, and causal order. This talk will outline how these ideas set the stage for the next century of quantum science.
		Chair: Rachel Grange, ETH Zürich
09:45	32	**Spin Qubits in Semiconductors for Scalable Quantum Computers** *Daniel Loss, Department of Physics, University of Basel, CH-4056 Basel* Semiconductor spin qubits offer a unique opportunity for scalable quantum computation by leveraging classical transistor technology. This has triggered a worldwide effort to develop spin qubits, in particular, in Si and Ge based quantum dots, both for electrons and for holes. Due to strong spin orbit interaction, hole spin qubits benefit from ultrafast all-electrical qubit control and sweet spots to counteract charge and nuclear spin noise. In this talk I will present an overview of the state-of-the art in the field and focus, in particular, on recent developments on hole spin physics in Ge and Si nanowires, Si FinFETs, and Ge/SiGe heterostructures, as well as strategies for maximizing valley splitting crucial for scalability of electron spin qubits in Si and long-distance entanglement via magnetic domain walls in race tracks.
10:30		***Coffee Break***
11:00		***Award Ceremony***
		Chair: Hugo Zbinden, Université de Genève
12:00	33	**Quantum Threats and Opportunities for Secure Communication** *Nicolas Sangouard* *Institut de Physique Théorique, Orme des Merisiers, CEA Paris-Saclay, FR-91191 Gif-sur-Yvette Cedex* Algorithms that exploit quantum principles can efficiently solve mathematical problems that form the foundation of classical cryptographic systems. At the same time, these principles enable the development of cryptographic protocols with provable security guarantees. During this talk, I will present on-going efforts to precisely quantify the resources required to break widely used classical crypto-systems. I will also highlight recent results demonstrating that cryptographic keys can be distributed between remote locations with provable security guarantees — even in the extreme scenario where the quantum devices involved in the distribution are untrusted.

Time	ID	*Chair: Christian Teichert, Montanuniversität Leoben*
12:30	**34**	**AYPT: 27 Years, 17 Problems, 7 Challenges** *Paul Worm, Teamleiter AYPT* 27 years ago, the Austrian Young Physicists' Tournament (AYPT) was held for the first time. Since then, each year countless young physicists have had the opportunity to develop and present creative solutions to 17 open-ended physics problems as part of this competition. The range of topics spans questions such as "Under what conditions does hot water freeze faster than cold water?" to "How can one design the most effective arrestor bed to safely bring trucks to a stop?". At the competition, the solutions developed are presented in front of a jury and discussed in a scientific exchange format with students from other teams. This event offers 7 challenges, or as I prefer to call them, learning opportunities, for students: (1) working independently on open-ended topics, (2) collaborating effectively as a team (3) designing creative and practical experimental setups, (4) applying theoretical and computational physics, (5) presenting solutions to an audience, (6) engaging in live discussions about other teams' ideas, (7) and most importantly, having fun and connecting with fellow science enthusiasts, especially within this competitive setting. In this talk, I will share how I first had the chance to grow through AYPT as a student and later pass on that experience to new generations - as juror, team leader, and organizer. I can say with absolute confidence that this tournament has shaped me and fellow participants more deeply than we could have ever imagined. Today, I am both proud of our organizing teams and grateful for the recognition we have received as an organization for our efforts to popularize science in general, and physics in particular, among curious young students.
13:00		***Lunch***
14:00		***Topical Sessions***
18:00		***Transfer to ÖAW*** *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*

Tuesday, 19.08.2025, ÖAW Festsaal

Time	ID	**Public Lecture** *Chair: Christian Wüthrich, Université de Genève*
19:00	**35**	**Physical understanding in the times of AI. A philosophical analysis.** *Claus Beisbart, Institut für Philosophie, Universität Bern* These days, AI applications, particularly neural networks, are all the rage in physics and beyond. Undoubtedly, they can be powerful in classification and prediction tasks. However, can AI provide physicists with scientific understanding? Some authors have been skeptical and suggested that big-data-oriented science remains shallow because AI remains a black box to humans. Others, by contrast, have taken a more optimistic stance and pointed to examples in which AI has seemingly been instrumental to human understanding. This talk aims to reconcile these different views. I start with systematic reflections on understanding in physics. To account for the skeptical voices, I argue that AI can be trained with fairly little domain knowledge, and that tools that predict something to be the case are typically not known to contain explanatory information, which means that they are not suited for explanatory understanding. However, in some situations, there can be reasons to think that AI applications become sensitive to explanatory relevant variables, and a closer investigation of a network or a bunch of runs of a simulation program can often reveal explanatory information. Accordingly, the impact of AI tools on scientific understanding depends crucially on what people know and how they use AI. To show the power of AI for understanding, the talk systematically carves out inferences that lead to more understanding.
20:15		***END***

Wednesday, 20.08.2025, Room Großer Festsaal

Time	ID	Plenary Session II: Symposium "ERC Funding in Quantum Science"
08:30		***Opening remarks*** *Markus Aspelmeyer, Universität Wien* *Axel Cleeremans, President of the Association of ERC Grantees – AERG* *Silke Bühler-Paschen, TU Wien*
		Chair: Markus Aspelmeyer, Universität Wien
09:00	36	**When Crystals Flow: The Emergence of Supersolid Quantum States** *Francesca Ferlaino, Institut für Experimentalphysik, Universität Innsbruck, Austria* *IQOQI- Institut für Quantenoptik und Quanteninformation, Österreichische Akademie der Wissenschaften, Innsbruck, Austria* The exploration of superfluidity has fascinated scientists for decades, spanning a wide range of systems—from solids and liquids to gases, and even light. Traditionally, the study of superfluid order has been confined to spatially homogeneous systems, where uniform conditions provide a simpler framework for understanding this extraordinary quantum state. But what happens when superfluidity arises in systems with periodic density modulations? Can the inherent localization of periodic structures coexist with the fluid-like properties of a superfluid? Could a solid, with its rigid crystalline structure, exhibit superfluid behavior? Or conversely, might a superfluid reveal a crystalline order? These questions have long intrigued the scientific community, pushing the boundaries of our understanding. Recent breakthroughs have provided compelling answers with the discovery of “supersolid” quantum states—phases that uniquely combine superfluid and crystalline properties. This talk will delve into the experimental realization of supersolidity in magnetic quantum gases, enabled by the momentum-dependent, long-range, and anisotropic dipole-dipole interactions. Key topics include the softening of roton excitations as a precursor to the supersolid phase transition, the dynamics of symmetry breakings, and the observation of quantized vortices in rotating supersolid states. These advancements open new avenues for understanding many-body quantum physics and the interplay of order and coherence in complex quantum systems.
09:45	37	**A mechanical qubit** *Yiwen Chu, ETH Zürich* Strong nonlinear interactions between quantized excitations are an important resource for quantum technologies based on bosonic oscillator modes. However, most electromagnetic and mechanical nonlinearities are far too weak to allow for nonlinear effects to be observed on the single-quantum level. This limitation has been overcome in electromagnetic resonators by coupling them to other strongly nonlinear quantum systems such as atoms and superconducting qubits. I will present the realization of the single-phonon nonlinear regime in a solid-state mechanical system. The single-phonon anharmonicity in our system exceeds the decoherence rate by a factor of 6.8, allowing us to use it as a mechanical qubit and demonstrate initialization, readout, and single qubit gates. Our approach provides a powerful quantum acoustics platform for quantum simulations, sensing, and information processing.
10:30		***Coffee Break***

<table>
<tr><th>Time</th><th>ID</th><th>Chair: Silke Bühler-Paschen, TU Wien</th></tr>
<tr><td>11:00</td><td>38</td><td>Models and methods in the study of high-temperature superconductivity

Jaksa Vucicevic, Institute of Physics Belgrade Pregrevica 118, 11080 Belgrade, Serbia

We will cover several lines of ongoing work aimed at improving our understanding of the cuprate superconductors. We focus on the mechanisms that determine the normal-phase transport properties and the magnitude of the superconducting critical temperature. The main difficulty in the theoretical description of the cuprates is that it requires a many-body treatment of an effectively strong interaction between the electrons; in addition, the details of the crystal structure also play a role, and one cannot account for material-specific properties by solving the simplest models. We will discuss the possible low-energy models and the ways to extract the corresponding model-parameters from ab initio results. Then, we will discuss recent advancements in methodology, in particular related to computing the dynamical response functions in interacting lattice models. Our results are pertinent to the hypothesis that the cuprate strange-metal regime is linked with quantum criticality.</td></tr>
<tr><td>11:30</td><td>39</td><td>Non-equilibrium self-assembly in quantum materials:
emergence of trapped quasiparticle noise.

Dragan Mihailović, Yevhenii Vaskivskyi and Jaka Vodeb
Jožef Stefan Institute, Jamova 39, 1000-Ljubljana, Slovenia,
Faculty of Mathematics and Physics, University of Ljubljana, 1000-Ljubljana, Slovenia, & CENN Nanocenter, 1000-Ljubljana, Slovenia

The formation of defects and imperfections seems inevitable in any self-assembly process. This includes everything from crystal growth and device fabrication to biological self-assembly. Such processes are key to life and technology as well as fundamental physics of emergence in non-equilibrium systems. To understand the behaviour of such imperfections in quantum systems we experimentally focus on a model experimental system that exquisitely describes the salient features, particularly imperfections resulting from optically induced quench and ensuing self-assembly in the aftermath of a 1st order phase transition of a 2D charge-density-wave system. The chosen system allows us to perform real-time imaging of trapped quasiparticle motion by fast scanning tunnelling microscopy while spectrally and spatially analysing noise with atomic resolution. The experiments show that the electrons localised to topologically non-trivial defects form emergent states (qubits) exhibiting characteristic two-level system (TLS) behaviour including telegraph noise. The findings have direct implications for the physics of glasses and in the fabrication of superconducting Josephson-junction based devices used in quantum processors where topologically similar traps can lead to TLS noise interference.</td></tr>
<tr><td>12:00</td><td>40</td><td>The Quantum Twisting Microscope: Visualizing Waves in Quantum Matter

Shahal Ilani, Department of Condensed Matter Physics, Weizmann Institute of Science

Some of the most fascinating phenomena in nature arise when electrons behave as quantum mechanical waves that interact with one another. But how can we visualize these electronic waves in action? In this talk, I will introduce the Quantum Twisting Microscope (QTM), an innovative scanning probe microscope, developed within the ERC-Adv framework, designed to directly image electronic wavefunctions and energy bands within quantum materials. At its core lies a unique tip composed of an atomically thin van der Waals material, which functions as a quantum interferometer. Electrons tunnel from this tip into a sample at multiple locations at once, and the quantum interference between these tunneling paths enables the measurement of the phase evolution within electronic wavefunctions. These measurements allow the QTM to probe electrons in momentum space, much as a scanning tunneling microscope probes electrons in real space. I will present new experimental results on one of the most puzzling quantum systems - magic angle twisted bilayer graphene – revealing its interacting electronic bands and the intriguing interactions between its electrons and phonons.</td></tr>
<tr><td>12:30</td><td></td><td>Lunch</td></tr>
</table>

Time	ID	*Chair: Jörg Schmiedmayer, TU Wien*
14:00	**41**	**The laser in quantum science** *Serge Haroche, Collège de France, Paris* This year marks the 100th anniversary of quantum mechanics. Among all the inventions born of this physics, the laser occupies an important place, both for the lineage of discoveries that led to its birth, and for the role it plays today in fundamental and applied science. It has opened up fields in research that could not have been imagined at the time it was invented. We owe to it the cooling and trapping of atoms, the study of quantum gases of bosons and fermions, the discovery of gravitational waves and the manipulation of individual quantum particles which has led to current research into quantum simulation and quantum computing. The laser may also provide answers to fundamental questions about the link between quantum physics and gravitation, or about the nature of the hypothetical dark matter. The history of the laser in blue sky science illustrates the passion for precision and the essential link between basic research and technological advances that have driven modern science since its advent in the Age of Enlightenment.
14:45	**42**	***Panel Discussion:*** **From Blue Sky Research to Quantum Technologies** *Moderation: Silke Bühler-Paschen, TU Wien* PANELISTS: ***Serge Haroche*** (AERG Science & Society Seminar), ***Tom Henzinger*** (ERC Scientific Council), ***Ulrike Diebold*** (Vice President of the Austrian Academy of Sciences), ***Monika Ritsch-Marte*** (ERC ADG grantee, Medical University of Innsbruck), ***Johannes Fink*** (ERC POC grantee, ISTA).
15:45		***Exhibitor Presentation Session***
16:00		***Poster Session with Apéritif***
19:00		***END***

Thursday, 21.08.2025, Room Großer Festsaal

Time	ID	**PLENARY SESSION III** *Chair: Gernot Eichmann, Universität Graz*
09:00	**43**	**Status of the anomalous magnetic moment of the muon** *Martin Hoferichter, Universität Bern* The anomalous magnetic moment of the muon quantifies the deviation of the muon's g-factor from g = 2, as predicted by the Dirac equation. It can be measured very precisely in experiment and predicted at a comparable level, turning it into a prime precision observable with which to search for physics beyond the Standard Model. In the talk, I will discuss the current status of this precision test after the release of the final results from the Fermilab experiment, focusing on the role of theory to match the experimental precision in the Standard-Model prediction.
		Chair: Peter Korczak, ÖPG
09:45	**44**	**Trapped-ion quantum computing at Infineon** *Clemens Rössler, Infineon AG* The world is filled with computational problems that are far too complex for today's or even future classical supercomputers. These challenges span various critical domains such as life- and material science, finance and logistics and require new computational paradigms to be solved efficiently. Quantum computers, with their potential to process information in fundamentally different ways, promise to efficiently solve many of these intractable problems. However, for quantum computers to become practically useful, they must achieve the ability to control a large number of qubits with

		high precision, surpassing the state-of-the-art capabilities available today. Among the leading qubit modalities, trapped ions lead in key metrics such as the two-qubit fidelity, coherence time and connectivity between qubits. Furthermore, ion traps can be realized in an industrial semiconductor fabrication environment which offers precision and reproducibility. Infineon employs a dedicated team of developers to co-design, fabricate, and validate cutting-edge quantum processing units (QPUs) for both academic and commercial partners. Their work includes integrating advanced functionalities such as photonics for efficient light delivery and integrated electronics for the precise control of large-scale QPUs. I will introduce the basics of industrial ion trap fabrication, present recent developments in the field and provide an outlook to utility-scale quantum computing.
10:30		***Coffee Break***
		Chair: Michel Calame, Empa & Universität Basel
11:00	**45**	**Broadband integrated photonics with planarized terahertz quantum cascade lasers** *Urban Senica, Laboratory for Nanoscale Optics, John A. Paulson School of Engineering and Applied Sciences, Harvard University, USA;* *Quantum Optoelectronics Group, Institute for Quantum Electronics, Department of Physics, ETH Zurich, Switzerland* We developed an integrated photonics platform based on planarized waveguides, where terahertz quantum cascade laser (THz QCL) active waveguides (GaAs/AlGaAs quantum wells) are embedded in a low-loss polymer Benzocyclobutene (BCB), with an extended top metallization and placement of bonding wires over the passive area. Besides improved thermal, microwave, and dispersion properties, this also allows to co-integrate active and passive components on the same photonic chip, enabling the development of many novel integrated photonic devices. These include inverse-designed semiconductor laser cavities, field-enhancing structures for nonlinear photonics, and two fundamentally new types of frequency combs based on strong microwave modulation.
11:30	**46**	**Engineering Andreev band structures in multi-terminal Josephson junctions** *Marco Coraiola, IBM Research Zürich* Hybrid multi-terminal Josephson junctions, where three or more superconducting leads are coupled to a semiconducting region, offer a novel platform for engineering quantum states. In these systems, Andreev bound states form synthetic band structures controlled by multiple superconducting phases. I will present the experimental realization of Andreev band structures in three-terminal Josephson junctions. Using tunnelling spectroscopy, we probed the two-dimensional phase space, demonstrating the formation of hybridized Andreev molecules, as well as the emergence of spin-split energy levels and fermion parity transitions. These results open new opportunities for superconducting spin qubits and topological phases in higher-dimensional Andreev band structures.
		Chair: Gian Salis, IBM Rüschlikon
12:00	**47**	**Electrical and Optical Manifestation of Flat Bands in 2D Semiconductors** *Gabriele Pasquale, EPFL & Harvard University* This talk presents a series of experimental discoveries on how flat band physics emerges in the electrical and optical response of 2D semiconductors, with metal monochalcogenides as a case study. A new tunneling-based method is introduced to detect flat bands via the onset of out-of-plane current. This fast and reliable technique enables the observation of many-body excitonic interactions, chirality-sensitive tunneling in an originally achiral system, and the realization of a long-standing prediction: spin-polarized hole accumulation at the valence band edge. These findings establish new pathways to explore flat band phenomena and emergent effects across condensed matter systems.
12:30		***Lunch***
14:00		***Topical Sessions***

		Transfer to Dinner
19:00		***Conference Dinner***

Friday, 22.08.2025, Room Großer Festsaal

Time	ID	PLENARY SESSION IV *Chair: Rainer Leitgeb, Med. Universität Wien*
09:00	**48**	**Using cellular phase transitions to understand cancer** *Roberto Cerbino, Universität Wien* Cells within tissues can undergo phase transitions—such as jamming and unjamming—that alter their collective behavior and mechanical properties. These transitions influence how tissues grow, move, and respond to their environment, and are increasingly recognized as important in both healthy development and disease. We explore how such transitions shape the organization and dynamics of epithelial cell assemblies. Our recent findings identify the small GTPase RAB5a as a key regulator of unjamming, enabling collective motion in both 2D monolayers and 3D spheroids. Alterations of its expression levels promote stronger mechanical interaction with the surrounding matrix and support invasive behavior through unjamming. Moreover, unjamming induces large density fluctuations that generate nuclear stress and lead to the release of DNA into the cytoplasm, potentially activating innate immune pathways. These insights highlight how mechanical state changes in tissues can contribute to cancer progression and offer new perspectives on the physical basis of disease.
		Chair: Ulrike Diebold, TU Wien
09:45	**49**	**Towards Quantum Computing with Spins on Surfaces** *Andreas Heinrich, Center for Quantum Nanoscience, Institute for Basic Science (IBS), and Department of Physics, Ewha Womans University, Seoul 03760, Republic of Korea.* There is a strong international research effort in the area of quantum information science. Here, the concepts of quantum coherence, superposition and entanglement of quantum states are exploited. Over the past two decades, many advances at studying such quantum coherence in solid-state and molecular architectures have evolved. In this talk we will focus on quantum-coherent experiments in Scanning Tunneling Microscopy (STM). STM enables the study of surfaces with atomic-scale spatial resolution and offers the ability to study individual atoms and molecules on surfaces. To study quantum spins with STM, we recently learned how to combine STM with electron spin resonance. Spin resonance gives us the means to quantum-coherently control an individual atomic or molecular spin on a surface. Using short pulses of microwave radiation further enables us to perform qubit rotations and learn about the quantum coherence times of our spins. Finally, we will demonstrate multi-qubit operations with spins on surfaces and discuss future research directions. Support from Institute for Basic Science (IBS-R027-D1) is gratefully acknowledged.
10:30		***Coffee Break***
		Chair: Teresa Montaruli, Université de Genève
11:00	**50**	**A matter of time, gravity and galaxies** *Sveva Castello, Université de Genève* Our understanding of the Universe relies on two pillars, gravity and dark matter. These are involved in compelling open questions: is the accelerated cosmic expansion due to gravity modifications? And does dark matter experience gravity in the same way as normal matter? I will discuss some insights about these issues that can be drawn from the observed distribution of galaxies. In particular, I will introduce you to the protagonist of my PhD thesis: the distortion of time, a novel observable that provides key information to disentangle gravity modifications from extended dark matter scenarios.

11:30	**51**	**Oscillating rings, IPT 2025** *Tamás Simon, Hannes Ischinger, ETH Zürich* We present the problem 'Oscillating rings' that won Switzerland first place at the IPT 2025. Take two ferromagnetic rings of different radii and tie them by a string. Connect another string to the larger ring at the same point. Now holding the whole construction by the second string, you can suspend it in the air by a magnet placed above. Being held only by these vertical strings, the rings are free to rotate around the vertical axis. We investigate their rotational motion based on the parameters of the system experimentally and compare these results with both theory and simulations.
		Chair: Sebastian Knauer, Universität Wien (ÖPG Young Minds)
12:00	**52**	**From Pen and Paper to Neural PDE Solvers: The Evolving Landscape of Computational Physics** *Claas Abert, TU Wien* This talk traces the evolution of computational physics from early hand-calculated climate models to modern high-performance simulations. Emphasis is placed on the numerical solution of partial differential equations (PDEs), highlighting how algorithmic strategies have adapted to increasingly parallel architectures. We conclude by exploring emerging approaches that integrate machine learning with physics-based modeling, such as physics-informed neural networks and neural operators, illustrating how these innovations are shaping the future of scientific computing.
12:30		***Poster Awards and Closing Ceremony***
12:45		***End; Lunch***
14:00	***Topical Sessions***	
16:00		***CONFERENCE END***

History and Philosophy of Physics

Tuesday, 19.08.2025, Room Erika Weinzierl Saal

Time	ID	HISTORY AND PHILOSOPHY OF PHYSICS *Chair: Bruno Besser, ÖAW Graz,* *Christian Wüthrich, Université de Genève, Jérôme Baudry, EPF Lausanne*
14:00	**61**	**A Medieval Planetary Diagram in the University Library Graz, Austria** *Sonja Draxler, Max Lippitsch, Karl-Franzens University, Graz, Austria* Up to the 12th century only a few ancient works on planetary astronomy were available in Europe. From the 8th onwards, the knowledge contained in these few works was frequently illustrated by diagrams. These range from purely schematic representations of the ordering of the planetary spheres over quantitative representations of data from the ancient texts to elaborate representations of planetary positions. A planetary diagram from a 12th century manuscript in the university library of Graz provides a good example for medieval planetary diagrams showing a lot of different data in one diagram. Possible interpretations of the diagram as well as of the surrounding text and dating of the diagram will be discussed.
14:15	**62**	**Erwin Schrödinger's explanation of abnormal audibility of artillery explosions** *Heinz Krenn, Universität Graz, Institute of Physics, Universitätsplatz 5, Graz* The mysterious 100 km wide "zone of silence" in the sound propagation of dynamite explosions attracted a great deal of attention during the construction of the Swiss Jungfrau Railway in 1908. Erwin Schrödinger (E.S.) seems to have been inspired by his experiences as a lieutenant in the fortress artillery on the Italian Isonzo front and published an article on the "outer zone of abnormal audibility" of gun explosions in 1917. The effect was initially interpreted as the reflection of sound from the hydrogen atmosphere at high altitudes, but the analysis contradicted the energy conservation. E.S. solved the problem with a modified wave equation. The paper is considered an excellent example of classical applied physics and is recognized as Schrödinger Hallmarks.
14:30	**63**	**Bohr's Complementarity in the Age of Quantum Information:** **Bridging Epistemology and Quantum Foundations** *Marina Passaro, Utrecht University, Utrecht, Netherlands* My claim is that Bohr's Complementarity lays the foundation for informational approaches to QM and these approaches, in turn, bring Complementarity to its full realization. Authors of informational approaches such as Zeilinger and Brukner have stated to draw inspiration directly from Bohr. I will take this claim a step further: I argue that the early rejection of complementarity is being replaced by its integration into informational frameworks and that this has been made possible by the shift in perspective first exemplified by Bohr's philosophy. Combining physical, philosophical, and historical analysis, and drawing on unpublished material from Bohr Archive, I will clarify Bohr's long-misinterpreted concept of Complementarity and highlight its undiminished but underappreciated relevance a hundred years after the theory's birth.

14:45	**64**	**Ignored because of prejudices? The late discovery of the Aharonov-Bohm effect from a historical-philosophical perspective** *Guy Hetzroni, The Open University of Israel, Ra'anana, Israel* "It is interesting that something like this can be around for thirty years but, because of certain prejudices of what is and is not significant, continues to be ignored." This presentation addresses Feynman's (1964) puzzle regarding the late discovery of the Aharonov-Bohm effect (30 years after quantum theory) from a historical-philosophical perspective. Through comparative analysis of near-discoveries by Weyl, Schrödinger, and Dirac in the 1920-1930s, Ehrenberg and Siday's 1949 overlooked proposal, and insights from a recent oral-history interview I conducted with Yakir Aharonov (submitted:04/2025), I suggest that the delayed discovery may have been influenced by limited foundational and interpretational discourse on electromagnetism in the early 20th century, demonstrating how shifts in foundational attention within physics communities influence theoretical breakthroughs.
15:00	**65**	**The Atomic Clock Program at Neuchâtel (1952-1967)** *Ion Mihailescu [1], Christoph Affolderbach [2], Gianenrico Bernasconi [1], Julien Gressot [1], Romain Jeanneret [1], Gaetano Mileti [2]* *[1] Institute of History, University of Neuchâtel,* *[2] Time-Frequency Laboratory, Institute of Physics, University of Neuchâtel* In the 1950s, Neuchâtel emerged unexpectedly as a leading site for atomic clock development. Its research strategy—anchored in a close collaboration between the physics institute, the observatory, and a laboratory funded by the watch industry—enabled it to compete with and even surpass much larger and better-funded national laboratories. Its researchers designed some of the most precise ammonia masers, reported the first experiments on a thallium beam, and built the first hydrogen maser in Europe. This presentation explores how Neuchâtel's local configuration allowed it to thrive within the broader Cold War research ecology and take advantage of a new environment shaped by post-war American scientific and military priorities.
15:15	**66**	*cancelled*
15:30		***END; Coffee Break***

Physics and School

Tuesday, 19.08.2025, Room HS 27

Time	ID	Physics and School I *Chair: Alexander Strahl, Universität Salzburg*
14:00	**71 A-E**	**Preisträgervorträge der ABA-Preisträgerinnen und -Preisträger der ÖPG 2025** *NN* Schülerinnen und Schüler können ihre abschließenden Arbeiten mit Bezug zum Unterrichtsfach Physik bei der ÖPG einreichen. Im Jahr 2025 gab es 57 Einreichungen, aus denen 5 Preisträgerinnen und Preisträger ermittelt wurden.
14:50	**72**	**Vorstellung des IYPT Tournament** *NN* Das österreichische Team des International Young Physicists' Tournament präsentiert seine Beiträge. Das IYPT zeichnet sich durch Teamarbeit bei der Präsentation von Lösungen physikalischer Aufgaben aus. Der Beitrag wird in englischer Sprache gehalten.
15:05	**73**	**Vorstellung der Physikolympiade** *NN* Bei der internationalen Physikolympiade treten Schülerinnen und Schüler gegeneinander an, um theoretische und experimentelle Aufgaben zu lösen. Die diesjährigen Teilnehmenden geben einen kurzen Einblick.
15:20		
15:30		***Coffee Break***
		Physics and School II *Chair: Alexander Strahl, Universität Salzburg*
16:00	**74**	**Understanding of Nature of Science and Dealing with Errors** *Rahel Schmid, Pädagogische Hochschule St. Gallen, Switzerland* Errors are not only made at school, but also in scientific work. In both areas, they represent important learning opportunities if they are used appropriately. For example, errors make it possible to reflect on scientific practice or represent a source for the falsifiability of scientific knowledge. However, little attention has been paid to errors as an aspect of the Nature of Science. In this study, the connection between the understanding of NOS and the handling of errors was examined. To this end, secondary school students (grades 7 to 9) from eastern Switzerland were surveyed in an intervention study using a mixed-methods design. The results show, among other things, that the understanding of NOS aspects influences the error learning orientation and that this also mediates the effect on the affective-motivational reactions to errors. The results indicate that an adequate understanding of NOS aspects favours a constructive approach to errors.

16:30	**75**	**Schrödinger's cat in basic physics instruction - Sketch of a learning path for the Swiss Gymnasium** *Hans Peter Dreyer, Kantonsschule, Wattwil, Switzerland* Quantum physics only recently became a part of the curriculum for basic physics instruction in Swiss secondary school (Gymnasium). Schrödinger's cat is popular even among students who arn't in favor of STEM-topics. The promise to understand the cat may motivate them to dive into a demanding topic. - A partially tested path will be presented how to overcome classical preconcepts while aiming at Schrödinger's Psi and the superposition of "life and death" states. The observed decoherence of cat-states helps to clear some ideas. Finally, analyzing the measurement process in real experiments leads to Schrödinger's concept of entanglement which goes back to the 1930s and has consequences in today's basic and applied physics.
16:45	**76**	**PPLUS: Project-based Physics Lab for Undergraduate Students** *Andreas Eggenberger, Daniela Rupp, Barbara Schneider, Linos Hecht* *ETH Zürich, Departement of Physics, Zürich* We present the development and implementation of PPLUS, the novel Project-based Physics Lab for Undergraduate Students at ETH Zürich. In this inquiry-based format, students choose their own research question, design and build an appropriate setup, and conduct their own experiments. We discuss the challenges and successes encountered during the first three semesters of its conduction. The students' self-perceived skill levels associated with a set of learning goals was tracked. All learning objectives are achieved in the new format at least equally well as in the traditional lab course. In addition, students benefit from increased collaboration, a structured approach to project development, and the opportunity to explore their interests, which leads to exceptionally high motivation, a key factor for efficient learning.
17:00	**77**	**Making physics matter - Strategies for science communication** *Henrik Siboni, Pharmaceutical Technology and Biopharmacy & Single Molecule Chemistry, University of Graz* Science communication is no longer just a fun side project, but an essential part of research. But how do you share complex physics with non-physicists? In this talk, we will cover the key steps to getting started: choosing your message, finding your audience, and picking the right format. I will share a collection of practical examples, tools, and resources to help you grow and build your confidence. Whether you are curious about getting started or want to exchange ideas with fellow communicators, this is the talk for you. Join us and discover how to make your physics matter!
17:15	**78**	**PLANCKS Austria: Competing, Connecting, and Changing Physics Education** *Christian Binder, Oxford University, Oxford, United Kingdom* PLANCKS is an international physics competition for undergraduate and master's students. We share our journey from last place in 2017 to 9th place at the international finals in Milan 2023 — and how that experience led us to found PAULI and organize PLANCKS Austria. Our goal is to bridge the gap between coursework and research by designing problems inspired by active research areas such as quantum computing or fusion physics, solvable using first principles. We aim to show students that research is approachable and engaging early in their studies. With initiatives like "Students vs. Professors," we foster a collaborative, low-barrier physics culture. Our long-term goal: bring the PLANCKS finals to Graz in 2030 and build a lasting physics community.

17:30	**79**	**Empowering Youth Through Physics by Three Innovative Approaches in Hands-On School Outreach: Iridescent Chocolate, Iridescent Kombucha Vegan Leather and Complex Mycelium Shapes** *Ille C. Gebeshuber, Institute of Applied Physics, TU Wien* Empowering curiosity in young minds is a central goal of effective science outreach. To foster an intuitive and playful approach to physics, we developed interdisciplinary workshops that appeal to young people's fascination with colour, texture and transformation. Core elements include the transfer of iridescent diffraction patterns from compact discs onto chocolate and self-produced kombucha-based vegan leather, as well as the growth of bio-based and biodegradable complex mycelium shapes. These workshops were realized in collaboration with student teachers from the University of Applied Arts Vienna. By integrating physics with aesthetic and tactile experiences, this approach builds bridges between science and creativity, encouraging engagement and empowerment.
17:45		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

Progress in Material Sciences – from Lab to Industry

(Physics in Industry)

Thursday, 21.08.2025, Room HS 30

Time	ID	PROGRESS IN MATERIAL SCIENCES – FROM LAB TO INDUSTRY *Chair: Gian Salis, IBM Rüschlikon,* *Peter Korczak, ÖPG*
14:00	**81**	**Diamond thin films – from lab to industry** *Doris Steinmüller-Nethl, CarbonCompetence GmbH, 6112 Wattens, Austria* Carbon is one of the most important elements present in every living being. In the form of diamond thin films carbon shows what elseit is capable of. Due to the extraordinary properties such as highest hardness, high thermal conductivity, biocompatibility, chemical resistance, electrical insulator/doping to semiconductor, etc., many areas of application are opening up. New manufacturing processes developed in the last years enable the realisation of many applications of thin diamond films. CarbonCompetence GmbH has been active in the development for many years and has now been able to bring several diamond-based products from the lab to industrial application. An overview of current applications, but also promising innovations will be presented - from the laboratory to industrial use.
14:20	**82**	**Thin film coatings – adressing modern industry challenges** *Georgios Christides, Evatec* Material science has evolved significantly over the past decades, transitioning from experimental laboratory setups to tools designed to meet stringent industrial applications and challenges. Among these advancements, thin film coatings, which are typically deposited using Physical Vapor Deposition (PVD), play a crucial role in addressing the ever-growing technological demands of modern society. PVD deposition techniques enable the precise and repeatable deposition of optical, electrical, and functional nm- and μm-thick layers under controlled uniformity specifications, making them ideal for producing reliable, nanoscale microelectronic components with high production yields that meet strict fabrication and performance specifications. These thin films typically consist of oxides, nitrides, and other piezoelectric and metal materials, used to create components and devices such as gratings, waveguides, RF filters, antireflection coatings or highly reflective mirrors. Such components are an integral part of everyday electronics and find application in a wide array of industries, including telecommunications, medical devices, consumer electronics and automotive. In the context “Material Physics – from Lab to Industry” we will focus on the evolution of thin film coatings from small chip sizes all the way up to 300 mm Si wafers looking at different deposition concepts (batch, inline, single process module) with an emphasis on the modern industry requirements (uniformities, stress, particle reduction and costs). As concrete examples we will highlight the potential of PVD deposited optical materials like Si_3N_4 and AlN for next generation photonic integrated components alongside different piezoelectric materials like AlScN and $BaTiO_3$, which promise new applications and synergies between photonics and optoelectronics. In conclusion, we will introduce the concept of quantized nanolaminates, an implementation enabled by the in-house Batch Process Module (BPM), and its fabrication advantages compared to conventional multilayer coating designs. These new materials could potentially pave the way for new technological advancements, fostering more efficient and smaller devices.

14:40	**83**	**High-k SiC power MOSFETs for the next generation of E-mobility power modules** *Stephan Wirths, Hitachi Energy Research, Hitachi Energy Ltd, Baden-Dättwil, Switzerland* Nowadays, power electronics is undergoing an exciting technology shift driven by the steadily growing demand for energy of our digital society and the urgent requirement for low carbon emission transport infrastructures. SiC MOSFETs have entered the power devices arena, however, challenges connected to the gate stack technology are still to be solved to fully exploit the enormous potential of SiC MOSFETs. At Hitachi Energy, we have developed a novel MOS gate stack technology based on high-k dielectrics and successfully fabricated fully functional vertical high-k SiC power MOSFETs for several voltage classes such as 1.2 kV, 1.7 kV and 3.3 kV. We demonstrated devices with superior SiC/high-k dielectric interface trap density and, thus, boosted performance by 35 % compared to SiO_2 gate stack technology.
15:00	**84**	**Elucidating the diffision of hydrogen in Zn coatings for the steel industry** *Andreas Kretschmer [1,2], Alper Tunga Celebi [2], Markus Valtiner [1,2]* *[1] Christian-Doppler Laboratory for Surface and Interface Engineering, TU Wien, Wiedner Hauptstraße 8-10, 1040 Wien, Austria* *[2] Institute of Applied Physics, TU Wien, Wiedner Hauptstraße 8-10, 1040 Wien, Austria* Despite its economic importance, the behavior of hydrogen in Zn coatings is not well studied. Here, we investigate the H-trapping energies at different defect sites in Zn such as using DFT, and compare them to 9 other metals. As the only metal, Zn repels H at all investigated defects, while Ti shows strong attraction. We explain this with the band structure, showing that all investigated metals except for Zn form localized bonds with H. We next develop machine-learning force-fields for H-diffusion studies using molecular dynamics (MD) for Zn and Ti. Training forces are consecutively sampled from ab-initio-MD simulations of defect cells with several dispersed H atoms, achieving training errors below 0.1 eV/Å, sufficient to perform large-scale simulations in poly-grain structures.
15:20		
15:30		***Coffee Break***
		Chair: Christian Teissl, FabLab. Tirol
16:00	**85**	**A brain-inspired computing approach – the role of material science** *Wooseok Choi, Valeria Bragaglia, IBM Research Europe-Zurich* Computation in its many forms is the engine that fuels our modern world. With the increasing amount of complex data availability and AI applications invading our daily life, conventional computing technologies based on Von-Neumann architectures are gradually reaching their limits in terms of performance, speed, energy efficiency, and miniaturization. A dedicated neuromorphic hardware can help overcome these issues as it is explicitly designed to support dynamic learning in the context of complex and unstructured data. The development of novel functional materials and devices incorporated into unique architectures will allow a technological leap toward the implementation of a neuromorphic computer that can efficiently implement the heavy vector - matrix manipulation inherent to AI workloads with O(1) time complexity. In this talk I will focus on the role of materials science in the development of various memristive technologies, key building blocks for the realization of the artificial synaptic function in brain-inspired computing. Memristors rely on diverse physical mechanisms and materials and their understanding via experimental and theoretical means is pivotal to the device optimization and coupling to the higher layers of the computer architecture.

16:20	**86**	**The world of refractory metals molybdenum and tungsten – linking basic research and industrial applications** *Arno Plankensteiner, Plansee SE, Reutte, Austria* The situation for molybdenum (Mo) and tungsten (W) is that their commerical markets are comparatively small, academic education of scientists and engineers in refractory metals is limited, and some of the properties of Mo and W tend to discourage their use. However, increasingly more novel technical and material soluations are required to meet future demands from megatrends such as climate change, renewable energy, and artificial intelligence, utilizing specific and partly unique properties of Mo and W. This way, Mo and W act as enablers by expanding the boundaries of what is currently technically feasible which is shown in the present contribution on examples from various industries by adopting interdisciplinary R&D approaches capturing fundamental physical and chemical challenges in industrial applications.
16:40	**87**	**Printed Piezoelectric Transducers as Highly Integrated Nanogenerators for Harvesting Deformation, Motion and Vibration Energy** *Barbara Stadlober, Jonas Groten, Asier Alvarez Rueda, Philipp Schäffner, Oliver Werzer, Andreas Petritz, Krzysztof Krawczyk, Matthias Hammer, Matthias Adler, Elisabeth Schreck, Maria Belegratis, Andreas Tschepp, Martin Zirkl* *JOANNEUM RESEARCH, Graz, Austria* Many application fields for energy harvesting (EH) require compact devices featuring a high-integration density that can be realized with low-cost, high-throughput fabrication methods. We present multiple types of nanogenerators based on printed piezoelectric transducers for EH of deformation, motion, and vibration. Their design is guided by FEM simulations to optimize both conversion efficiency and electrical output thus meeting the requirements of low-power IoT electronics. First, we will present a fully integrated wireless EH-system for self-powered tire pressure monitoring in bicycle tubes. In addition, we accomplished a thin smart floor piezoelectric harvester that generates up to 6 μJ/step. For harvesting of machine vibrations to supply a sensor, we demonstrate an EH-system tuned to the vibration frequency of a vacuum pump.
17:00	**88**	**GaN – much more than a semiconductor** *Clemens Ostermaier, Infineon Technologies Austria AG, Villach, Austria* Gallium nitride (GaN) offer fundamental andvanges over Silicon, due to its wide bandgap, higher critical electric field, and high electron mobility, which have driven the transition from academic research to the industrialization of GaN power devices, offering outstanding specific dynamic on-state resistance and smaller capacitances enabling higher switching frequencies. This talk will furthermore delves into the slightly more hidden secrets of GaN as a heteroepitaxial layer stack on silicon substrates, exploring how the real electronic structure, interfaces, and buffer layers critically influence device performance, reliability, and manufacturability.

17:20	**89**	**Advances in green manufacturing of Li-ion batteries for scalable eco-friendly production** *Marcus Jahn, Buket Boz, Artur Tron, Lukas Neidhart, Katja Fröhlich* *Battery Technologies, AIT Austrian Institute of Technology GmbH, Vienna, Austria* The future of the electrification in the mobility sector is increasingly dependent on battery solutions that offer not only a high energy density for long rage driving, but are also sustainable. In order to create a more sustainable Li ion battery, the focus of research has shifted towards green manufacturing methods, including design for circularity, energy efficient production methods as well as the decrease in hazardous and rare substances. This includes not only the reduction in cobalt, but more so the move towards aqueous or completely dry slurry preparation as well as the decrease of fluorinated compounds. In this work, the authors present recent progresses in slurry processing using alterative binder materials, such as Li-PAA and Na-alginate at prototype scale with areal loadings of 2.5 mAh/cm^2 for industrially relevant electrode formulations. These binder systems are used in combination with Ni- rich cathodes as well as Co-free high voltage cathode materials. In addition, F-free binder systems have been investigated in scalable cathode processing for solid-state batteries (SSB). It has been shown that in certain systems, such as Si-rich graphite composite anodes, that the LiPAA binder system and hence the greener option, display in fact better rate capability and slightly improved coulombic efficiency compared to conventional PVDF systems. For SSB systems, binder materials have an even larger environmental impact, since the binder is not only used for adhesion to the current collector and cohesion of the active particles, but instead as a composite material responsible also for Li ion conduction within the electrode itself – thus acting as an electrolyte filler material within cathode composites. Therefore, HNBR, NBR and SBS have been used as PVDF alternative for producing a cathode composite within an SSB system. The results indicate a good processability of the composite, including good adhesive properties. Furthermore, it has been observed that the electrochemical performance is outperforming the PVDF composite NMC811 cathode, displaying good electrochemical stability. The entire work is evaluated with a focus on assessing the influence production parameters of the electrodes on the overall cell performance. This includes tortuosity, ionic conductivity and porosity of the resulting electrodes.
17:40		*Discussion*
18:00		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

Condensed Matter

This session has been organised in the frame of the initiative Condensed Matter in Central Europe.

Tuesday, 19.08.2025, Room HS 31

Time	ID	KOND I: Magnetism I *Chair: Andrii Chumak, Universität Wien*
14:00	101	**Magnetoresistance in Antiferromagnets** *Karel Vyborny, FZU - Institute of Physics, Acad. Sci. Czech Rep., Praha, Czech Republic* Antiferromagnets are abundant in nature yet much less explored in terms of their magnetotransport properties than ferromagnets. Various magnetoresistive phenomena in these materials will be discussed, ranging from isotropic magnetoresistance (MR), certain quantum effects to anisotropic MR and the anomalous Hall effect (AHE). Finite-frequency analogs of these effects will be mentioned. While the main focus in research of MR is naturally on metals, semiconducting materials will also be covered. Some new developments pertaining to the class of altermagnetic materials will be included and outlook to non-collinear antiferromagnets presented. Examples of strategies to disentangle various contributions to MR will be given.
14:30	102	**Chiral nanomagnetism induced by 3D nanopatterning** *Amalio Fernandez-Pacheco [1], John Fullerton [4], Naëmi Leo [1], Jakub Jurczyk [1], Claire Donnelly [2], Dédalo Sanz-Hernández [6], Stefan Stanescu [5], Donald Maclaren [7], Rachid Belkhou [5], Aurelio Hierro-Rodríguez [3]* *[1] TU Wien, [2] Max Planck for Chemical Physics of Solids, Dresden, Germany, [3] University of Oviedo, Spain, [4] Argonne National Laboratory, Illinois, United States, [5] SOLEIL synchrotron, L'Orme des Merisiers, France, [6] Laboratoire Albert Fert, Palaiseau, France, [7] University of Glasgow, United Kingdom* Chiral nanomagnetism—a key concept in the design of next-generation spintronic systems- can arise from a range of mechanisms, including interfacial and bulk Dzyaloshinskii–Moriya interactions. In this work, we exploit instead geometrically-induced magnetochirality in helical nanowires, thanks to advanced nanoscale 3D printing using focused electron beam induced deposition. We have previously demonstrated that 3D printed helical nanowires provide a tuneable platform for exploring 3D chiral spin textures and topologically structured stray fields. Here, using a combination of XMCD magnetic techniques and transmission electron holography, we will show that such systems also support the formation of stable fractional skyrmion tubes, demonstrating how 3D nano-patterning leads to advanced forms of chiral nanomagnetism.
15:00	103	**Doping-controlled magnetic and optical effects in $EuCd_2X_2$** *David Santos-Cottin [1], Serena Nasrallah [1,4], Florian Le Mardelé [2], Mario Novak [3], Neven Barisic [3,4], Milan Orlita [2], Premysl Marsik [1], Ana Akrap [3]* *[1] Department of Physics, University of Fribourg, Switzerland, [2] LNCMI, CNRS-UGA-UPS-INSA, Grenoble, France, [3] Department of Physics, Faculty of Science, University of Zagreb, Croatia, [4] Institute of Solid-State Physics, TU WienAustria* Recent studies using infrared and magneto-optical techniques have identified $EuCd_2As_2$ and related $EuCd_2X_2$ compounds (X = P, As, Sb) as magnetic semiconductors, contradicting earlier views as topological semimetals. These materials exhibit large band gaps that are sensitive to magnetic fields and chemical substitution. Motivated by this, we used both linearly and circularly polarized light to prob their magnetic properties below the band gap and observed a strong Faraday effect at very low magnetic fields, persisting up to room temperature. Additionally, the system exhibits unique circular dichroism over a broad energy range, caused by band splitting under a low magnetic field. These effects are highly tunable with doping, suggesting promising applications in optoelectronics.

15:15		
15:30		***Coffee Break***
		KOND II: Magnetism II *Chair: Alberta Bonanni, JKU Linz*
16:00	**105**	**Magnetic anisotropy and symmetry of unconventional antiferromagnets** *Mirta Herak [1], William Lafargue-Dit-Hauret [2], Xavier Rocquefelte [3]* *[1] Institut za fiziku, Zagreb, Croatia,* *[2] Université de Pau et des Pays de l'Adour, E2S UPPA, CNRS, Institut des Sciences Analytiques et Physico-chimie pour l'environnement et les matériaux (IPREM), Pau, France,* *[3] ISCR - University of Rennes 1 - CNRS, Rennes, France* Antiferromagnets are materials with significant potential for increasing information processing and storage capabilities by several orders of magnitude, as well as unprecedented energy efficiency in future electronics. The key ingredient in understanding their properties is symmetry. Torque magnetometry is a particularly sensitive, but underused, probe of macroscopic magnetic anisotropy, which is related to symmetry. It can be utilized to detect symmetry breaking, the presence of multiple AFM domains, or to determine the anisotropic magnetic phase diagrams. I will present our ongoing effort in studying magnetic anisotropy and symmetry in several unconventional antiferromagnets by combining torque magnetometry with DFT calculations. Our combined expertise sheds light on important anisotropic and symmetry-defined magnetic properties often overlooked or undetected by conventional methods.
16:30	**106**	**At the Frontier of Altermagnetism:** **Unraveling MnTe's Dual-Channel Photoresponse to Polarized Light** *Juraj Krempasky, Paul Scherrer Institut, Villigen, Switzerland* At a fundamental level, the altermagnetic phase is characterized by collinear magnetism with zero net magnetization. MnTe serves as a prime example of such a material. SARPES combined withXPEEM spectroscopy enabled us to gain a detailed understanding of MnTe altermagnetism in both reciprocal and real space at the nanoscale. Together, these techniques have confirmed the existence of this distinctive magnetic order. Furthermore, comprehensive ARPES investigations of pre-patterned MnTe structures with well-defined Néel vector orientations indicate that MnTe exhibits an unconventional photoresponse to polarized light. Our findings demonstrate that this unique behavior potentially reveals the sub-lattice d-wave altermagnetic spectral response of MnTe.
17:00	**107**	**Altermagnet / Superconductor / Altermagnet Tunneling Junction** *František Herman [1], Marcel Polák [1], Andreas Costa [2], Jaroslav Fabian [2]* *[1] Comenius University, Bratislava, Slovakia, [2] Regensburg University, Germany* Altermagnetism, as a novel form of magnetic order, naturally offers itself as a focus of study in electronic systems, with emphasis on spin. We study the spin-resolved conductance of the altermagnet / superconductor / altermagnet junction. We show that depending on the form of the altermagnetic exchange splitting, describing the rotation of the spin-resolved Fermi surfaces, the conductance falls somewhere between two limit behaviors. Specifically, it can behave similar to a normal metal / superconductor / normal metal junction or ferromagnet / superconductor / ferromagnet junction. We propose the use of tunneling magnetoresistance as a tool that, among other things, allows us to focus on these two limits and quantitatively distinguish between them. We show this through the "four-leaf clover" pattern in the angle-resolved tunneling magnetoresistance.

17:30	**108**	**Anomalous temperature dependence of local magnetic fields in altermagnetic MnTe** *Jonas A. Krieger [1], Thomas Hicken [1], Oliver J. Amin [2], Alfred Dal Din [2], J. Hugo Dil [3], Gianluca Janka [1], Dominik Kriegner [4], Hubertus Luetkens [1], Thomas Prokscha [1], Helena Reichlova [4], Zaher Salman [1], Gunther Springholz [5], Andreas Suter [1], Klara Uhlířová [6], Peter Wadley [2], Juraj Krempaský [1]* *[1] Paul Scherrer Institute, Villigen PSI, Switzerland, [2] University of Nottingham, United Kingdom, [3] École Polytechnique Fédérale, Lausanne, Switzerland, [4] Czech Academy of Sciences, Prague, Czech Republic, [5] Johannes Kepler University Linz, Austria, [6] Charles University, Prague, Czech Republic* Altermagnets are a novel type of magnetic system that has spin-split bands but no net magnetization. A ferromagnetic-like transport response makes such materials particularly interesting for potential device applications. Hexagonal MnTe is a prototypical altermagnet consisting of alternating ferromagnetically ordered Mn layers, and exhibits the expected strong spin splittings in the band structure. Here we present muon spin spectroscopy measurements on MnTe. We observe pronounced anomalies in the temperature dependence of depolarization rates and oscillation frequencies, pointing to a more complex evolution of the local magnetic environment.
17:45	**109**	**Percolative metallic state with Kondo-like behavior in manganites $Ca_{1-x}Gd_xMnO_3$** *Matija Culo [1], Tomislav Ivek [1], Nikolina Novosel [1], Milena Rosić [2]* *[1] Institut za fiziku, Zagreb, Croatia,* *[2] "Vinča" Institute of Nuclear Sciences, National Institute of the Republic of Serbia, University of Belgrade, Serbia* Manganites are one of the most intriguing materials in condensed matter physics due to the famous colossal magnetoresistance (CMR) – an enormous decrease of electric resistivity in applied magnetic field close to Curie temperature. Despite intensive research for more than 30 years, CMR and closely related conduction mechanism in manganites remain unresolved. Here we present our most recent magnetotransport measurements on nanocrystalline manganites $Ca_{1-x}Gd_xMnO_3$ (x = 0.05, 0.10), in the temperature range 2 - 300 K, and in magnetic fields up to 16 T. Our results show the presence of an insulator-to-metal transition, a peculiar resistivity upturn at low temperatures, and a large negative magnetoresistance. We argue that such behavior implies percolation of ferromagnetic metallic regions with Kondo-like scattering on Gd impurities.
18:00		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

Tuesday, 19.08.2025, Room HS 33

Time	**ID**	**KOND III: Quantum Dots & 2D Materials I** *Chair: Danko Radić, University of Zagreb*
14:00	**111**	**Gate defined electron and hole quantum dots in bilayer graphene** *Luca Banszerus, Quantum Transport Lab, Faculty of Physics, University of Vienna, Austria, 22[nd] Institute of Physics, RWTH Aachen University, Aachen, Germany* Bilayer graphene (BLG) quantum dots (QDs) are regarded as attractive platform for spin qubits due to the low nuclear spin densities and weak spin-orbit interaction. In addition to spin, BLG exhibits a tunable valley degree-of-freedom, which is associated with strong out-of-plane magnetic moments. This allows controlling the valley splitting using valley space as qubit platform. In contrast to conventional semiconductors, the band structure of BLG is electron/hole symmetric and exhibits a tuneable band gap, which we use to form electron/hole double-QDs. We observe

		the creation of single electron-hole pairs with opposite quantum numbers and achieve a protected spin-valley Pauli blockade. The latter allows for spin-to-charge conversion and valley-to-charge conversion – essential for the operation of spin and valley qubits.
14:30	**112**	**Shaped pulses enable robust quantum dot coherent control** *Vikas Remesh, René Schwarz, Florian Kappe, Yusuf Karli, Gregor Weihs* *University of Innsbruck, Austria* Semiconductor quantum dots (QD) stand apart from other solid-state material platforms due to their exceptional photostability, brightness, color tunability, and above all, the easiness to realize chip-scale quantum photonic devices. Exceptional progress has been made in the last decade on the optical control of QDs. In this presentation, I will navigate through novel coherent control schemes for QDs, relying on optical pulse shaping, such as swing-up scheme to trigger QDs below the band edge, stimulated two-photon excitation to enhance the photon purity, and most importantly, chirped pulse excitation which enables robust triggering of multiplexed photon states from quantum dots.
15:00	**113**	**Strong magnon-spin coupling between layered van der Waals antiferromagnet CrSBr and paramagnetic ion crystal GdW10** *David García Pons, Jorge Pérez-Bailón, Xavier del Arco-Fargas, David Zueco,* *María-José Martínez-Pérez* *Instituto de Nanociencia y Materiales de Aragón (Unizar-CSIC), Zaragoza, Spain* Cavity Quantum Electrodynamics (C-QED) is used to manipulate and interrogate qubits or to engineer hybrid light-matter states. Beyond light, the solid state offers a variety of quantized bosonic excitations, such as magnons. Magnon-matter states have additional advantages such as reduced size and enhanced coupling strengths. We report on magnon-spin interaction between the layered van der Waals antiferromagnet CrSBr and paramagnetic ion crystal GdW10, measured via microwave absorption spectroscopy at millikelvin temperatures. The avoided crossing seen at low probing power indicates that we achieve the strong coupling regime between both systems.
15:15	**114**	**Pore shape selection in hexagonal boron nitride (hBN) with electron beam induced chemical effects** *Umair Javed [1,2], Manuel Längle [1], Vladmir Zobac [1], Alexander Markavich [1], Clara Kofler [1,2],* *Clemens Mangler [1], Toma Susi [1], Jani Kotakoski [1]* *[1] University of Vienna, Faculty of Physics, Austria,* *[2] University of Vienna, Vienna Doctoral School in Physics, Austria* It's well-established that electron irradiation of hexagonal boron nitride (hBN) leads to the formation of triangular pores with nitrogen-terminated edges, but the cause is still unclear. We resolve this by experimenting with different acceleration voltages at different low-pressure atmospheres. At 10^{-10} mbar, electron irradiation led to round pores. At oxygen pressure of ca. 10^{-9} mbar, growth accelerates by ca. a factor of three, the shapes remain circular. But, at ca. 10^{-8} mbar, the pores turn into triangles and the growth further spurs. This indicates that, at higher pressures, the pore growth is dominated by a beam-assisted chemical process rather than direct electron-beam damage. Ab-initio simulations based on experiments confirm that oxygen is the main cause for triangular pores in hBN.
15:30		***Coffee Break***

Time	ID	KOND IV: 2D Materials II *Chair: Daniel Mazzone, PSI Villigen*
16:00	121	**Multifrequency Excitation and High Dynamic Range Tunneling Spectroscopy** *Fabian Natterer, University of Zurich, Switzerland* The large number of spectra needed for high-resolution quasiparticle interference of low-dimensional quantum materials led to the development of faster spectroscopies. While parallel spectroscopy and compressive sensing offer speed gains, they come at a cost. Applying a sinusoidal voltage to the nonlinear current-voltage characteristics of a tunneling junction generates a frequency comb of higher-order current harmonics. Though their parallel measurement enables faster spectroscopy, it averages most where currents are largest, degrading signal-to-noise for small signals near the Fermi level. We introduce a multifrequency excitation mode that increases averaging time forthose small currents. The AC excitation further allows to increase the dynamic current range by deliberately suppressing large amplitude, low-order harmonics that would otherwise saturate the preamplifier.
16:30	122	**Atom diffraction through a free-standing 2D crystal** *Toma Susi [1,2], Carina Kanitz [1], Jacob Bühler [1], Vladimir Zobac [2], François Aguillon [3], Joseph J. Robinson [1], Philippe Roncin [3], Maxime Deboissac [1], Christian Brand [1]* *[1] German Aerospace Center, Ulm, Germany, [2] University of Vienna, Austria,* *[3] CNRS-Université Paris-Saclay, Paris, France* Diffraction of particles through materials allows studying their properties in great detail. So far, coherent transmission has only been demonstrated for electrons and neutrons, leading to the fundamental question whether this is possible with atoms. Here, we report the first results on atomic diffraction through a crystalline material, using H and He atoms with kinetic energies close to 1 keV normal to the surface of monolayer graphene. We observe detailed Debye-Scherrer rings up to the eighth diffraction order. This shows that atoms can pass through material and retain their coherence, which we elucidate using time-dependent density functional theory molecular dynamics simulations.
17:00	123	**Bi-modal response in Graphene Nanoribbon Devices** *Christian Teichert [1], Awais Aslam [1], Igor Stanković [2], Gannadiy Murastov [1], Zubair Khan [1], Zehao Song [3], Alois Lugstein [3], Raul Rodriguez [4], Aleksandar Matković [1]* *[1] Chair of Physics, Montanuniversität Leoben, Austria, [2] University of Belgrade, Serbia,* *[3] Institute of Solid State Electronics, TU Wien, Austria, [4] Tomsk Polytechnic University, Russia* The self-assembly of rod-like organic molecules on exfoliated graphene into networks of crystalline needles - which are several 10 nm wide, a few nm high, and several 10 μm long - can be used as masks for reactive ion etching to prepare graphene nanoribbon (Gr-NR) networks. Here, we investigate the role of water in the response of such Gr-NRs. We found that the number of Gr-NR layers plays a key role in the stability of the observed bi-modal response. This work lays the foundations for exploiting Gr-NRs in next-generation memory devices.
17:30	124	**Charge Density Wave Ground State in the Intercalated Graphite CaC_6** *Petra Đurkas Grozić [1], B. Keran [1], A. M. Kadigrobov [2], Danko Radić [1]* *[1] Physics Department, Faculty of Science, Bijenička 32, Zagreb, Croatia* *[2] Theoretische Physik III, Ruhr-Universität Bochum, Universitätsstraße 150, DE-44801 Bochum* We present an analytical model of the charge density wave instability in the graphene sheets within the intercalated graphite CaC_6 compound. The instability yields the experimentally observed uniaxial charge stripes of periodically modulated electron density, coupled to the softest phonon mode of the superlattice consisting of the Ca atoms intercalated between graphene planes. The Fermi surface of the chemically doped graphene undergoes the novel type of instability driven by the mechanism that gains the condensation energy of the stripe state by the topological reconstruction of the Fermi surface. This mechanism appears to be entirely different from the one based on the Fermi surface nesting, which has been considered a paradigm in the present literature concerning the onset of charge density waves.

17:45	**125**	**Quantum confinement effects in rhombohedral and hexagonal graphite nanoribbons** *Konrád Kandrai [1,2], András Balogh [1,3], András Pálinkás [1], Dóra Varga [1,2], Krisztián Márity [1], Zoltán Tajkov [1], Péter Vancsó [1], Levente Tapasztó [1], Péter Nemes-Incze [1]* *[1] Hungarian Research Network, Centre for Energy Research, Institute of Technical Physics and Materials Science, 1121 Budapest, Hungary,* *[2] Department of Physics, Institute of Physics, Budapest University of Technology and Economics, 1111 Budapest, Hungary,* *[3] Department of Biological Physics, Eötvös Loránd University, 1117 Budapest, Hungary* Rhombohedral graphite (RG) hosts strong electron correlations due to a surface flat band that arises from its bulk nodal-line topology. The flat band hosts many-body effects, notably fractional Chern insulator phases and unconventional superconductivity. Quantum confinement is a powerful tool to modulate the electronic structure in condensed matter systems, but it has not been applied to RG before. Here we study quantum confinement due to stacking domain walls in hexagonal and rhombohedral graphite nanoribbons (5–70 nm wide) using scanning tunneling microscopy. We observe that while confined hexagonal regions show clear intravalley scattering, rhombohedral strips do not. This suppression is likely due to RG's flat band and low group velocity in both the surface flat band and bulk electronic bands.
18:00		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

Tuesday, 19.08.2025, Room HS 7

Time	ID	KOND V: Correlated Materials I *Chair: Aline Ramires, TU Wien*
14:00	**131**	**Exact method for polarons with arbitrary nonlinear electron-phonon interaction: description of quantum paraelectric by double-well "Jahn-Teller" type potential.** *Andrey Mishchenko [1], Osor Barisic [1], Tomislav Miskic [1], Stefano Ragni [2], Cesare Franchini [2]* *[1] Institute of Physics, Zagreb, Croatia, [2] University of Vienna, Austria* We develop an approximation-free computational method for polarons with arbitrary nonlinear couplings of local vibration modes to the electron density and magnitude of the hopping amplitude. Our approach covers polaron models, which were impossible to solve using existing computational techniques. In contrast to former approximate methods, the method remains valid for realistic materials where the phonon frequency is much smaller than the electronic bandwidth.To describe quantum paraelectrics, we study the double-well type model with quadratic and quartic interactions. We observe three different regimes: (i) quantum interplay of quartic and quadratic interactions, which suppresses effects of the quadratic coupling, (ii) intermediate-coupling regime with exponential scaling of the quasiparticle weight and mass renormalization, and (iii) transient regime to strong-coupling asymptotic behavior.

14:30 | **132**

Novel States of Matter with Site- and Orbital-Selectivity as an Alternative to 'Charge Disproportionation' in Correlated Materials

Gheorghe Lucian Pascut, MANSiD Research Center, Stefan Cel Mare University (USV), Suceava, Romania

In this presentation, I will provide a concise overview of the fundamental principles of the resonant X-ray scattering technique usually used to probe experimentally states with charge disproportionation/oxidation states. Additionally, by employing dynamical mean-field theory (DMFT), I will present an alternative perspective on chemically estimated oxidation states, using compounds such as $AgNiO_2$, $NdNiO_3$, $CaFeO_3$, $LaMnO_3$, and $BiMnO_3$ as illustrative examples. This alternative viewpoint suggests that what is often interpreted as "charge disproportionation" may instead reflect the emergence of novel electronic states characterized by site- or orbital-selective behavior. In such states, we observe intriguing phenomena—for instance, non-equivalent crystallographic sites displaying features of both Mott and band-like insulators, or the coexistence of metallic and insulating orbitals within a single crystallographic site.

15:00 | **133**

O(3) Conformal Field Theory from a Truncated Quantum Rotor on the Fuzzy Sphere

Arjun Dey [1,2], Andreas Läuchli [2], Loic Herviou [3]
[1] Paul Scherrer Institut, Villigen, Switzerland, [2] Institute of Physics, EPFL, CH-1015 Lausanne, [3] Université Grenoble Alpes, CNRS, LPMMC, Grenoble, France

The O(N) Wilson-Fisher fixed points govern universal behavior in diverse systems, including magnets, superfluid transitions, classical fluids, and relativistic scalar field theories. We develop a general method to study O(N) Wilson-Fisher criticality via truncated quantum rotor models, and apply it to the O(3) case on a fuzzy sphere. Using conformal perturbation theory, we locate the critical point, extract scaling dimensions through the state-operator correspondence, and determine OPE coefficients from finite-size errors, effectively transforming noise into signal. We discover several new operators, including an O(3) pseudoscalar Lorentz vector that resolves a known discrepancy in dimerized antiferromagnets. The appearance of the stress tensor and Noether current confirms the conformal symmetry in the spectrum.

15:15 | **134**

Charge transport in two-dimensional system with massive and massless Mexican-hat-like bands

Zoran Rukelj [1], Željana Bonačić Lošić [2]
[1] University of Zagreb, Faculty of Science, Zagreb, Croatia,
[2] Faculty of Science, University of Split, Croatia

We study the single-particle, DC and optical properties of a two-dimensional system with massless and massive Mexican-hat-like valence bands desribed by two types of 2×2 Hamiltonian matrices and two ground state phases: a gapped phase and a nodal-loop phase. We calculate the single particle density of states, the effective concentration of charge carriers and the Hall coefficient. The interband conductivity is calculated for the gapped phase as it depends on doping and temperature. In the undoped nodal-loop phase only the zero-frequency interband conductivity is shown to be finite.
Two results stand out: Hall coefficient answers whether the Mexican-hat-like bands are massive or massless and measuring the square-root singularity in the finite-temperature optical conductivity, we identify the gapped phase.

15:30 | | ***Coffee Break***

Time	ID	**KOND VI: Superconductivity I** *Chair: Bela Pecz, HUN-REN Centre for Energy Research, Budapest*
16:00	**141**	**Nanomechanical cat states in NEM-based quantum processing** *Danko Radić [1], Sang-Jun Choi [2,3], Hee-Chul Park [3,8], Junho Suh [7], Leonid Gorelik [4], Robert Shekhter [5], Sergei Kulinich [6], Matija Tečer [1]* *[1] University of Zagreb, Faculty of Science, Department of Physics, Zagreb, Croatia,* *[2] University of Würzburg, Germany, [3] Institute for Basic Science, Daejeon, Korea,* *[4] Chalmers University of Technology, Gothenburg, Sweden, [5] University of Gothenburg, Sweden,* *[6] B. Verkin Institute for Low Temperature Physics and Engineering of the National Academy of Sciences of Ukraine, Kharkiv, Ukraine,* *[7] Korea Research Institute of Standards and Science, Daejeon, Korea,* *[8] Pukyong National University, Busan, Korea* Motivated by huge quality factors achievable in nanomechanics and ease of electrical control of charge qubits, we suggest realisation of cat states and their utilisation in quantum information processing in nanoelectromechanical setup. NEM terminal is based on AC Josephson effect: superconducting qubit mechanically oscillates between leads, controlled by bias and gate voltage. Resonant leads-qubit tunnelling of Cooper pairs builds nanomechanical coherent states entangled with electrical states of qubit. By specifically tailored operating protocols of external parameters, one switches between entangled and pure cat states. Quantum information, encoded electrically into the charge qubit states, is transduced between the mechanical and electrical subsystem. By coupling several terminals, quantum information can be transported between them, constituting the basic element of quantum network.
16:30	**142**	**Cuprates, Pnictides, and Sulfosalts: Lessons in Functional Materials** *Denis Karl Sunko, Department of Physics, Faculty of Science, Zagreb, Croatia* Murunskite $K_2FeCu_3S_4$ is a representative sulfosalt, here used as a bridge to compare the chemical and physical roles of metal and ligand orbitals in cuprates and pnictides. In cuprates, ionicity, covalency, and metallicity are tightly interwoven to give superconductivity. In pnictides, ionic and metallic sectors are separate. In murunskite, the greater covalency of sulfur orbitals compensates for total disorder in the Fe atom positions, giving rise to a surprisingly robust antiferromagnetism. Because of open ligand orbitals, the antiferromagnetism in murunskite is more like superconductivity in cuprates than like antiferromagnetism in pnictides, where the ligands are passive.
17:00	**143**	**Discovery of Charge Order and a Dome-Shaped Superconducting Phase Diagram in the Kagome System $LaRu_3Si_2$** *Zurab Guguchia [1], Ke Yuan Ma [2], Igor Plokhikh [1], Charles Mielke III [1], Vahid Sazgari [1], Jennifer Graham [1], Petr Kral [1], Orion Gerguri [1], Hiroto Nakamura [3], Sohal Shams Islam [1], Claudia Felser [2], Ekaterina Pomjakushina [1], Hubertus Luetkens [1], Fabian von Rohr [5], Satoru Nakatsuji [3], Dariusz Gawryluk [1], Björn Wehinger [4], Sergey Medvedev [2]* *[1] PSI Center for Neutron and Muon Sciences CNM, CH-5232 Villigen PSI,* *[2] Max Planck Institute for Chemical Physics of Solids, Dresden, Germany,* *[3] University of Tokyo, Japan, [4] European Synchrotron Radiation Facility, Grenoble, France,* *[5] University of Geneva, Switzerland* I will present the discovery of a characteristic kagome band structure in $LaRu_3Si_2$, accompanied by charge-order transitions at 400 K and 80 K, and an electronic/magnetic transition at 35 K. Through high-pressure magnetotransport and X-ray diffraction measurements up to 40 GPa, we reveal a dome-shaped superconducting phase diagram, with T_c peaking at 9 K (2 GPa) and decreasing beyond 12 GPa, where the charge order evolves from long-range to short-range. Our results demonstrate that superconductivity is intimately linked to the normal-state electronic properties.

17:30	**144**	**Accidental cancellation of out-of-plane hopping amplitudes and breakdown of Drude behavior as the origin of anomalous c-axis resistivity of Sr_2RuO_4** *Sophie Beck [1,2], Matthew Shammami [2,3], Lorenzo Van Muñoz [4], Jason Kaye [2,5], Antoine Georges [2,6,7,8], Jernej Mravlje [9,10]* *[1] Institute of Solid State Physics, TU Wien, Austria,* *[2] Center for Computational Quantum Physics, Flatiron Institute, New York, USA,* *[3] University of California, Los Angeles, Los Angeles, USA,* *[4] Department of Physics, Massachusetts Institute of Technology, Cambridge, USA,* *[5] Center for Computational Mathematics, Flatiron Institute, New York, USA,* *[6] Collège de France, Paris, France, [7] CPHT, CNRS, École Polytechnique, Paris, France,* *[8] DQMP, Université de Genève, Switzerland, [9] Jožef Stefan Institute, Ljubljana, Slovenia,* *[10] Faculty of Mathematics and Physics, University of Ljubljana, Ljubljana, Slovenia* The mechanism behind the anomalous temperature dependence of the out-of-plane resistivity of Sr_2RuO_4 remains a central question even 30 years after its discovery. We show that an accidental cancellation of interlayer hopping amplitudes in the d_{xz}/d_{yz} orbitals leads to a suppression of c-axis conductivity. Using a tight-binding analysis we calculate the resistivity, revealing clear deviations from Drude behavior that are a direct result of the peculiar electronic structure. This behavior originates from the symmetry and connectivity of the body-centered tetragonal lattice, resulting in a suppression of interlayer conduction channels at low temperature. Our results suggest that this mechanism may be relevant more broadly, potentially affecting c-axis transport in other layered materials with similar orbital character and crystal symmetry.
17:45	**145**	**A dynamical vertex approximation perspective on superconductivity in infinite-layer nickelates** *Viktor Christiansson, Karsten Held, TU Wien, Austria* The recent experimental discovery of superconductivity with a critical temperature around 35 K at ambient conditions in a new Sm based infinite-layer nickelate marks a further milestone in the quest for realizing high-T_c superconductivity in oxide compounds beside cuprates. On the theoretical side, the discovery begs the question of what mechanisms underlie this large increase in T_c compared to the previously synthesized (La, Pr and Nd) members of the family with $T_c \leq 20$ K. Here, we will discuss recent insights based on calculations using a combined DFT+DMFT+DΓA (dynamical vertex approximation) formalism, and further speculate on how higher critical temperatures could be achieved. We acknowledge support from the Austrian Science Fund (FWF), Project I 5398.
18:00		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

Thursday, 21.08.2025, Room HS 31

Time	ID	**KOND VII: Magnetism III** *Chair: Martin Gmitra, P. J. Šafárik University, Košice*
11:00	**151**	**Topological magnetism of centrosymmetric skyrmion hosts** *Matjaž Gomilšek, Jožef Stefan Institute, Ljubljana, Slovenia, & Faculty of Mathematics and Physics, University of Ljubljana, Slovenia* Skyrmions are intriguing vortex-like spin textures with non-trivial topology and quasiparticle properties. While they are typically stabilized by antisymmetric interactions in bulk noncentrosymmetric materials, centrosymmetric skyrmion hosts have recently been discovered. There, both the skyrmion stabilization mechanisms and the parent zero-field ground states remain controversial. In our work on centrosymmetric skyrmion hosts Gd_2PdSi_3 and $GdRu_2Si_2$, we address their topological nature, spin dynamics, and the stabilizing role of anisotropy in both their ground-state and skyrmion phases via muon spectroscopy, resonant X-ray scattering, magnetometry, and ab initio calculations.
11:30	**152**	**Topological meron-antimeron domain walls and skyrmions in a low-symmetry system** *Levente Rózsa, HUN-REN Wigner Research Centre for Physics, Budapest, Hungary* Topologically nontrivial magnetic textures have attracted considerable interest in both basic and applied nanomagnetism research. Magnetic skyrmions have been mainly studied in systems with a high rotational symmetry so far. Here, we study an atomically thin magnetic layer with only a twofold rotational symmetry using spin-model simulations based on first-principles calculations, which are found to agree with spin-polarized scanning tunneling microscopy experiments. We demonstrate that both topologically trivial and nontrivial domain walls are formed in this system depending on their crystallographic orientation. The topologically nontrivial walls correspond to alternating chains of merons and antimerons. These domain walls transform into chains of elongated skyrmions in out-of-plane magnetic fields. These findings establish low-symmetry systems as a versatile platform for engineering spin configurations.
12:00	**153**	**Long-range propagating paramagnons** *Sebastian Knauer [1], Rostyslav O. Serha [1,2], Denys Slobodianiuk [3], Roman Verba [3], Sergej Demokritov [4], Andrii V. Chumak [1]* *[1] Faculty of Physics, University of Vienna, Austria,* *[2] Vienna Doctoral School in Physics, University of Vienna, Austria,* *[3] V. G. Baryakhtar Institute of Magnetism of the NAS of Ukraine, Kyiv, Ukraine,* *[4] Institute for Applied Physics, University of Münster, Germany* For long, it was believed that long-range order could not exist in the paramagnetic phase of magnetic materials, inhibiting the propagation of magnons. Our research demonstrates that long-range order can be maintained in the organic free radical TEMPO at cryogenic temperatures, in the presence of strong magnetic fields. This discovery reveals a new type of magnon, known as paramagnons. Our experiments demonstrate that coherently excited low-energy paramagnons can travel distances of up to 8 mm, with group velocities exceeding 180 km/s. We utilise organic free radicals as (para)magnon carriers to merge their properties with spintronics. Demonstrating propagating paramagnons in organic materials opens new avenues for research in organic electronics and potential applications in high-density information storage and quantum information processing.

12:15 | **154**

Realization of Inverse-Design Magnonic Logic Gates

Fabian Majcen [1,2], Noura Zenbaa [1,2], Claas Abert [1,3], Florian Bruckner [1,3], Norbert Mauser [3,4], Thomas Schrefl [3,5], Qi Wang [6], Dieter Suess [1,3], Andrii Chumak [1,3]
[1] Faculty of Physics, University of Vienna, Austria,
[2] Vienna Doctoral School in Physics, University of Vienna, Austria,
[3] Research Platform Mathematics-Magnetism-Materials, Vienna, Austria,
[4] Faculty of Mathematics, University of Vienna, Austria,
[5] Center for Modelling and Simulation, Donau-Universität Krems, Wiener Neustadt, Austria,
[6] School of Physics, Huazhong University of Science and Technology, Wuhan, China

The field of magnonics, which utilizes magnons, the quanta of spin waves, for energy-efficient data processing, has made significant advancements through the application of inverse design. A universal magnonics processor has been developed, utilizing a 7×7 array of independent, omega-shaped current loops to generate local inhomogeneous magnetic fields of up to ± 3.46 mT, thereby scattering spin waves in a Yttrium-Iron-Garnet thin film to achieve various functionalities. In this system, binary data ('0' and '1') is encoded in the spin-wave amplitude. By making use of the nonlinearity of spin waves at 25 dBm excitation power and applying the inverse-design process, logic gates including NOT, OR, NOR, AND, NAND, and a half-adder have been successfully created, demonstrating high contrast ratios and reconfigurability.

12:30 | ***Lunch***

KOND VIII: Magnetism IV

Chair: Ana Akrap, University of Zagreb

14:00 | **161**

Spectroscopy of coupled magnetic and electric resonances

Dávid Szaller, University of Technology and Economics, Budapest, Hungary

Controllable non-reciprocal propagation of light is an intensively investigated field of optics, with studies motivated both by fundamental questions and possible telecommunication applications. So far, polarization-independent, switchable one-way transparency has been demonstrated at certain resonances of multiferroic crystals at cryogenic temperatures and in high magnetic fields, limiting the practical implementation. As an alternative approach, we present one-way transparency of an artificial layered structure consisting of split-ring metamaterial and magnetic substrate layers interacting in the dynamic regime. Our quasi-optical experiments in the GHz frequency range show that this unique combination breaks time and space inversion symmetries in external magnetic field. The ease of tuning the dynamic response and the controllable one-way transparency make this approach promising for real-world applications.

14:30 | **162**

Unraveling the magnetic order in kagome magnet $Co_3Sn_2S_2$

Yona Soh [1], Sandy Ekahana [1], Hengli Duan [1], Yuran Niu [2], Satoshi Okamoto [3], Ingrid Zimmermann [4], Neeraj Kumar [1], Armin Kleibert [1], Carlos Vaz [1], Evangelos Golias [2], Jan Dreiser [1], Loïc Roduit [1], Igor Plokhikh [1], Chaocheng Liu [5], Andrew Hunter [6], Anna Tamai [6], Jakub Gawryluk [1]
[1] Paul Scherrer Institut, Villigen, Switzerland, [2] Max IV Laboratory, Lund, Sweden,
[3] Oak Ridge National Laboratory, Oak Ridge, USA,
[4] National Institute of Standards and Technology, Boulder, USA,
[5] National Synchrotron Radiation Laboratory, Heifei, China, [6] University of Geneva, Switzerland

Shandite $Co_3Sn_2S_2$ has been considered a ferromagnet with c-axis as its easy axis.However, recently, there have been reports suggesting the presence of spin glass or antiferromagnetism, challenging our understanding of the ground state.In order to unravel the magnetism of $Co_3Sn_2S_2$, we have conducted magnetic imaging studies using XMCD-PEEM; no antiferromagnetic phases are detected. On the other hand, using spatially resolved Angular Resolved Photoemission Spectroscopy (ARPES) combined with Density Functional Theory (DFT) calculations, we discover small regions of the sample that match the antiferromagnetic band structure rather than the ferromagnetic band structure at 6 K.This band converts to a band corresponding to the paramagnetic phase at 200 K, indicating that it is associated to a magnetic phase.

~~163~~ | *cancelled*

15:00	164	**Steady state currents defy non-Hermitian many-body localization** *Pietro Brighi [1], Marko Ljubotina [2,3,4], Federico Roccati [5,6], Federico Balducci [7]* *[1] University of Vienna, Austria,* *[2] Technical University of Munich, Physics Department, Garching, Germany,* *[3] Munich Center for Quantum Science and Technology , Munich, Germany,* *[4] Institute of Science and Technology Austria, Klosterneuburg, Austria,* *[5] Quantum Theory Group, Dipartimento di Fisica e Chimica Emilio Segre, Universita degli Studi di Palermo, Italy,* *[6] Max Planck Institute for the Science of Light, Erlangen, Germany,* *[7] Max Planck Institute for the Physics of Complex Systems, Dresden, Germany* Non-Hermitian many-body localization (NH-MBL) has emerged as a possible scenario for stable localization in open systems, as suggested by spectral indicators. In this work, we shift the focus to dynamical probes to investigate transport properties in a disordered, non-Hermitian spin chain. We demonstrate that the steady-state current remains finite, showing no evidence of a transition up to disorder values beyond the previously claimed critical point. This reveals a stark discrepancy between spectral indicators, which suggest localization, and transport behavior, which indicates delocalization. This highlights the importance of dynamical observables in characterizing NH MBL and suggests that traditional spectral measures may not fully capture the physics of non-Hermitian systems. These findings challenge the existence of NH MBL in the studied model.
15:15		
15:30		*Coffee Break*
		KOND IX: 2D Materials III *Chair: Ivica Zivkovic, EPF Lausanne*
16:00	171	**Rhombohedral graphite as the simplest platform for exploring strong correlations in topological electron systems** *Peter Nemes-Incze, HUN-REN Centre for Energy Research, Budapest, Hungary* Graphene-based van der Waals systems offer new platforms for studying electron correlations, revealing phenomena such as unconventional superconductivity and fractional Chern insulators. Rhombohedral graphite (RG), composed of graphene layers stacked in the ABC sequence, is a candidate for the simplest material system that supports strong correlations. Here I show that scanning tunneling microscopy measurements on RG samples with eight or more layers indicate that correlation effects become so pronounced that the mean-field approximation breaks down, suggesting a quantum magnetic ground state in thick RG. I also demonstrate how key bottlenecks to investigating RG can be overcome, by tweaking mechanical exfoliation to produce abundant RG and using electronic Raman scattering to identify defect-free crystals up to 12 layers.
16:30	172	**Unconventional temperature evolution of quantum oscillations in topological insulator $BiSbTe_2S$** *Mario Novak, University of Zagreb, Faculty of Science, Zagreb, Croatia* Among various topological insulators, $BiSbTe_2S$ stands out for its exceptional properties. It has a wide energy gap, exhibits a well-isolated Dirac point, and a Fermi level positioned within the gap. We present high-quality samples that display metallic-like low-temperature resistivity attributed to surface states, pronounced quantum oscillations (QO) observable, and a Fermi level located approximately 100 meV above the Dirac point. In this presentation, we focus on the QO that show an unusual effect:strong temperature dependence of the QO which decreases by around 10 % between 2 and 40 K. We attribute the observed effect to the temperature-induced renormalization of the bulk band gap due to electron-phonon interactions, which in turn affect the position of the Dirac point within the gap.

17:00	173	**Electronic, and Magnetic Properties of Intercalated 2H-NbS_2 and 2H-TaS_2** *Gaurav Pransu [1], Wojciech Sas [2], Bruno Gudac [1], Mario Novak [3], Yuki Utsumi Boucher [1], Laszlo Forro [4], Neven Barišić [3,5], Petar Popčević [1]* *[1] Institut za fiziku, Zagreb, Croatia,* *[2] Institute of Nuclear Physics Polish Academy of Sciences, 31-342,Kraków, Poland,* *[3] Physics Department, University of Zagreb, Bijenička Cesta 32, 10000, Zagreb,Croatia,* *[4] Stavropoulos Center for Complex Quantum Matter, University of Notre Dame, USA,* *[5] Institute of Solid State Physics, TU Wien,1040 Vienna, Austria* Transition metal dichalcogenides are class of layered materials exhibiting diverse phenomena, including charge density waves and superconductivity. Due to their layered structure, these materials can be intercalated with transition metals which induces magnetic ordering. We synthesized high-quality single crystals of $NixNbS_2$ for a wide intercalation range(0.01< x < 0.6) and stoichiometric $Co_{0.33}TaS_2$. Interestingly, the magnetic ground state is more strongly influenced by the intercalated ion than by the host material. Both systems exhibit antiferromagnetic order; however, a coexisting ferromagnetic component indicates Dzyaloshinskii–Moriya interaction. Further, ARPES, magnetotransport, and Hall measurements were conducted to study the effect of intercalation on the magnetic and electronic structure. The impact of uniaxial and hydrostatic pressure is ongoing to understand the interaction between magnetic and metallic subsystems.
17:15	174	**Spin Bridges and Transport Barriers:** **Contrasting Electronic Effects of Co and Ni Intercalation in 2H-NbS_2** *Petar Popčević [1], Yuki Utsumi Boucher [1], Gaurav Pransu [1], Ivo Batistić [2], László Forró [3], Neven Barišić [2,4], Eduard Tutiš [1]* *[1] Institute of Physics, Zagreb, Croatia,* *[2] Department of Physics, Faculty of Science, University of Zagreb, Croatia,* *[3] Stavropoulos Center for Complex Quantum Matter, University of Notre Dame, USA,* *[4] TU Wien, Vienna, Austria* We investigate the effect of Co and Ni intercalation into the host 2H-NbS_2. Upon intercalation, the superconductivity of the host is suppressed, and an antiferromagnetic ground state forms below the Néel temperature. Despite sharing the same crystal structure, the two compounds exhibit different magnetic and electronic properties due to the distinct roles Co and Ni ions play in the electronic structure. To explain these differences, we explore the electronic structure of both compounds using angle-resolved photoemission spectroscopy (ARPES), ab initio calculations, and modeling. Our findings highlight the role of hybridization between intercalated orbitals and the NbS_2 conducting layers: while Co ions act as spin-selective electronic transport bridges, Ni ions effectively reduce interlayer electronic transport.
	~~175~~	*cancelled*
17:30	176	**Control of antiferromagnetism in $La_{0.8}Sr_{0.2}MnO_3$ ultrathin films driven by interfacial chemical potential mismatch** *Carlos Antonio Fernandes Vaz, Gyanendra Panchal, Federico Stramaglia* *Paul Scherrer Institut, Villigen PSI, Switzerland* In this work, we show that nominally ferromagnetic $La_{0.8}Sr_{0.2}MnO_3$ ultrathin films interfaced with antiferromagnetic $La_{0.45}Sr_{0.55}MnO_3$ buffer layers adopt an antiferromagnetic ground state at small thicknesses. Specifically, by using x-ray photoemission electron microscopy combined with the circular and linear x-ray magnetic dichroic effects, we find antiferromagnetic domains for $La_{0.8}Sr_{0.2}MnO_3$ thicknesses up to 3 uc but no ferromagnetic contrast, showing that nominally ferromagnetic $La_{0.8}Sr_{0.2}MnO_3$ is antiferromagnetic. We attribute the interfacial modified magnetic ground state to charge sharing at the interface due to the chemical potential mismatch, which leads to hole doping at the $La_{0.8}Sr_{0.2}MnO_3$ interface. Our results represent another example of how intrinsic charge doping at oxide interfaces leads to modified interfacial electronic and magnetic properties.
17:45		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

Thursday, 21.08.2025, Room HS 33

Time	ID	**KOND X: Semiconductors** *Chair: Milan Sýkora, Comenius University, Bratislava*
11:00	**181**	**Perovskites for photovoltaics: growth and stability characterization** *Nada Mrkyvkova, CEMEA, Slovak Academy of Sciences, Bratislava, Slovakia* Halide perovskites are promising materials for solar energy and light-based technologies, with rapidly improving power conversion efficiencies rivaling single-crystal semiconductors. A key challenge for further performance gains is reducing defect-driven, non-radiative carrier recombination. Thus, understanding perovskite formation and process control is essential for defect reduction. In this talk, a combination of techniques used for studying the structural and optoelectronic kinetics during the perovskite formation will be presented, including in-situ photoluminescence spectroscopy and grazing-incidence small/wide-angle X-ray scattering. The obtained growth kinetics for vapor-deposited perovskites, as well as for perovskite layers fabricated from the wet phase, will be described. The results reveal the formation of lead-halide perovskite films from the early stages and uncover the morphology, crystallographic structure, and defect density evolution.
11:30	**182**	**Observation of entangled electron-zone boundary phonon states with transient spectroscopic ellipsometry** *Kurt Hingerl [1], Yael Guitérrez [2], Christoph Cobet [1], Saúl Vázquez-Miranda [3], Mateusz Rebarz [3], Shirly Espinoza [3]* *[1] Center for Surface and Nanoanalytics, University Linz, Austria,* *[2] Departamento de Física Aplicada, Universidad de Cantabria, 39005 Santander, Spain,* *[3] ELI Beamlines Facility, The Extreme Light Infrastructure, Dolní Brezany, Czech Republic* Silicon has three optical phonons. These phonons remain inaccessible with linear optics. Here we demonstrate that time-resolved pump-probe spectroscopic ellipsometry enables the detection of optical phonon responses at both the BZ center and -edge. Using pump pulses with photon energies below the indirect bandgap of silicon, we leverage two-photon absorption to induce sub-bandgap excitation. Transient optical effects were probed in the 1.9 – 3.6 eV spectral range with pump-probe time delays from 50 fs to 4.5 ns. We observed distinct features: a structure at the E1 critical point persisting for 4.5 ns; longitudinal optical phonons with an energy spacing of 57 ± 9 meV, lasting approximately 300 fs; and two-phonon replicas, exhibiting a spacing of 81 ± 7 meV.
11:45	**183**	**Characterization of Excitons for bulk Black Phosphorus** *Juan Felipe Pulgarin Mosquera [1,2], Geoffroy Kremer [2,3], Joel Morf [2], Claude Monney [2], Michael Schüler [1,2]* *[1] Paul Scherrer Institut (PSI), Villigen, Switzerland, [2] University of Fribourg, Switzerland,* *[3] Institut Jean Lamour, France* Excitons (coupled electron-hole pairs) in semiconductors can form collective states that exhibit spectacular nonlinear properties and possible applications in future optoelectronic devices. We present some theoretical methods and a workflow for determining the excitonic wave functions and the correspondingbinding energies for bulk Black Phosphorus. We solve the Bethe-Salpeter equations for coherent and incoherent excitations. The theoretical results are compared to the experimental ones of angle resolved photoemission spectroscopy (ARPES), analyzing the spectra produced after including non-equilibrium electron-phonon dynamics; solving the time-dependent Boltzmann equation. These results allow us to understand the nature and characteristics of these two-particle bound states, together with some scattering effects, being challenging due to the stronger screened potential for 3D materials, resulting in short time excitations.

12:00 | **184**

Magnetic co-doping in $Al_xGa_{1-x}N$: An emission Mössbauer spectroscopy study

Rajdeep Adhikari [1,2], Hilary Masenda [3], Haraldur Gunnlaugsson [4], Arthur Ernst [5], Alberta Bonanni [1]
[1] Institute of Semiconductor and Solid State Physics, Johannes Kepler University, Altenbergerstrasse 69, AT-4040 Linz,
[2] Linz Institute of Technology, Johannes Kepler University, Altenbergerstrasse 69, AT-4040 Linz,
[3] School of Physics, University of Witwatersrand, Johannesburg 2050, South Africa,
[4] Science Institute, University of Iceland, 107 Reykjavik, Iceland,
[5] Inst. for Theoretical Physics, Johannes Kepler University, Altenbergerstrasse 69, AT-4040 Linz

The charge states and lattice sites of Fe ions in both virgin and Mn-doped $Al_xGa_{1-x}N$ samples have been investigated by employing ^{57}Fe emission Mössbauer spectroscopy (eMS) using radioactive $^{57}Mn^+$ ion implantation at ISOLDE, CERN. In undoped $Al_xGa_{1-x}N$, Fe^{2+} ions occupying Al/Ga lattice sites associated with nitrogen vacancies, as well as substitutional Fe^{3+} ions, have been identified. Upon Mn doping, a substantial suppression of the Fe^{3+} signal is observed. This is accompanied by the emergence of a single-line component, attributed to Fe^{4+} ions on Al/Ga sites that are enabled by the presence of nearby substitutional Mn^{2+} ions. The experimental results are supported by density functional theory calculations. This work establishes co-doping as new avenue for tailoring magnetic properties in doped semiconductors.

12:15 | **185**

Epitaxial control of silicon color centers for quantum applications at telecom wavelengths

Johannes Aberl, Merve Karaman, Andreas Salomon, Diego Haya Enriquez, Jacqueline Marböck, Enrique Prado Navarrete, Oliver E. Lang, Thomas Fromherz, Moritz Brehm
Institute of Semiconductor and Solid State Physics, Johannes Kepler University Linz, Altenberger Straße 69, Linz, Austria

Silicon is the cornerstone material for nearly all digital hardware, with high-quality silicon and group-IV layers traditionally produced through high-temperature epitaxial growth processes. In this work, we present the potential of cold epitaxy, a novel approach that enables the fabrication of nanoscale and quantum structures with exceptional material quality at significantly reduced temperatures. Specifically, we highlight the formation of self-assembled silicon-based color centers, achieved through epitaxial growth at temperatures as low as 200°C. These color centers, emitting at telecom wavelengths, can be deterministically created within sub-nanometer-thin layers, offering unprecedented spatial control that surpasses conventional fabrication techniques. This breakthrough paves the way for new opportunities in silicon-integrated quantum photonics, as such color centers have been demonstrated to function as single-photon emitters.

12:30 | ***Lunch***

Time	ID	KOND XI: SUPERCONDUCTIVITY II *Chair: Silke Bühler-Paschen, TU Wien*
14:00	191	see below
14:30	192	see below

14:00 — 191

Dual ground states in Ce_3PtIn_{11} - Coexistence of Magnetism and Superconductivity

Jeroen Custers [1], Jan Fikáček [1], Manuel Brando [2], Sébastien Laughrea [3], Andrea D. Bianchi [3], Sarah R. Dunsiger [4,5]
[1] Charles University, Faculty of Mathematics and Physics, Department of Condensed Matter Physics, Ke Karlovu 5, 121 16 Prague 2, Czech Republic
[2] Max Planck Institute for Chemical Physics of Solids, 01187 Dresden, Germany.
[3] Département de Physique & Regroupement Québécois sur les Matériaux de Pointe (RQMP), Université de Montréal, Montréal, Québec H3C 3J7, Canada,
[4] Centre for Molecular and Materials Science, TRIUMF, Vancouver, BC V6T 2A3, Canada.
[5] Department of Physics, Simon Fraser University, Burnaby, BC V5A 1S6, Canada.

The heavy fermion compound Ce_3PtIn_{11} exhibits a fascinating array of unusual properties. This material belongs to the broader $Ce_nT_mIn_{3n+2m}$ family, which includes other notable compounds like $CeCoIn_5$, $CeRhIn_5$, and Ce_2RhIn_8. Its crystal structure is tetragonal P4/mmm, characterized by lattice parameters a = 4.6874(4) Å and c = 16.8422(12) Å.
At ambient pressure, Ce_3PtIn_{11} undergoes two sequential transitions into antiferromagnetic (AFM) states, at T_{N1} = 2.2 K and T_N = 2.0 K, respectively. Below T_c = 0.32 K, superconductivity (SC) emerges. The simultaneous presence of AFM and SC has led to speculation that it arises from two distinct cerium (Ce) sites within the material. The Ce1-ion environment is similar to that in Ce_2TIn_8 compounds (where T is a transition element), suggesting it is largely Kondo screened and responsible for the observed superconductivity. Conversely, the Ce2-ion is in a $CeIn_3$-like environment, which is thought to drive the magnetic ordering. This hypothesis is supported by entropy analysis and further corroborated by ^{115}In NQR experiments, which indicate that the magnetic moment of Ce2 is 20 to 40 times greater than that of Ce1. Intriguingly, the NQR experiments also show an abrupt drop in the spin-relaxation rate (1/T1) upon entering the superconducting state, implying a first-order transition from the AFM to the SC state. Such a transition would signify a breaking of symmetry, suggesting a competitive relationship between magnetic order and superconductivity.
Our current work investigates these phenomena through recent low-temperature specific heat measurements. Additionally, we performed zero-field and longitudinal field muon spin resonance experiments across the paramagnetic, AFM, and SC states. Our findings provide evidence for a static or quasi-static internal magnetic field below T_c, which further supports the coexistence of magnetic order and superconductivity in Ce_3PtIn_{11}.

*This work was supported by the Czech Ministry of Education, Youth and Sports under grant number LUC24139 and by the European COST Action SUPERQUMAP (CA21144).

14:30 — 192

Differentiation of Site-Sensitive Symmetry Breakings

Johan Chang [1], Leonardo Martinelli [1], Izabela Biało [1], Jens Oppliger [1], Sophie Rüdiger [1], Riccardo Arpaia [2], Floriana Lombardi [3], Martin von Zimmermann [4], Fernando Igoa [4], Eugen Weschke [5]
[1] University of Zurich, Switzerland, [2] Ca' Foscari University of Venice, Italy,
[3] Chalmers University of Technology, Göteborg, Sweden,
[4] Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany,
[5] BESSY II Light Source, Berlin, Germany

Solid matter is classified through symmetry of ordering phenomena. Experimentally, this approach is straightforward except when distinct orderings occur with identical or almost identical symmetry breaking. In this talk, we show that the cuprate system $Y_{1-x}Pr_xBa_2Cu_3O_{7-y}$ hosts two distinct orderings with almost identical translational symmetry breakings. Only when applying site-sensitive resonant elastic x-ray scattering (REXS), charge ordering can be conclusively differentiated from a super-lattice structure. These two orderings occur with almost the same in-plane symmetry but manifest at different atomic sites and display different temperature dependence. Differentiating these orders provides an important cue as to why $PrBa_2Cu_3O_7$ isinsulating. We conclude that the symmetry breaking at the Pr-site is unfavorable for superconducting pairing.

15:00	**193**	**Transverse magnetic susceptibility reveals gigantic magnetic anisotropy in UTe_2 at high fields** *Valeska Zambra [1], Amit Nathwani [1,2], Muhammad Nauman [1], Sylvia Lewin [3,4], Corey Frank [3,4], Nicholas Butch [3,4], Arkady Shekhter [5], Brad Ramshaw [6,7], Kimberly Modic [1]* *[1] Institute of Science and Technology Austria, Klosterneuburg, Austria,* *[2] California Institute of Technology, Pasadena, USA,* *[3] NIST Center for Neutron Research, National Institute of Standards and Technology, Gaithersburg, USA,* *[4] Department of Physics, Quantum Materials Center, University of Maryland, College Park, USA,* *[5] Los Alamos National Laboratory, Los Alamos, USA,* *[6] Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, USA,* *[7] Canadian Institute for Advanced Research, Toronto, Canada* In recent years, UTe_2 has been proposed as a potential spin-triplet superconductor, with an anisotropic and rich phase diagram. A key feature is a re-entrant superconducting phase up to 35 T for magnetic fields near the b-axis, which ends at a metamagnetic transition, suggesting interplay between magnetism and superconductivity. To investigate the surrounding magnetic anisotropy, we studied the normal state using resonant torsion magnetometry in pulsed fields. High-quality crystals were measured up to 60 T in the a-c and b-c planes at 4 K. We observed a sharp drop in magnetotropic susceptibility for fields aligned near the c-axis. At high fields, our technique uniquely accesses transverse susceptibility, and the observed drop suggests a significant increase in χaa and χbb.
15:15	**194**	**Stripe order in cuprates: a new perspective from high magnetic field scattering experiments** *Leonardo Martinelli [1], Izabela Bialo [1], Jens Oppliger [1], Julia Küspert [2], Jochen Geck [3], Marein Rahn [4], Ellen Fogh [5], Oleksandr Prokhnenko [6], Thomas Herrmannsdörfer [7], Cornelius Strohm [8], Carsten Bähtz [8], Zahir Islam [9], Niels Christensen [10], Tohru Kurosawa [11], N. Momono [11], M. Oda [11], Dmitri Novikov [12], Azhat Khadiev [12], Shingo Yamamoto [7]* *[1] Universität Zürich, CH-8057 Zürich, [2] ESRF, FR-38043 Grenoble Cedex 9,* *[3] Institute of Solid State and Materials Physics, TU Dresden, Germany,* *[4] University of Augsburg, DE-86159 Augsburg, [5] EPFL, CH-1015, Lausanne,* *[6] Helmholtz-Zentrum Berlin für Materialien und Energie, Berlin, Germany,* *[7] Helmholtz-Zentrum Dresden-Rossendorf, DE-01328 Dresden,* *[8] European XFEL, DE-22869 Schenefeld,* *[9] X-ray Science Division, Argonne National Laboratory, Lemont, IL 60439-USA,* *[10] Technical University of Denmark, DK-2800 Kongens Lyngby,* *[11] Muror Institute of Technology, Muroran 050-8585, Japan,* *[12] Deutsches Elektronen-Synchrotron, Notkestraße 85, DE-22607 Hamburg* The standard interpretation of stripes order in cuprates is that it is weakened by superconductivity. Experiments in moderate magnetic fields show an enhancement of charge order only below the superconducting critical temperature Tc. However, new experiments in ultra-high magnetic fields are contesting this simple scenario. X-ray diffraction experiments in $La_{1.875}Sr_{0.125}CuO_4$ have shown an anomalous enhancement across the magnetic-field-induced transition from vortex solid to vortex liquid. NMR measurements also reveal changes above the upper critical field of the material. The development of ultra-high magnetic-field instruments for scattering experiments in x-ray free-electron lasers can provide newl insights. We present here new XRD measurements obtained with the new HED-HiBEF magnetic field instrument at the EuXFEL at field above 40 T on $La_{1.875}Sr_{0.125}CuO_4$.
15:30		***Coffee Break***

Time	ID	**KOND XII: Superconductivity III** *Chair: Johan Chang, Universität Zürich*
16:00	**201**	**Magnetism and superconducting pairing in spin-state crossover nickelates** *Jiří Chaloupka, Department of Condensed Matter Physics, Faculty of Science, Masaryk University, Brno, Czech Republic* One major focus in condensed matter research is the search for superconductivity at temperatures above those achievable by conventional superconductors. The "traditional" cuprate superconductors have recently been complemented by superconducting nickelates, which exhibit diverse behavior due to the complex spin-orbital physics of Ni ions. Given the ongoing search for new superconducting nickelates, I will discuss a scenario for magnetism and superconductivity in quasi-two-dimensional compounds containing d^8 Ni^{2+} ions in the spin-state crossover regime. This situation is particularly interesting due to possible dynamical switching between S = 0 and S = 1 states of Ni^{2+}, driven by exchange interactions. In the corresponding hole-doped system, carriers interact strongly with mobile singlet-triplet excitations of the magnetic background, leading to polaronic behavior and, crucially, to robust Cooper pairing.
16:30	**202**	**Effects of the in-plane stress on stripe order in $La_{1.875}Ba_{0.125}CuO_4$ - insights from NMR** *Mihael S. Grbic [1], Ivan Jakovac [1], Adam P. Dioguardi [2], Miroslav Pozek [1], Hans-Joachim Grafe [2]* *[1] University of Zagreb, Faculty of Science, Zagreb, Croatia,* *[2] Leibniz Institute for Solid State and Materials Research, Dresden, Germany* We report on an extensive ^{139}La NMR and ^{63}Cu NQR study of the spin and charge order onset temperatures under uniaxial strain in $La_{1.875}Ba_{0.125}CuO_4$. Stress along [110] direction (σ110) strongly suppresses TCO and TSO, but has little effect on the onset of low temperature tetragonal phase TLTT. In other words, σ110 opens a large splitting (≈ 21 K) between TCO and TLTT, showing that these transitions are not tightly linked. On the other hand, σ100 causes a slight suppression of TLTT but has essentially no effect on TCO and TSO. Our findings can be interpreted as an interplay of symmetry-breaking terms driven by the orientation of spins.
17:00	**203**	**Persistence of Small Polarons into the Superconducting Phase of $Ba_{1-x}K_xBiO_3$** *Nicholas Plumb [3], Muntaser Naamneh [1], Eric O'Quinn [2], Eugenio Paris [3], Daniel McNally [3], Yi Tseng [3], Wojciech Pudelko [1], Dariusz Gawryluk [3], Jacob Shamblin [2], Benjamin Cohen-Stead [2], Ming Shi [3], Milan Radovic [3], Maik Lang [2], Thorsten Schmitt [3], Steven Johnston [2]* *[1] Ben-Gurion University of the Negev, Beer-Sheva, Israel,* *[2] The University of Tennessee, Knoxville, USA, [3] Paul Scherrer Institut, Villigen PSI, Switzerland,* *[4] Zhejiang University, Hangzhou, China* Perovskite "bismuthates" have long drawn interest as possible bipolaron superconductors, but conclusive evidence for a (bi)polaron metallic state in these materials remains elusive. We combine resonant inelastic x-ray and neutron total scattering techniques with advanced modelling to study the local lattice distortions, electronic structure, and electron-phonon coupling in $Ba_{1-x}K_xBiO_3$. At x = 0, we find the electronic gap opens in predominantly oxygen-derived states strongly coupled to a long-range ordered breathing distortion of the oxygen sublattice. Upon doping, short-range breathing distortions and sizable electron-phonon coupling persist into the superconducting regime (x = 0.4). Exact diagonalization and determinant quantum Monte Carlo calculations further support this conclusion. Our results provide compelling evidence that BKBO's metallic phase hosts a liquid of small bipolarons.

17:30	204	**Quantum-Corrected Drude–Lorentz Model of Optical Conductivity in Disordered Superconducting Films** *Pavol Neilinger, Samuel Kern, Martin Baránek, Miroslav Grajcar Department of Experimental Physics, Comenius University, Bratislava, Slovakia* The conductivity of thin metallic films is suppressed by quantum corrections, and at a critical level of disorder, a superconductor/metal-insulator transition occurs. To characterize the electronic properties of thin films, optical methods are commonly employed. However, analysis of the optical conductivity using the Drude–Lorentz model yields parameters that are inconsistent with transport measurements. This discrepancy arises from the presence of quantum corrections even at optical frequencies, as demonstrated in MoC films. To address this issue, we propose a modified Drude–Lorentz model that incorporates quantum corrections for analyzing the optical conductivity of strongly disordered metals. Using this model, analysis of the optical conductivity of NbN films, measured by spectroscopic ellipsometry, yields film parameters consistent with both transport and magnetotransport measurements.
17:45		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

Friday, 22.08.2025, Room 31

Time	ID	**KOND XIII: 2D Materials IV & Topology** *Chair: Christian Teichert, Montanuniversität Leoben*
11:00	211	**Spintronics in 2D: Graphene and Beyond in van der Waals Heterostructures** *Martin Gmitra, Institute of Physics, P. J. Šafárik University, Košice, Slovakia, & Institute of Experimental Physics, Slovak Academy of Sciences, Kočice, Slovakia* Stacking two-dimensional materials into van der Waals heterostructures offers a versatile tool for engineering their electronic structures. The talk will discuss proximity-induced effects and charge-to-spin conversion efficiency in the context of spintronics applications. Specifically, we will discuss electron correlations on the conversion efficiencies, chirality switching of spin textures due to ferroelectricity, and self-induced spin-orbit torque. The results were obtained using first-principles calculations based on density functional theory, tight-binding modeling of the proximity effects, linear Kubo response theory, and a non-equilibrium Green's function approach to investigate charge-spin conversion and spin-orbit torque. Funding from Grant No. VEGA 1/0104/25 and project IMPULZ IM-2021-42 is acknowledged.
11:30	212	**Oxidized MoS_2 based memristors** *Katharina Burgholzer, Rajdeep Adhikari, Alberta Bonanni, Johannes Kepler Universität Linz* Memristors are strategic elements for the next-generation of memories and for neuromorphic computing technologies. Previous studies,showed that molybdenum disulfide (MoS_2) is an appealing system for two terminal memristive devices. In particular, memristors fabricated from oxidized MoS_2 were shown to be thermally stable up to 340°C. Here, a comprehensive study on MoS_2-based memristors is carried out, with focus on the selection of a suitable conduction material, on the role played by the thickness of the MoS_2 layers and on how the oxidation of the MoS_2 layer influences the resistance and the performance of the devices. The results contribute to the optimization of memristors based on 2D material systems, essential for implementing these elements as building-blocks of artificial neural networks.

Time	No.	
12:00	213	**Topological superconductivity studied from first principles**

Topological superconductivity studied from first principles

Laszlo Szunyogh [1,2], Bendegúz Nyári [1,2,3], András Lászlóffy [3], Levente Rózsa [3,1], Gábor Csire [4], Balázs Újfalussy [3]
[1] Budapest University of Technology and Economics, Budapest, Hungary,
[2] HUN-REN BME Condensed Matter Research Group, Budapest, Hungary,
[3] HUN-REN Wigner Research Centre for Physics, Budapest, Hungary,
[4] Università di Salerno, Italy

Magnetic atomic chains on superconductors are predicted to host Majorana Zero Modes (MZM) being therefore possible candidates for fault tolerant quantum computing architectures. I will present a first principles technique including the solution of the Bogoliubov–de Gennes equations. The one-dimensional band structure of infinite chains provides a clear picture to analyze the topological nature of Shiba bands. The band structure is compared with the quasiparticle interference spectrum for Mn chains on Nb(110) and Ta(110). In case of Fe chains on a Au monolayer on Nb(110) we show that the formation of MZMs is supported for a broad range of spin-spiral states. Through computer experiments we demonstrate the emergence of topological fragmentation and simulate the movement of MZMs along the nanowire.

12:30		***Poster Awards and Closing Ceremony***
12:45		***Lunch***
		KOND XIV: Magnetism V *Chair: Dávid Szaller, University of Technology and Economics, Budapest*
14:00	221	**Magnetization processes and emergent magnetic excitations of the double spin ladder Cu-CPA**

Magnetization processes and emergent magnetic excitations of the double spin ladder Cu-CPA

Tina Arh [1], Jonas Philippe [1,2], Frank Elson [4], Kirill Povarov [5], Stanislaw Galeski [3], Marc Janoschek [1], Gediminas Simutis [1]
[1] Paul Scherrer Institute, CH-5232 Villigen PSI,
[2] Physik-Institut, Universität Zürich, CH-8057 Zürich,
[3] Radboud University, NL-6525 XZ Nijmegen,
[4] Department of Applied Physics, KTH Royal Institute of Technology, SE-10691 Stockholm,
[5] Helmholtz-Zentrum Dresden-Rossendorf, DE-01328 Dresden

Quantum spin ladders bridge the gap between one- and two-dimensional quantum magnets, featuring a complex excitation spectrum that depends on the relative strengths of the leg and rung exchange interactions. One such material, the organometallic compound (C5H9NH3)2CuBr4 (Cu-CPA), was recently found to contain two inequivalent spin ladders at temperatures below the structural phase transition, inviting new emergent phenomena. A recent success in synthesis of large single crystals has allowed us to perform high-resolution neutron spectroscopy and high-field magnetization measurements. The resulting study of the magnetic excitations and their interplay with the dynamics of the lattice helps us towards better understanding of the ground state and excitations of the two-ladder spin Hamiltonian.

14:30	222	**Long-living magnons at the quantum limit**

Long-living magnons at the quantum limit

Rostyslav Serha [1,7], Kaitlin Mc Allister [2], Fabian Majcen [1,7], Sebastian Knauer [1], Timmy Reimann [3], Oleksii Surzhenko [3], Carsten Dubs [3], Genadii Melkov [4], Alexander Serga [5], Vasyl Tyberkevych [6], Andrii Chumak [1], Dmytro Bozhko [2]
[1] Faculty of Physics, University of Vienna, Austria,
[2] Department of Physics and Energy Science, University of Colorado, Colorado Springs, USA,
[3] INNOVENT e.V. Technologieentwicklung, Jena, Germany,
[4] Faculty of Radiophysics, Electronics, and Computer Systems, Taras Shevchenko National University of Kyiv, Ukraine,
[5] Fachbereich Physik and Landesforschungszentrum OPTIMAS, Rheinland-Pfälzische Technische Universität Kaiserslautern-Landau, Kaiserslautern, Germany,
[6] Department of Physics, Oakland University, Rochester, USA,
[7] Vienna Doctoral School in Physics, University of Vienna, Austria

Quantum magnonics explores the use of magnons—quantized spin excitations—for quantum information processing. A key challenge is the short magnon lifetime, limiting their use as information carriers. Here, we report magnon lifetimes exceeding 18 μs at 1.6 GHz in ultra-pure single-crystal

		YIG spheres at millikelvin temperatures. Using ferromagnetic resonance spectroscopy and three-magnon splitting experiments, we investigated both fundamental k = 0 and short-wavelength dipolar modes. We observed a strong lifetime dependence on material purity, with ultra-pure samples showing the longest lifetimes. Our results reveal that magnon relaxation mechanisms such as multi-magnon scattering and magnon-phonon coupling are strongly suppressed at low temperatures and finite wavevectors. These findings set a new benchmark for coherence in magnetic systems, advancing the prospects for magnons in quantum technologies.
15:00	**223**	**Steerable current-driven emission of spin waves in magnetic vortex pairs** *Sabri Koraltan, TU Wien, Austria* Efficient spin-wave excitation is essential for advancing magnonic devices. We demonstrate current-driven spin-wave generation in antiferromagnetically coupled magnetic vortices using time-resolved x-ray microscopy. Spin waves are emitted when alternating currents pass through the magnetic stack, with micromagnetic simulations identifying the Oersted field—not spin-transfer torques—as the primary excitation mechanism. These internal fields are significantly more efficient than traditional stripline antennas. In magnetostrictive materials, we further show that increasing the excitation amplitude can steer magnon propagation by altering the magnetization profile. Our approach enables efficient, tunable spin-wave excitation, offering key progress for magnonic device design.
15:30	**224**	**Optical detection of magnon in bulk α-MnTe** *Jan Dzian [1,2], P. Kubaščík [2], Stáňa Tázlarů [2,3], M. Białek [4], M. Šindler [3], Florian Le Mardelé [1], C. Kadlec [5], F. Kadlec [5], M. Gryglas-Borysiewicz [6], K. P. Kluczyk [6], A. Mycielsky [7], P. Skupiński [7], J. Hejtmánek [3], R. Tesař [3], J. Železný [3], A.-L. Barra [1], C. Faugeras [1], J. Volný [2], Klara Uhlířová [2], L. Nádvorník [2], M. Veis [2], Karel Výborný [3], Milan Orlita [1,2]* *[1] LNCMI-EMFL, CNRS UPR3228, Univ. Grenoble Alpes, Grenoble, France* *[2] Faculty of Mathematics and Physics, Charles University, Ke Karlovu 5, CZ-121 16 Prague,* *[3] Institute of Physics, ASCR, Cukrovarnická 10, Prague 6, CZ-16253,* *[4] Institute of High Pressure Physics, PAS, PL-01142 Warsaw,* *[5] Institute of Physics, ASCR, Na Slovance 2, CZ-182 00 Prague,* *[6] Faculty of Physics, University of Warsaw, Pasteura 5, Warsaw,* *[7] Institute of Physics, PAS, Aleja Lotnikow 32/46, PL-02668 Warsaw* MnTe is an estabilished material in solid state physics. As an antiferromagnetic semiconductor it received a resurgence of attention in the last couple years. We focus on the NiAs-type polymorph of MnTe, so called α-MnTe, where anomalous Hall effect and chiral splitting of magnonic bands has been observed. α-MnTe is a biaxial antiferromagnet, with spins alligned in hexagonal planes of Mn atoms. The spin in planes are coupled ferromagnetically and planes themselves are coupled antiferromagnetically. Previous inelastic neutron scattering experiments observed single magnon mode approaching energy of 2.6 ± 0.8 meV at Γ point. Our results of magneto-FTIR/THz transmission spectroscopy confirm theoretical predictions based on linear spin wave theory and further refine the out-of-plane component of single-ion magnetic anisotropy, thanks to precise determination of the magnon energy at the Γ point.
15:45	**225**	**Tuneable spin-wave dynamics in nanoscale YIG magnonic crystals** *Khrystyna Levchenko [1], Kristýna Davídková [1], Rostyslav Serha [1], Mathieu Moalic [2], Andrey Voronov [1], Carsten Dubs [3], Oleksii Surzhenko [3], Jaganandha Panda [4], Qi Wang [5], Ondrej Wojewoda [4], Björn Heinz [6], Michal Urbánek [4], Maciej Krawczyk [2], Andrii Chumak [1]* *[1] Faculty of Physics, University of Vienna, Austria,* *[2] Department of Physics of Nanostructures, Adam Mickiewicz University, Poznan, Poland,* *[3] INNOVENT e.V. Technologieentwicklung, Jena, Germany,* *[4] CEITEC Nano, Brno University of Technology, Brno, Czechia,* *[5] Huazhong University of Science and Technology, Wuhan, China,* *[6] Fachbereich Physik & Landesforschungszentrum OPTIMAS, RPTU, Kaiserslautern, Germany* Artificial magnetic media with periodic modulation — magnonic crystals (MCs) — enable tunable spin-wave dynamics and tailored magnonic band structures. Scaling these systems to the nanoscale enhances control by enabling operation in a single spin-wave mode regime and makes nano-MCs highly attractive for both fundamental research and device applications. We report on the design, fabrication, and characterisation of 1D and 2D YIG-based MCs featuring periodic nanoholes. Both structures show clearly defined pass- and stop-bands, with signal rejection levels

		reaching 25 dB, while 1D MC also reveals near single-mode spin-wave transmission. Our findings advance the field of functional MCs and pave the way toward 2D magnonic nanoarrays and compact magnonic RF devices.
16:00		***END***

Friday, 22.08.2025, Room 33

Time	**ID**	**KOND XV: Correlated Materials II** *Chair: Peter Nemes-Incze,* *HUN-REN Centre for Energy Research, Budapest*
11:00	**231**	**THz dynamics of quantum materials, also under pressure** *Elsa Abreu, Department of Physics, ETH Zürich, Switzerland* Quantum materials exhibit rich phase diagrams, strongly sensitive to external parameters, which include intriguing properties such as electronic correlations, superconductivity, and spin and charge order. These macroscopic properties arise from complex interactions between electronic, structural, spin and orbital degrees of freedom. The complexity of these interactions poses a tremendous challenge for the understanding, modeling and technological applications of quantum materials. One approach that has proven successful in decoupling the effect of different degrees of freedom is to perform time-resolved measurements. Photoexcitation by a low photon energy terahertz pulse, in particular, ensures that the out-of-equilibrium sample remains close to its electronic ground state. I will discuss two examples in our work, where we explore the THz response of Mott insulators and of spin-ladder compounds. Another approach to address the complexity of quantum materials is to reduce the available parameter space by choosing one external parameter, such as pressure, which can be continuously controlled while preserving thermal equilibrium. Pressure has been used extensively in equilibrium but only to some extent with ultrafast measurements. I will discuss our ongoing work to combine ultrafast THz, high pressure and low temperature capabilities.
11:30	**232**	**Influence of magnetic field on the band structure of $EuCd_2X_2$ (X = P, As, Sb)** *Serena Nasrallah [1], David Santos-Cottin [2], Florian Le Mardelé [3] , Luka Aksamovic [1],* *Petar Saccer [4], Mario Novak [4], C. C. Homes [5], Milan Orlita [6], Neven Barisic [2], Ana Akrap [4]* *[1] Institute of Solid-State Physics, TU Wien, AT-1040 Vienna,* *[2] Department of Physics, University of Fribourg, CH-1700 Fribourg,* *[3] LNCMI, CNRS-UGA-UPS-INSA, 25, avenue des Martyrs, FR-38042 Grenoble,* *[4] Dep. of Physics, Faculty of Science, University of Zagreb, Bijenicka 32, HR-10000 Zagreb,* *[5] National Synchrotron Light Source II, Brookhaven National Laboratory, Upton, New York 11973, NY, USA,* *[6] Institute of Physics, Charles University, CZ-12116 Prague* The $EuCd_2X_2$ (X = Sb, As, P) compounds host large-spin Eu^{2+} ions, making them ideal for studying magnetic field effects on electronic structure. Using infrared and magneto-optical spectroscopy, we find that $EuCd_2X_2$ acts as a p-type magnetic semiconductor with direct energy gaps of ~ 0.5 eV (Sb), 0.77 eV (As), and 1.2 eV (P), which redshift under magnetic fields up to 35 T. Photoemission and resistivity data confirm semiconducting behavior in $EuCd_2As_2$ and $EuCd_2P_2$, while $EuCd_2Sb_2$ appears metallic due to Fermi level shifts. Magnetostriction reveals field-induced atomic displacements, linking structural changes to electronic properties. These findings highlight the tunability of $EuCd_2X_2$ via chemical substitution and magnetic fields.

11:45	233	**Soft x-ray photoelectron spectroscopy of Mn_2P** *Yuki Utsumi Boucher [1], Seyed Ashkan Moghadam Ziabari [1], Trpimir Ivšić [2], Sheng-Huai Chen [3], Chun-Fu Chang [3], Yukimi Tanimoto [4], Naveen Singh Dhami [1], Wojciech Sas [1], Gaurav Pransu [1], Petar Popčević [1]* *[1] Institute of Physics, Zagreb, Croatia, [2] Ruđer Bošković Institute, Zagreb, Croatia, [3] Max Planck Institute for Chemical Physics of Solids, Dresden, Germany, [4] Graduate School of Advanced Science and Engineering, Hiroshima University, Higashi-Hiroshima, Japan* Binary transition metal phosphides based on the M_2P formula (M: transition metal) exhibit rich magnetic properties that are sensitive to temperature, magnetic field, and chemical substitution. Antiferromagnetic Mn_2P ($T_N \sim 104$ K) crystallizes in a non-centrosymmetric hexagonal structure. Although Mn2P has been known for decades, its electronic structure still needs to be studied. We successfully synthesized single-crystalline Mn_2P using the Sn-flux method. We performed soft X-ray photoelectron spectroscopy on the grown Mn_2P crystals and studied their bulk electronic structure. The Mn 2p core level spectrum exhibits a characteristic feature of the well-screened Mn d6 final states. By varying excitation photon energies around the Mn 2p-3d threshold, we experimentally determined the Mn 3d states in the valence band using resonant photoemission effect.
12:00	234	**Time-resolved terahertz spectroscopy in high electric and magnetic fields** *Bence Szász, Dávid Szaller, Viktor Farkas* *Budapest University of Technology and Economics, Budapest, Hungary* The study of magnetically ordered systems at low temperatures via time-resolved terahertz spectroscopy is often hindered by geometrical restrictions of high-field magnets and the difficulty of generating stable high electric fields with standard equipment. To overcome these limitations, we developed a novel experimental setup at the Budapest University of Technology, comprising a high-magnetic-field terahertz spectrometer and a custom-built, programmable high-voltage power supply. The spectrometer offers continuous frequency coverage from approximately 0.3 to 3 THz and supports transmission and reflection measurements. It is integrated with a customized cold-finger cryostat, positioned within a cryogen-free superconducting magnet covering magnetic fields up to 9 T. The programmable power supply, developed in-house, provides voltages up to 20 kV and is integrated into the cryogenic setup.
12:15	235	**Competing Valence-Bond-Solid Ground States of the Spin-1/2 Heisenberg Antiferromagnet on the Star Lattice** *Pratyay Ghosh [1], Samuel L. Nyckees [1], Jan Koziol [2], Kai Phillip Schmidt [2], Frédéric Mila [1]* *[1] EPF Lausanne, Switzerland, [2] Universität Erlangen-Nürnberg, Germany* We investigate the ground-state phase diagram of the spin-1/2 Heisenberg antiferromagnet on the star lattice using the infinite projected entangled pair states (iPEPS) algorithm. Analyzing the ground-state energy for varying coupling ratios of the lattice's symmetry-inequivalent bonds within an 18-site unit-cell tensor-network, we identify two valence-bond-solid (VBS) phases spanning the parameter space: one fully preserving Hamiltonian symmetries and an 18-site VBS breaking C3 symmetry. The 18-site VBS differs from prior predictions of a 6-site resonating VBS and possesses a lower energy. Another 6-site VBS also competes with the 18-site VBS, which becomes energetically unfavorable only at the sixth-order of perturbation. We find that the phase transition between the two ground-states occurs at a coupling ratio different from the earlier studies.
12:30		***Poster Awards and Closing Ceremony***
12:45		***Lunch***

Time	ID	KOND XVI: Correlated Materials III *Chair: Denis Sunko, University of Zagreb*
14:00	241	**Symmetry and Complexity in Condensed Matter: Two Nonsymmorphic Tales** *Aline Ramires, Technical University of Vienna, Austria* Nonsymmorphic symmetries have been in the spotlight in condensed matter physics since the advent of topological band theory and, most recently, have been highlighted in the context of altermagnetism. In this talk, I will introduce nonsymmorphic symmetries and show how these necessarily introduce complexity in condensed matter systems. I will also discuss two scenarios in which the presence of nonsymmorphic symmetries can lead to novel physical phenomena. The first example concerns superconductivity-induced odd-parity orders. The second example involves the protection of a ferromagnetic quantum critical point against its transmutation to a first-order phase transition. These examples highlight important consequences of this special type of symmetry also in correlated electronic matter.
14:30	242	**Do we really need symmetry functions to understand micro-structure and phase transitions?** *Carina Karner, TU Wien, Austria* Phase transitions, such as the crystallization of a supercooled liquid, involve complex collective rearrangements. While full system information lies in a high-dimensional phase space, understanding these dynamics requires dimensionality reduction. Traditionally such structure detection has relied on physically motivated descriptors, such as symmetry functions, to identify emerging phases. However, these approaches may miss subtle or unexpected features, especially in complex systems. Machine learning, particularly autoencoders, offers a new way to discover latent structures without prior assumptions. In this work, we explore whether phase transition signatures can be captured directly from raw particle configurations, challenging the notion that symmetry-based inputs are necessary for understanding the emergence of order.
14:45	243	**Order Informed Sampling in the Physical Sciences** *Christian Binder, Oxford University, Oxford, United Kingdom* Nested sampling is widely used to evaluate high-dimensional, sharply peaked integrals and generate posterior samples. In materials science and quantum chemistry, it enables partition function calculations but requires millions of energy evaluations—making it impossible to use high-level potential energy surface (PES) predictors such as DFT or Hartree–Fock. As a result, applications have been limited to low-cost approximations like Lennard-Jones potentials. We introduce Order Informed Sampling, a new method that uses information from lower-level models to guide sampling efficiently. This drastically reduces the number of required evaluations. Hence, for the first time, it becomes feasible to compute partition sums and related thermodynamic properties using chemically accurate PESs.
15:00	244	**Electronic structure and superconductivity in nickelates and cuprates: insights from DMFT and DΓA** *Eric Jacob [1], Mario Malcolms de Oliveira [2], Thomas Schäfer [2], Paul Worm [1], Liang Si [3,1], Karsten Held [1]* *[1] Institute of Solid State Physics, TU Wien, Austria,* *[2] Max-Planck-Institut für Festkörperforschung, Stuttgart, Germany,* *[3] Northwest University, Xi'an, China* The infinite-layer nickelates and cuprates are key materials for studying unconventional superconductivity and correlated electronic behavior. I will discuss recent progress in understanding the electronic structure of infinite-layer nickelates, based on dynamical mean-field theory (DMFT) and its comparison with angle-resolved photoemission spectroscopy results, which put severe constrains on scenarios for their electronic states. In particular, only one Ni orbital crosses the Fermi surface. I will also present ongoing investigations into superconductivity in nickelates and cuprates using the dynamical vertex approximation (DΓA).

15:15	**245**	**Controlling Plasmonic Catalysis via Strong Coupling with Electromagnetic Resonators** *Christian Schäfer [2], Jakub Fojt [1], Paul Erhart [1]* *[1] Department of Physics, Chalmers University of Technology, Göteborg, Sweden,* *[2] TU Wien, Institute for Applied Physics, Vienna, Austria* Plasmonic excitations decay within femtoseconds, leaving nonthermal charge carriers behind that can be injected into molecular structures to trigger chemical reactions that are otherwise out of reach - a process known as plasmonic catalysis. In this talk, we demonstrate that strong coupling between resonator structures and plasmonic nanoparticles can be used to control the spectral overlap between the plasmonic excitation energy and the charge injection energy into nearby molecules. Our atomistic description couples real-time density-functional theory self-consistently to EM resonators. Control over the resonator provides then an additional knob for nonintrusively enhancing plasmonic catalysis [J. Fojt, P. Erhart, C. Schäfer, Nano Lett. 2024, 24, 11913.], here more than 6-fold - a new facet of modern catalysis.
	~~**246**~~	*→ moved to 164*
15:30	**247**	**Analytical treatment of π-ton vertex corrections to optical conductivity** *Juraj Krsnik [1], Anna Kauch [2], Karsten Held [2]* *[1] Institute of Physics, Zagreb, Croatia, [2] TU Wien, Vienna, Austria* Numerical studies for correlated metals hinted that π-ton vertex corrections generally suppress the dc conductivity, eventually leading to a displaced Drude peak (DDP). These findings were further supported by analytical calculations, providing additional insights into the temperature dependence of these vertex contributions. These results suggest that with the exponential scaling of the correlation length, the DDP becomes more pronounced at higher temperatures, while at low temperatures it diminishes into a broadened Drude peak, as it is observed experimentally in several materials, with the dc resistivity exhibiting a linear temperature dependence at low temperatures. Additionally, the displacement frequency of the Drude peak is identified with the inverse quasiparticle lifetime, offering experimentally testable characteristic behaviors for detecting π-ton effects in real materials.
15:45		***END***

Friday, 22.08.2025, Room Erika Weinzierl Saal

Time	**ID**	**KOND XVII: Functional Materials** *Chair: Tomáš Bzdušek, Universität Zürich*
14:00	**251**	**Photoinduced phase transitions into hidden states** *Igor Vaskivskyi, Department of Complex Matter, Jozef Stefan Institute, Ljubljana, Slovenia, & CENN Nanocenter, Ljubljana, Slovenia* Engineering material functionalities on demand remains a key challenge in materials science. Photoinduced phase transitions to hidden metastable states offer a promising route, enabling rapid and efficient control of system properties. However, a deeper understanding of the mechanisms that govern the formation and enhance the stability of new phases is required. In this work, we explore the interplay between electronic reordering and the crystal lattice in a correlated material. While initially driven by electrons, the subsequent stabilization and extended lifetimes of the hidden orders in the system are tied to lattice dynamics, which provides a tunable lever for controlling their longevity, potentially revealing new metastable phases and unlocking potential applications ranging from ultrafast memory to tunable X-ray light modulators.

14:30	**252**	**Topological Flat Bands for Metallic Thermoelectrics** *Andrej Pustogow, TU Wien, Austria* Frustrated lattices like the kagome network, where destructive interference creates flat electronic bands, have attracted great interest for realizing exotic quantum phases in solids. Here, we show that interband scattering between topologically flat and dispersive bands gives rise to a large thermoelectric effect. Thermoelectrics are materials that convert heat directly into electricity and are key for energy harvesting and cooling applications. Using first-principles calculations, we show that extreme interband scattering in the kagome system $Ni_3In_{1-x}Sn_x$ may result in exceptional thermoelectric performance on par with Bi_2Te_3 – the only commercially available thermoelectric material around room temperature. Our discovery highlights a novel route to design thermoelectrics from metals and sheds new light on charge transport in topological materials.
15:00	**253**	**Insights into the flexibility of the DMOF-1 Metal-Organic Framework upon azobenzene isomerization revealed by terahertz (THz) and infrared (IR) spectroscopy** *Peter Hartmann [1], Sumea Klokic [2], Heinz Amenitsch [2], Giovanni Birarda [3], A. Daniel Boese [1], Johannes Hoja [1], Benedetta Marmiroli [2] , Andrea Perucchi [3]* *[1] Department of Chemistry, University of Graz, Austria, [2] Technical University of Graz, Austria, [3] Elettra Sincrotrone, Trieste, Italy* Structurally flexible metal-organic frameworks (MOFs) are at the forefront for energy storage applications due to their unique feature to undergo phase-changes when exerting an external stimulus such as light. However, a comprehensive understanding of the factors governing their structural response still remains largely unascertained. By means of solid-state Density Functional Theory (DFT) calculations, we provide new insights into the origins of the structural response of DMOF-1 to the photo-induced trans to cis isomerization of infiltrated azobenzene. Towards this end, we chiefly focus on the impact of different types of lattice vibrations, scrutinizing their volume-dependency, analyzing their impact on the quantity of stored energy via Helmholtz free energy profiles, and linking them to observations in experimental terahertz and infrared measurements.
15:30	**254**	**Optical conductivity of layered topological semimetal $TaNiTe_5$** *Jakov Budić [1], Serena Nasrallah [2], David Santos-Cottin [3], Aki Ismo Olavi Pulkkinen [4], Jan Minar [4], Chris Homes [5], Mario Novak [1], Ana Akrap [1]* *[1] University Of Zagreb, Croatia, [2] TU Wien, Austria, [3] University of Fribourg, Switzerland, [4] University West Bohemia, Pilsen, Czechia, [5] Brookhaven National Laboratory, Upton, USA* $TaNiTe_5$ is a quasi-one-dimensional topological semimetal characterized by a chain-like atomic structure and strong in-plane anisotropy. The material shows high magnetoresistance and low effective carrier masses, suggesting it as a potential two-dimensional topological semimetal. We measured infrared reflectance and electronic transport along the a and c crystallographic axes. No spectral features indicative of reduced dimensionality were observed. The experimental optical response aligns well with ab initio calculations. Our results show that $TaNiTe_5$ is an anisotropic semimetal without clear signatures of low-dimensional electronic behavior. The agreement between experiment and ab initio calculations further supports a three-dimensional electronic structure, despite the material's quasi-one-dimensional lattice.
15:45	**255**	**Influence of Antisite Defects on Multiferroic Functionalities in $LaFeO_3$ Perovskite Oxides.** *Souren Majani, Ulrich Aschauer* *Department of Chemistry and Physics of Materials, Paris Lodron University of Salzburg, Austria* Single-phase materials that exhibit both ferroelectric and magnetic properties above room temperature are highly desirable, sparking ongoing research into unconventional ferroelectric mechanisms in magnetic oxides. Here, we investigate an underexplored route towards ferroelectricity by introducing antisite defects in the perovskite oxide $LaFeO_3$. Our density functional theory (DFT) calculations uncover a highly non-centrosymmetric environment of a FeLa antisite defect that leads to switchable ferroelectricity.

		In addition to studying ferroelectricity, we also conduct magnetic exchange energy calculations to elucidate the relationship between polarization configuration and antisite spin orientation, aiming to explore the magneto-electric properties of our system. By establishing a novel method to achieve ferroelectricity, this study emphasizes the significance of defect engineering as a powerful tool for rational material designing
16:00		***END***

ID	KOND Poster
261	**Spontaneous voltage and persistent electric current from rectification of ambient electronic noise in cuprate/manganite interface**

Subhrangsu Sarkar [1], Mathias Soulier [1], Shamashis Sengupta [2], Yurii G. Pashkevich [1,3], Roxana Capu [4], Jarji Khmaladze [1], Miguel Monteverde [5], Louis Dumoulin [2], Dominik Munzar [6], Christian Bernhard [1]
[1] University of Fribourg, Department of Physics and Fribourg Center for Nanomaterials, Chemin du Musée 3, 1700 Fribourg, Switzerland,
[2] Université Paris-Saclay, CNRS/IN2P3, IJCLab, 91405 Orsay, France,
[3] O. Galkin Donetsk Institute for Physics and Engineering NAS of Ukraine, Kyiv-03028, Ukraine,
[4] West University of Timisoara, Faculty of Physics, Bd Vasile Parvan 4, Timisoara-300223, Romania,
[5] Université Paris-Saclay, CNRS, Laboratoire de Physique des Solides, 91405 Orsay, France,
[6] Department of Condensed Matter Physics, Faculty of Science, Masaryk University, Kotlářská 2, 61137 Brno, Czech Republic

In epitaxial heterostructures made of optimally doped YBCO and $Nd_{0.65}(Ca,Sr)_{0.35}MnO_3$(NCSMO), we observe below ~130 K a spontaneous voltage (SpV) signal that can be used for driving a persistent current (SpC) across an external circuit. This SpV signal also exhibits an intriguing magnetic field dependence with an overall strong suppression towards large magnetic fields and hysteretic, jump-like changes at intermediate values of magnetic field. The mechanism underlying the SpV involves ambient electronic noise rectification is due to a ratchet-type electronic potential originating from a competing coexistence of a nonpolar ferromagnetic (FM) minority phase and a charge/orbital ordered (COO) majority phase with polar moments and charged domain walls that cannot be screened by a YBCO layer when it is thinner than 10 nm.

262	**Bridging Quantum Scars and Classical Localization: Spin Transport Anomalies in Low-Dimensional Systems**

Satar Almazyoudawi [1,2], Masar Almuttairi [1]
[1] University of Wasit, Kut, Iraq, [2] Medical University of Vienna, Austria

Quantum scars, localized enhancements in quantum wavefunctions—offer a unique insight into the connection between classical chaos and quantum dynamics. This work investigates how Rashba spin-orbit coupling (SOC) can induce scar-like states in low-dimensional quantum dots and how these structures influence spin transport.
Inspired by classical localization in nonlinear systems described by the Discrete Nonlinear Schrödinger Equation (DNLSE), we propose a framework where quantum scarring is viewed as a counterpart to classical self-trapping. We analyze how such scars affect spin current density, coherence, particularly via the Rashba-Edelstein effect.
Our findings suggest that scar-induced confinement may enhance spin coherence while enabling new regimes of spin relaxation. This approach bridges quantum chaos and spintronics, with implications for spin-based devices and non-equilibrium quantum systems.

263	**Generalized Josephson effect with arbitrary periodicity in qunatum magnets.**

Anshuman Tripathi [1], Felix Gerken [1,4], Peter Schmitteckert [2], Michael Thorwart [1,4], Mircea Trif [3], Thore Posske [1,4]
[1] I. Institute for Theoretical Physics, University of Hamburg, Germany,
[2] HQS Quantum Simulations GmbH, Karlsruhe, Germany,
[3] Int. Research Centre MagTop, Institute of Physics, Polish Academy of Sciences, Warsaw, Poland,
[4] The Hamburg Centre for Ultrafast Imaging, Hamburg, Germany

Easy-plane quantum magnets are strikingly similar to superconductors, allowing for spin supercurrent and an effective superconducting phase stemming from their U(1) rotation symmetry around the z-axis. We uncover a generalized fractional Josephson effect with a periodicity that increases linearly with system size in one-dimensional spin-1/2 chains at selected anisotropies and phase-fixing boundary fields. The effect

	combines arbitrary integer periodicities in a single system, exceeding the 4π and 8π periodicity of superconducting Josephson effects of Majorana zero modes and other exotic quasiparticles. We reveal a universal energy-phase relation and connect the effect to the recently discovered phantom helices
264	**Static and Dynamic Magnetic Response of van der Waals Antiferromagnets** *Ignac Fejes [1], Maxim Ryzhkov [2], Bence Szász [1], Alexey Shuvaev [2], Andrei Pimenov [2], Dávid Szaller [1]* *[1] Budapest University of Technology and Economics, Budapest, Hungary, [2] TU Wien, Austria* A fundamental understanding of magnetoelectric phenomena—characterized by coupled magnetic and electric degrees of freedom—requires the study of both the static and dynamic responses of candidate materials under magnetic and/or electric fields. We investigated the magnetic phase transitions and magnetization dynamics of van der Waals antiferromagnets at cryogenic temperatures and in high magnetic fields, using vibrating sample magnetometry and millimeter-wave spectroscopy. The results are interpreted within the framework of classical mean-field theory.
265	*cancelled*
266	**Extended s-wave pairing from an emergent Feshbach resonance in bilayer nickelate superconductors** *Pietro Borchia [1], Hannah Lange [2,3,4], Fabian Grusdt [2,4]* *[1] University of Vienna, Austria, [2] Ludwig-Maximilians University of Munich, Germany,* *[3] Max Planck Institute for Quantum Optics, Garching, Germany,* *[4] Munich Center for Quantum Science and Technology, Munich, Germany* Since cuprate superconductivity was discovered, understanding pairing mechanism in doped antiferromagnets remains challenging. Inspired by high-T_c superconductivity in $La_3Ni_3O_7$ bilayers, we analyze a minimal mixed-dimensional t–J model with repulsive interlayer Coulomb interaction V. When hole-doped, previous numerical simulations revealed strong binding energies and BCS–BEC crossover signatures via a Feshbach resonance mechanism between two charge-carrier types. We introduce a mean-field analysis that directly captures this crossover, uncovers its microscopic structure, and predicts pairing symmetry in two-dimensional bilayers. Benchmarking against density-matrix renormalization group results in quasi-1D geometries shows excellent agreement. For two-dimensional bilayers relevant to $La_3Ni_3O_7$, our theory predicts an extended s-wave BCS gap emerging from Feshbach-mediated pairing. This framework gives insight into unconventional pairing and can be tested in ultracold-atom experiments.
267	**Strain engineering of the magnetic exchange interactions in a CrI_3 monolayer** *Jyothi Bhasu Anjali [1], László Szunyogh [1], László Oroszlány [2], Dániel Pozsár [2], Zoltán Tajkov [2], Gabriel Martinez-Carracedo [3], Amador García-Fuente [3], Jaime Ferrer [3]* *[1] Budapest University of Technology and Economics, Budapest, Hungary* *[2] Eotvos Lorand University, Budapest, Hungary, [3] Universidad de Oviedo, Spain* A monolayer CrI_3 has gained significant attention as a potential candidate for spintronic and topological magnonic technologies due to its inherent ferromagnetism and adaptable electronic characteristics. In this study we performed detailed ab initio simulations using density functional theory to explore how biaxial strain influences the magnetic properties of CrI_3 monolayer. The calculated exchange interactions reveal a strain-induced magnetic phase transition from a ferromagnetic to an antiferromagnetic ground state. Importantly, we demonstrate that biaxial strain affects the Dzyaloshinsky–Moriya interaction (DMI) both in magnitude and orientation. Overall, our findings shed light strain-driven modulation of magnetism in CrI_3 monolayer and highlight the potential of strain engineering of future spintronic devices.
268	**Non-trivial Berry phase and anomalous Hall effect in layered $ZrTe_5$** *Sophia Hollweger, Institute of Semiconductor and Solid State Physics, Johannes Kepler University, Linz* Mechanically exfoliated $ZrTe_5$ flakes are investigated by means of Raman spectroscopy, x-ray photoemission spectroscopy, and low-temperature / high-field magnetotransport. The crystalline flakes are transferred onto SiO_2/Si substrates with Pt contacts in a 1-3-3-1 Hall bar geometry. Magnetotransport measurements carried out using an AC phase-locked technique, reveal a peak in longitudinal resistance at 154 K, pointing at a Lifshitz transition and at a shift from hole to electron-dominated transport. Shubnikov-de Haas oscillations and anomalous Hall effects indicate a non-trivial Berry phase ($\Phi_B \simeq \pi$), suggesting the presence of topological surface states. These findings position $ZrTe_5$ as a platform for studying proximity-induced phenomena like p-wave pairing and superconducting diode effects.

269

Magnetic field-induced phases in BoNO: an extensive NMR study of a model S = 1 Haldane chain

Ivan Jakovac [1], Mihael Srđan Grbić [1], Maxime Dupont [2], Yuko Hosokoshi [4], Mladen Horvatić [3]
[1] University of Zagreb, Faculty of Science, Department of Physics, Zagreb, Croatia,
[2] Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley,, USA,
[3] Laboratoire National des Champs Magnetiques Intenses, LNCMI-CNRS, EMFL, Universite Grenoble Alpes, UPS and INSA Toulouse, Grenoble, France,
[4] Department of Physics, Osaka Metropolitan University, Osaka, Japan

One-dimensional quantum spin systems exhibit rich magnetic field-induced phase diagrams, though intrinsic anisotropies, additional interactions, and high critical fields frequently plague their experimental realisations. Here, we present a novel organic Haldane S = 1 spin chain system m-NO_2PhBNO (BoNO). Our magnetic susceptibility, heat capacity, and ESR data confirm an almost isotropic g-tensor (g = 2.0023 ± 2 ‰) and accessible critical fields (B_{c1} = 1 T, B_{c2} = 34 T). High-resolution 1H NMR was employed to map the complete phase diagram, determine the critical exponent at B_{c2}, and validate the theoretical framework across the Tomonaga-Luttinger regime, long-range ordered phase and quantum critical region. Our findings are further supported by advanced computational techniques, including Bayesian inference and quantum Monte Carlo simulations.

270

Ultrafast Vortex Velocities in Superconducting MgB_2 Films

Clemens Schmid [1,2], Markus Gruber [1], Corentin Pfaff [3], Theo Courtois [3], Anton Pokusinskyi [4], Alexander Kasatkin [5], Karine Dumesnil [3], Stephane Mangin [3], Thomas Hauet [3], Oleksandr Dobrovolskiy [4]
[1] Universität Wien, Austria, [2] Vienna Doctoral School in Physics, Wien, Austria,
[3] Institut Jean Lamour, Nancy, France, [4] Technische Universität Braunschweig, Germany,
[5] G. V. Kurdyumov Institute for Metal Physics, Kyiv, Ukraine

The velocity with which Abrikosov vortices move in a type II superconductor is a crucial property in determining the suitability of a material for the fabrication of applications such as single-photon detectors and magnon generators of the Cherenkov type. In our experiments, we probe films consisting of the two-band superconductor MgB_2, testing varying thicknesses and material compositions. The resistivity dependence on temperature as well as the current-voltage characteristics show peculiar features, attributed to the two-band nature of MgB_2 and the emergence of vortex rivers. Furthermore, in samples with larger (~30 nm) thicknesses, we estimate the maximum velocity of Abrikosov vortices to be in the range of 10 - 20 km/s, a competitive value compared with other materials used in applications.

271

Impact of ambient hydrocarbon contamination on scanning tunneling microscopy and spectroscopy of graphite

György Kálvin [1,2], Péter Vancsó [1], András Pálinkás [1], Márton Szendrő [1], Konrád Kandrai [1,3], Péter Nemes-Incze [1]
[1] HUN-REN Centre for Energy Research, 1121 Budapest, Hungary,
[2] Institute of Physics, Faculty of Science, ELTE Eötvös Loránd University, 1117 Budapest, Hungary,
[3] Department of Physics, Institute of Physics, Budapest University of Technology and Economics, 1111 Budapest, Hungary

Ambient hydrocarbon contamination is an inevitable factor to consider in measurements of van der Waals materials. In recent years, our group has identified the structure of this contamination as a self-organized layer of normal alkanes resulting from exposure to air. Here we investigate its impact on scanning tunneling microscopy (STM), and spectroscopy. We show that in the presence of the alkane layer, the well-known phonon-induced gap vanishes, solving the persistent mystery in previous STM studies why this feature is often absent.Additionally, the contamination layer significantly alters the observed current-distance curves (I(z)), by flattening the exponential decay by a factor of 2. Based on the I(z) and dI/dV characteristics, we propose a guideline to detect surface contamination.

272

Γ-point magnons in antiferromagnetic α-MnTe

Stáňa Tázlarů [1,2], SigurðurI. Erlingsson [3], Milan Orlita [4], Karel Výborný [1]
[1] Institute of Physics, Academy of Sciences of the Czech Republic, Prague, Czech Republic,
[2] Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic,
[3] School of Science and Engineering, Reykjavik University, Iceland,,
[4] LNCMI-EMFL, CNRS UPR3228, Univ. Grenoble Alpes, Grenoble, France

Manganese telluride (α-MnTe) is a relatively well-known material whose antiferromagnetic and semiconducting properties make it relevant for various applications, notably for spintronics. Its Γ-point magnon mode with low temperature energy ≈ 3.5 meV was observed by several techniques and its behavior in external magnetic field was investigated.
A simplified linear spin wave theory (LSWT) model was then utilized to interpret the observed behavior and determine the single-ion out-of-plane component of magnetic anisotropy D = (40 ± 10) μeV. Expected field-dependence of this mode agrees both qualitatively and quantitatively with experimentally observed shifts of the magnon α-mode and it allows us to extract information related to dynamics of magnetic moments. We find asymmetry in absorption of circularly polarised THz radiation and discuss its magnitude.

273

Colossal magnetoresistance effect and spin-dependent variable-range hopping in the charge ordered phase of overdoped $La_{1-x}Ca_xMnO_3$ manganites

Emil Tafra [1], Nikolina Novosel [2], Željko Skoko [1], Tomislav Ivek [2], Mario Basletić [1], Branimir Mihaljević [1], Zvonko Jagličić [3,4], David Rivas Góngora [2], Silvia Tomić [2], Amir Hamzić [1], Vladimir Roddatis [5], Florian Fischgrabe [6], Vasily Moshnyaga [6], Bojana Korin-Hamzić [2], Matija Čulo [2]
[1] Department of Physics, Faculty of Science, University of Zagreb, Croatia,
[2] Institut za fiziku, Zagreb, Croatia,
[3] Faculty of Civil and Geodetic Engineering, University of Ljubljana, Slovenia,
[4] Institute of Mathematics, Physics and Mechanics, Ljubljana, Slovenia,
[5] GFZ Helmholtz Centre for Geosciences, Potsdam, Germany,
[6] I. Physikalisches Institut, Georg-August-Universität Göttingen, Germany

$La_{1-x}Ca_xMnO_3$ manganites exhibit the famous colossal magnetoresistance (CMR), which, at the low doping part of the phase diagram, is suggested to arise from phase-separated clusters of ferromagnetic, paramagnetic, and antiferromagnetic phases. We investigated $La_{1-x}Ca_xMnO_3$ thin films for x = 0.5 – 0.75, in the much less studied overdoped part of the phase diagram, with an insulating charge ordered (CO) phase. Unexpectedly, we found CMR, ferromagnetism and other phase characteristics of the underdoped part. Charge transport in CO phase follows spin-dependent variable-range hopping (VRH), suggesting Anderson localization in a spin-disordered Mn background. The VRH activation energy, CMR effect, fraction of ferromagnetic clusters, and CO temperature are closely related, highlighting the role of spin disorder, and interactions (electron-electron and Jahn-Teller) in charge localization.

274

Optical Properties of Metallic Carbon Nanotubes: New Insights for Plasmonic Predictions

Domitille Baux Remini [1], Patrick Hermet [2], Stéphane Campidelli [4], Jean-Louis Bantignies [3], Emmanuel Rousseau [3], Nicolas Izard [3]
[1] Department of Quantum Matter Physics, University of Geneva, Switzerland,
[2] ICGM, Université de Montpellier, France,
[3] Laboratoire Charles Coulomb, Université de Montpellier, France,
[4] Université Paris-Saclay, CEA, CNRS, NIMBE, Gif-sur-Yvette, France

In recent years, plasmonics has seen rapid growth, paving the way for major breakthroughs in areas such as sensing and integrated photonic devices. As part of this miniaturization effort, metallic Single-Wall Carbon Nanotubes (m-SWCNTs) stand out as the smallest conceivable metallic wires—ideal building blocks for nanoscale plasmonic devices. Accurate knowledge of their complex dielectric function is thus essential. However, experimental data are often limited to unsorted samples or narrow frequency ranges. Here, we investigate the contribution of intraband transitions to the optical properties of m-SWCNTs, combining experimental reflectance measurements with electromagnetic modeling and Kramers-Kronig analysis. The results agree remarkably well with ab-initio calculations and reveal the limitations of the widely used linear surface conductivity model.

275 Atomic-resolution investigation of 2D hematene

Jana Dzibelova [1], Jan Filip [2], Jani Kotakoski [1]
[1] University of Vienna, Austria, [2] CATRIN, Palacky University in Olomouc, Czech Republic

Hematene is a recently discovered 2D form of α-Fe_2O_3. It is a so-called non-van der Waals 2D material, because it's bulk counter part has strong bonds in all three directions, making the cleaving into individual layers significantly more complex.
The dimensional confinement of the hematene structure is expected to introduce changes to the lattice. This distortion of atomic positions affects the electronic configuration and therefore the magnetic, electronic and optical behavior of the system. Here, we employ (scanning) transmission electron microscopy to investigate the atomic structure and distortions of the lattice in thin hematene sheets with the aim to quantify the lattice distortions and facilitate the physical description of the material.

276 Field-dependent Magneto-optical Kerr Effect Spectra of $EuCd_2As_2$

Michal Hubert [1], Ana Akrap [2], Mario Novak [2], Milan Orlita [1], M. Veis [1]
[1] Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic,
[2] Faculty of Science, University of Zagreb, Croatia

$EuCd_2As_2$ is a layered antiferromagnet that crystalizes in a trigonal lattice. The Cd_2As_2 bilayers are separated by Eu atoms arranged in ferromagnetic ab planes stacked antiferromagnetically in c direction. This compound was widely believed to be a Weyl semimetal which have promising physical properties for spintronic applications and has therefore attracted considerable attention. Recently, there have been reports that the $EuCd_2As_2$ is not a semimetal but a semiconductor with a gap of approximately 770 meV.
The samples studied in [3] display high sensitivity to magnetic field. This manifests for example in substantial shift of the band gap. In this work, we report a field dependent magneto-optical Kerr effect (MOKE) spectra measurements on $EuCd_2As_2$ bulk sample. The sample was measured in a Quantum Design Physical Property Measurement System with a custom-built experimental setup for MOKE measurements. The measurements were performed in the energy range from 1.25 eV to 4.5 eV in magnetic fields up to 5 Tesla. The sample was kept at 4 K during the measurement, below the Néel temperature T_N = 9.5 K.
The MOKE spectra are directly connected to different absorption of right- and left-circularly polarized light and therefore show that the whole band structure is extremely sensitive to magnetic field. This behavior is most profound up to approximately 1.7 T, at which the magnetic moments begin to saturate. The change in MOKE spectra is quite complex, with some peaks experiencing redshift while some experience blueshift. Some peaks, for example peak at 1.5 eV, entirely disappear above 1.7 T. It can also be noted that the amplitude of the MOKE is very large, reaching almost 4 degrees at 2.15 eV, which corresponds to large magnetic moment of Eu (7 mB). Our experimental data clearly show the evolution of a inter-band transitions with applied magnetic field and contribute to the debate about the nature of the $EuCd_2As_2$.

277 Wide-Field MOKE Imaging of Domains in Altermagnetic MnTe

Filip Chudoba [1], Ivan Soldatov [2], Gunther Springholtz [3], Rudolf Schäfer [2], Eva Schmoranzerová [1]
[1] Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic
[2] Intstitute for Metallic Materials, Leibniz IFW Dresden, Dresden, Germany
[3] Johannes Kepler University, Linz, Austria

Altermagnetism, a new type of magnetic state introduced only very recently, has quickly drawn the attention of the scientific community. However, little is known about the nature of altermagnetic ordering. Our research focuses on magnetic domain structure of a prototype altermagnet MnTe, a material characterized by its six-fold rotational symmetry and antiparallel spin alignment. We use wide-field Kerr microscopy, a method that utilizes magneto-optical Kerr effect (MOKE), where polarized light reflected from a magnetic sample undergoes a magnetization-dependent rotation, offering real-time observation of magnetic structure dynamics with high spatial resolution. In our experiment, we analyzed the MOKE as well as the purely optical response of MnTe during cooling and subsequent heating cycles around its Néel temperature (300 K), examining its behavior under different external magnetic fields. We report the observation of distinct hysteresis patterns dependent on the presence of an external magnetic field and the formation and subsequent disappearance of various types of structures (A-E) during the transition across the Néel temperature threshold. Though the physical origin of the structures remains to be explored, their formation provides a clear indication of a magnetic phase transition in the system.

278

Magneto-optical detection of malaria in rotating magnetic field

Gergely Babcsán [1], Dávid Szaller[1], Ágnes Orbán [2], István Kézsmárki [3]
[1] Budapest University of Technology and Economics, Budapest, Hungary,
[2] Institut Pasteur du Cambodge, Phnom Penh, Cambodia, [3] University of Augsburg, Germany

Sensitive, robust and cost-effective detection of malaria infection in its early stage is still an unsolved problem. Here we present a potential solution based on physical principles, utilyzing the optical and magnetic anisotropies of the hemozoin crystals produced by the malaria parasites.

279

Modification of the electronic properties of MBE-grown $NbSe_2$ on oxide substrates

Ryan Thompson [1] Subhrangsu Sarkar [1], Nicolas Brunner [1], Yuriy Pashkevych [1,2], Premysl Marsik [1], Christian Bernhard [1]
[1] University of Fribourg, Switzerland,
[2] O. Galkin Donetsk Institute for Physics and Engineering NAS of Ukraine

Transition metal dichalcogenides (TMDCs) are a family of 2D layered materials that have garnered attention recently due to their unique and highly tunable electronic and optical properties. However, heterostructures of TMDCs on oxides, in particular transition metal oxides, have not been well explored, despite notable results such as the enormous enhancement of the superconducting transition temperature from 9 K in bulk FeSe to 65 K in $FeSe/SrTiO_3$ heterostructures. In this work, we study the modification of the electronic and superconducting properties of $NbSe_2$ grown via MBE on a variety of oxide substrates. Preliminary results indicate an enhancement of weak localization and electron-electron interactions just before the superconducting transition.

280

Identifying Fulde–Ferrell–Larkin–Ovchinnikov Superconductivity via Magnetotropic Response

Gulnaz Rakhmanova [1], Ragheed Alhyder [1], Alberto Cappellaro [2], Mikhail Lemeshko [1], Kimberly Modic [1]
[1] Institute of Science and Technology Austria (ISTA), Klosterneuburg, Austria,
[2] Department of Physics and Astronomy "G. Galilei", University of Padova, Italy

The FFLO state is a superconducting phase that emerges under a strong magnetic field and is characterized by a spatially modulated order parameter due to Cooper pairs acquiring finite momentum. It exhibits unique anisotropic signatures due to the interplay between spatially varying superconductivity and applied magnetic fields. Strontium ruthenate, a layered perovskite superconductor, has been proposed as a promising candidate for hosting the FFLO state due to its high purity and layered structure. To investigate the FFLO phase there, we employ the resonant torsion magnetometry technique, which reflects the magnetic anisotropy of the system and enables a precise phase transition identification. We will probe the directional dependence of the superconducting order parameter and study its stability against competing phases.

281

Elimination of substrate-induced ferromagnetic resonance linewidth broadening in the epitaxial system YIG–GGG by microstructuring

David Schmoll [1,2], Rostyslav O. Serha [1,2], Jaganandha Panda [3], Andrey A. Voronov [1,2], Carsten Dubs [4], Sebastian Knauer [1], Michal Urbánek [3], Andrii Chumak [1]
[1] University of Vienna, Faculty of Physics, Vienna, Austria,
[2] Vienna Doctoral School in Physics, Vienna, Austria,
[3] CEITEC BUT, Brno University of Technology, Brno, Czech Republic,
[4] INNOVENT e.V. Technologieentwicklung, Jena, Germany

Long lifetimes, low decoherence rates, and a strong coupling to other subsystems make yttrium iron garnet (YIG), grown on a gadolinium gallium garnet (GGG) substrate, a promising platform to host magnonic quantum states. However, the magnetic damping at cryogenic temperatures significantly increases due to the paramagnetic character and the highly inhomogeneous stray field generated by GGG. We report on temperature-dependent ferromagnetic resonance spectroscopy studies in YIG–GGG thin films with different sample geometries. We experimentally demonstrate how to eliminate the asymmetric stray field-induced linewidth broadening via microstructuring of the YIG film. Additionally, our experiments reveal evidence of a non-Gilbert-like behavior of the linewidth at cryogenic temperatures, independent of the inhomogeneous GGG stray field.

282 Investigating Strain-Dependent Magnetoresistance and Metal-Insulator Transition in LCMO Films at Cryogenic Temperatures Using Near-Field Techniques

Giuliano Esposito [1], Gennady Logvenov [2], Georg Christiani [2], Alexey Kuzmenko [1]
[1] DQMP, University of Geneva, Switzerland,
[2] Max Planck Institute for Solid State Research, Heisenbergstraße 1, D-70569 Stuttgart,Germany

Metal-insulator transitions (MITs) in complex oxides like manganites present intriguing phenomena with significant implications for fundamental physics and potential applications.
In this study, we investigate the MIT in manganites, focusing on lanthanum calcium manganese oxide (LCMO). Scattering scanning near-field optical microscopy (s-SNOM) emerges as a powerful tool, offering high spatial resolution and sensitivity to local conductivity. By Using s-SNOM, we explore the MIT in LCMO and its modulation under strain.
Building upon successful applications in other materials like vanadium dioxide (VO_2) and neodymium nickel oxide ($NdNiO_3$), we present preliminary findings on the impact of strain on the MIT transition in LCMO. We will present preliminary results on colossal magneto resistance on LCMO where different strain translates to different transition temperatures.

283 Broken Symmetries and Ordered Electrons: Probing Charge Order in CsV_3Sb_5 Using Ultrasonic Pulse-echo Techniques.

German Cancino, Kimberly Modic, Shiva Safari,
Institute of Science and Technology, Klosterneuburg, Austria

In recent years, a spotlight has been put on the Kagome metal family. Of these, CsV_3Sb_5 has taken center stage with a slew of exotic phases and phenomena, including unconventional superconductivity, spontaneous time-reversal symmetry breaking, and charge density waves (CDWs). There is active debate as to the relation of potential anisotropies to the CDW and superconducting phases. By probing the elastic strain tensor, ε, using in-plane and out-of-plane GHz pulse-echo techniques, we aim to investigate the evolution of the symmetries of the system across these competing phases up to down to 1.6 K and up to 14 T.

284 Mapping stacking domains in rhombohedral graphite via conductive atomic force microscopy

Dóra Varga [1], Konrád Kandrai [1,2], Krisztián Márity [1,3], András Pálinkás [1], Péter Nemes-Incze [1]
[1] HUN-REN Centre for Energy Research, Konkoly-Thege Miklós út 29-33.,1121 Budapest, Hungary,
[2] Department of Physics, Institute of Physics, Budapest University of Technology and Economics, Műegyetem rkp. 3., 1111 Budapest, Hungary,
[3] Obuda University, Bécsi út 96/B, 1034 Budapest, Hungary

Recently, rhombohedral graphite (RG) has become a new platform for exploring correlated electron systems hosted in its topological flat band. However, few-layer RG samples contain domains with different stacking orders – hexagonal (ABA) and rhombohedral (ABC), which can significantly alter the electronic properties. We used conductive AFM to map local conductivity changes in RG samples containing both ABA and ABC domains, thereby bridging the scan size and resolution gap between atomic scale characterization tools (STM) and Raman spectroscopic mapping. By using the current contrast between the domains, with changing sample bias we can identify the local stacking configuration. A simple model, based on the calculated density of states and incorporating local doping effects, qualitatively reproduces the measurements.

285 Time-Domain THz Mueller Matrix Ellipsometry on Low Symmetry Crystals

Premysl Marsik, Alexander Ferguson, Laurent Bugnon, David Santos-Cottin, Yurii Pashkevich, Christian Bernhard
University of Fribourg, Switzerland

Time-domain THz spectroscopy has the remarkable ability to detect amplitudes as well as phases of the low-frequency electromagnetic waves. This feature allows for relatively simple implementation of full 4x4 Mueller matrix polarimetry only with rotating polarizer and analyzer, without the need for additional compensators.
I will show the geometrical configuration, and the formalism needed for the Mueller matrix ellipsometry method using the time-domain THz technique and present the proof-of-principle experimental results obtained on orthorhombic $DyScO_3$ crystals in controlled low symmetry orientations.
Further, I will present an application of the method on monoclinic ferroelectric semiconductor $Sn_2P_2S_6$, which exhibits rich phonon spectrum in the THz spectral range, with many vibration modes below 100 cm^{-1} (3 THz), manifesting rather complex temperature dependent behavior.

286	**Machine Learning for Quantum Many-Body Physics: Efficient Representation of Vertex Functions** *Sebastian Hepp [1], Sabine Andergassen [1,2], Daniel Springer [2]* *[1] Institute of Information Systems Engineering, TU Wien, Austria,* *[2] Institute of Solid State Physics, TU Wien, Austria* We explore the ability of machine learning models to extract information encoded in the two-particle vertex Γ that generalizes across different quantum phases. To steer the model away from relying on global phase-specific patterns we employ a sub-sampling strategy that encourages the model to learn general features tied to the phase specific competition between kinetic energy and Coulomb repulsion. We show that an autoencoder trained only on data from antiferromagnetic and ferromagnetic phases is able to reconstruct samples from a previously unseen superconducting phase.This demonstrates that the model captures essential aspects of the underlying many-body dynamics of the Hubbard model.
287	**Temperature dependence of the DC conductivity in anisotropic 3D Dirac semimetals** *Patrik Papac, Ivan Kupčić* *Department of Physics, Faculty of Science, University of Zagreb, Croatia* Relaxation processes associated with electron scattering by acoustic and optical phonons and by static disorder are studied in anisotropic three-dimensional Dirac systems. The frequency dependence of the real and imaginary parts of the memory function is calculated for different temperatures and for different values of the Dirac mass. At low temperatures, the imaginary part of the zero-frequency memory function and the DC resistivity are characterized by the scaling law aT^x, and at high temperatures, it is approximately linear.
288	**Kohler's Rule in the Strange Metal Regime of Cuprates** *Luka Aksamovic, Institute of Solid State Physics, TU Wien, Austria* In conventional metals, Kohler's rule reflects the invariance of the scattering rate with respect to magnetic field and temperature. In the pseudogap regime of underdoped cuprates, this scaling has been clearly demonstrated. Here, we investigate the validity of Kohler's rule in the strange metal regime at optimal doping. Our previous studies based on resistivity, Hall effect, optical conductivity, and Hall mobility indicate that the scattering rate scales quadratically with temperature, while the carrier density varies linearly. We present new magnetoresistivity measurements in BSCCO and analyze published LSCO data, showing that Kohler scaling holds when the temperature dependence of the effective carrier density is properly accounted for. This implies that itinerant charges retain Fermi-liquid-like character, despite prevailing non-Fermi-liquid interpretations.
289	**Progress in the studies of electronic and magnetic properties of layered MPX_3 materials (M: transition metal, X: chalcogen)** *Yuriy Dedkov [1], Elena Voloshina [2]* *[1] Institute of Physics, Zagreb, Croatia, [2] Ruđer Bošković Institute, Zagreb, Croatia* In this presentation we overview the recent progress on the studies of MPX_3 materials in our group and we focus on the consideration of electronic and magnetic properties of MPX_3 materials, where only 3d-ions as M and S, Se as chalcogens are considered, however, trying to avoid the description of the possible applications aspects. We overview the present approaches to the studies of MPX_3 as well as the recent experimental and theoretical results and draw further possible directions to the studies of these interesting materials.
290	**Proximity effects in the graphene-$Co_3Sn_2S_2$ interface** *Elena Voloshina [1], Yuriy Dedkov [2]* *[1] Ruđer Bošković Institute, Zagreb, Croatia, [2] Institute of Physics, Zagreb, Croatia* In this work, we explore the possible effects of the magnetic proximity and charge transfer on the interfacial properties of a graphene layer adsorbed on the (001) surface of $Co_3Sn_2S_2$, which bulk phase is known as topological quasi-2D semimetal in the half-metallic ferromagnetic state. Both counterparts mutually influence the properties of the heterostructure. Thus, formation of the interface allows to tune the electronic and magnetic properties of graphene over a wide range depending on the composition of the $Co_3Sn_2S_2$ interface layer. A synergy between graphene and the $Co_3Sn_2S_2$(001) enhances the perpendicular magnetic anisotropy energy of the systems, which gives a high promise for the development of new magnetic recording media.

291	**Electronic correlation and magnetic interactions in $PrNiO_2$**
	Xunyang Hong [1], Ying Chan [2], Izabela Bialo [1], Leonardo Martinelli [1], Qiang Gao [3], Xiaolin Ren [3], Xiangjiang Zhou [3], Zhihai Zhu [3], Jaewon Choi, Mirian Garcia-Fernandez [4], Ke-Jin Zhou [4], Henrik M. Rønnow [5], Qisi Wang [2], Johan Chang [1] *[1] University of Zürich, Switzerland, [2] The Chinese University of Hong Kong, China, [3] Chinese Academy of Sciences, Beijing, China, [4] Diamond Light Source, Didcot, The United Kingdom, [5] Ecole Polytechnique Federale de Lausanne, Switzerland*
	The discovery of superconductivity in infinite-layer nickelates has highlighted both similarities and crucial differences with cuprates, particularly in their electronic structure and magnetism. We present a resonant inelastic x-ray scattering (RIXS) study of $PrNiO_2$. By mapping magnetic excitations along high-symmetry directions and incorporating higher-order hopping terms (t', t''), we extract refined values for the Hubbard U and hopping parameters. Our results provide a more complete picture of magnetic correlation in $PrNiO_2$, offering key insights into its potential Mott character and relevance to unconventional superconductivity.
292	**Unconventional magnetic states in geometrically frustrated rare-earth heptatantalates**
	Kevin Jaksetič [1,2], Matej Pregelj [1], Matjaž Gomilšek [1], Mirela Dragomir [1], Lia Šibav [1,3], Manuel Pascal [4], Fabio Orlandi [4], Dmitry Khalyavin [4], Andrej Zorko [1] *[1] Jožef Stefan Institute, Ljubljana, Slovenia,* *[2] Faculty of Mathematics and Physics, University of Ljubljana, Slovenia,* *[3] Faculty of Chemistry and Chemical Technology, University of Ljubljana, Slovenia,* *[4] STFC Rutherford Appleton Laboratory, Chilton, Great Britain*
	The isotropic Heisenberg interactions between S = 1/2 spins on a two-dimensional triangular lattice result in a magnetically ordered ground state. Consequently, the search for quantum spin liquids in triangular-lattice antiferromagnets focuses on cases with anisotropic exchange interactions, which can stabilize disordered states. This has been particularly fruitful in rare-earth-based compounds where magnetic anisotropy is expected due to strong spin-orbit coupling. Our extensive magnetic characterization of $NdTa_7O_{19}$ down to very low temperature suggests that the material may realize a quantum spin liquid state. However, because electronic configurations of rare-earth ions vary, the resulting magnetic ground states are ion-dependent. Ongoing analysis of neutron diffraction data on $ErTa_7O_{19}$ reveals the emergence of an exotic magnetic phase.
293	**Magnetism of doped Murunskite**
	Jana Muževič [1], Nikolina Penić [1], Davor Tolj [2], Priyanka Reddy [3], Henrik M. Rønnow [2], László Forró [2], Denis K. Sunko [1], Neven Barišić [3] *[1] Department of Physics, Faculty of Science, University of Zagreb, HR-10000 Zagreb* *[2] Laboratory for Quantum Magnetism, EPFL, CH-1015 Lausanne* *[3] Institute of Solid State Physics, TU Wien, AT-1040 Vienna*
	Murunskite is isostructural to ferro-pnictides, however from optical conductivity we see that electronic properties show a similarity with insulating cuprates (~1 eV). Neutron scattering, and Mössbauer spectroscopy all indicate an AF-like transition at 97 K and a single ordered site at low temperatures (≈ 40 K). The magnetic transition is accompanied by an orbital transition. Despite the presence of distinct magnetic Fe sites at higher temperatures, where Fe is randomly distributed among non-magnetic Cu, full orbital and spin order is achieved at 30 K. To study magnetism and induce metallization, we developed substitution and doping strategies on both ligand and metal sites. The resulting single crystals were characterized by magnetic and resistivity measurements, as well as X-ray diffraction.
294	cancelled

295	**Hidden covalent insulator and spin excitations in $SrRu_2O_6$** *Diana Csontosova, Department of Condensed Matter Physics, Masaryk University, Brno* We theoretically study $SrRu_2O_6$, a high-TN antiferromagnetic insulator with a partially filled 4d shell, using Density Functional Theory combined with Dynamical Mean Field Theory. The competition between Hubbard interaction, Hund's exchange, and electron hopping makes the nature of its paramagnetic state still debated. While a high-spin Mott insulator is favored at half-filling, the Fermi level can lie within the molecular band gap, stabilizing a covalent insulator state. These regimes are accessible by tuning Hund's exchange. In 2019, the magnon spectrum of $SrRu_2O_6$ was measured via Resonant Inelastic X-ray Scattering and described by an S = 3/2 Heisenberg model. We compute two-particle correlation functions by inverting the Bethe-Salpeter equation to reproduce the measured magnon spectra and S = 1/2 → S = 3/2 excitations. We further analyze how varying Hund's exchange affects the magnon spectra and reflects the character of the paramagnetic state.
296	**Control of antiferromagnetic domains in $La_{0.55}Sr_{0.45}MnO_3$ ultrathin films** *Carlos Antonio Fernandes Vaz, Paul Scherrer Institut, Villigen PSI, Switzerland* We present our recent results on controlling the antiferromagnetic domain structure of ultrathin $La_{0.45}Sr_{0.55}MnO_3/SrTiO_3(001)$ films, by tuning the film thickness and post-growth annealing. The results of x-ray photoemission electron microscopy (XPEEM) show a non-monotonic variation of the domain size with film thickness in the range from 10 - 50 unit cells. We find that post-growth annealing strongly modifies the antiferromagnetic domain structure, leading to much larger antiferromagnetic domains. Theseresults show that the antiferromagnetic domain size can be tuned by the film thickness and suggests that the reduction in local defects, such as oxygen vacancies, have a strong impact on the antiferromagnetic domain structure. These observations have clear implications for size scaling of antiferromagnetic domains for antiferromagnetic spintronics applications.

Nuclear, Particle and Astrophysics (FAKT - TASK)

This session has been organised in collaboration with CHIPP.

Tuesday, 19.08.2025, Room Großer Festsaal

Time	ID	**FAKT - TASK I: EDM** *Chair: Victoria Kletzl-Teuffenbach, Österreichische Akademie der Wissenschaften*
14:00	**301**	**A Search for the Electric Dipole Moment of the Muon using the Frozen Spin Technique** *Johannes Alexander Jaeger, Paul Scherrer Institute, Villigen, & ETH Zurich, Switzerland* At PSI, we are developing an experiment to measure the electric dipole moment (EDM) of the muon using the frozen-spin technique, with plans to improve the current limit of $d_\mu < 1.8 \times 10^{-19}$ e cm to 6×10^{-23} e cm. The muon EDM probes CP violation, which exists in the Standard Model, but is too small to explain the observed matter–antimatter asymmetry in the universe. A non-zero EDM could help reveal BSM effects and possible mechanisms behind baryogenesis. Measuring the EDM of unbound muons offers a theoretically clean test of CP violation, without QCD effects. In this talk, I give an overview of our experiment, as well as my work on the numerical optimization of experimental parameters.
14:15	**302**	**Introducing the n2EDM experiment** *Gian Luca Caratsch, Paul Scherrer Institut / ETH Zürich, Villigen, Switzerland* A neutron electric dipole moment (nEDM) predicted by the Standard Model is below any currently measurable limits. A non-vanishing electric dipole moment of an elementary particle is a signature for new physics and implies charge-parity violation, which would contribute to the explanation of the observed matter-antimatter asymmetry in the Universe. The n2EDM experiment located at Paul Scherrer Institute, conducted by an international collaboration, employs a next-generation apparatus with the aim to search for an nEDM with unprecedented sensitivity. The goal is to increase the sensitivity by an order of magnitude than the current best limit of 1.8×10^{-26} e cm. In this talk, an overview of the experiment and preliminary results from the commissioning will be presented.
14:30	**303**	**An optically pumped magnetometer array used for a fundamental physics experiment** *Lea Segner, on behalf of the nEDM collaboration, ETH Zürich, Switzerland* The n2EDM experiment at the Paul Scherrer Institute searches for the neutron electric dipole moment with a sensitivity of below 10^{-27} e·cm by observing neutron spin precession in a near perfectly uniform magnetic field. Precise control of systematic effects, particularly those caused by magnetic field non-uniformities, is crucial for achieving this sensitivity. To address this, an array of 112 optically pumped Cesium vapour magnetometers, capable of picotesla-level accuracy measurements, will be deployed. This system will provide real-time measurements of magnetic field gradients, enabling the control and reduction of systematic uncertainties arising from magnetic field non-uniformities. Acknowledgement of grants: SNF 172639, 213222 and 236419

14:45	304	**A ^{199}Hg Co-Magnetometer System for the n2EDM Experiment at PSI** *Nikolaus von Schickh, on behalf of the nEDM collaboration, Paul Scherrer Institut, Villigen PSI, Switzerland* The n2EDM experiment at the Paul Scherrer Institut searches for the electric dipole moment (EDM) of the neutron with a baseline sensitivity of about 1×10^{-27} e·cm. This requires precise monitoring of the average magnetic field experienced by the neutrons. This is achieved using optically pumped ^{199}Hg co-magnetometers, which operate in the same storage volumes as the neutrons. Their role is crucial, as they guard against a class of systematic shifts that cannot be mitigated otherwise. Furthermore, their noise performance is critical to avoid dominating the experiment's statistical uncertainties. This contribution presents the mercury co-magnetometer system, including recent upgrades to laser stabilization and optical detection, and recent measurement results. This work is supported by SNF #10001566.
15:00	305	**Development of the superconducting injection channels for the muEDM experiment at PSI** *Pranas Juknevicius [1,2], Philipp Schimdt-Wellenburg [1]* *[1] Paul Scherrer Institut (PSI), CH-5232 Villigen PSI, [2] ETH Zürich, CH-8093 Zürich* Permanent electric dipole moments (EDMs) are excellent probes for testing the Standard Model and looking for Beyond Standard Model physics. The best direct muon EDM limit from Brookhaven's g-2 experiment is $\sigma(d) \leq 1.8 \times 10^{-19}$ e cm, while the muEDM collaboration aims for $\sigma(d) \leq 6 \times 10^{-23}$ e cm. At PSI, we are setting up a high-precision muon EDM experiment using the frozen-spin technique. A key part of the experiment is the superconducting injection channels. They are used to transport muons through a magnetic fringe field up to 2.1 T into the center of a 3 T superconducting solenoid magnet. In order to characterize the injection channels, axial and transversal shielding measurements together with auxiliary simulations were performed and will be presented.
15:15	306	**Deep-learning event reconstruction for the Cherenkov Telescope Array Observatory with CTLearn** *Bastien Lacave, Uni Genève* The Cherenkov Telescope Array Observatory (CTAO) is the next-generation ground-based observatory for very-high-energy (VHE) gamma-ray astronomy. The Large-Sized Telescope prototype, LST-1, located on the Canary Island of La Palma, is responsible for observation of the low-energy range of the VHE gamma-ray spectrum. It is undergoing commissioning and has already observed the Crab Nebula as a standard reference source. Accurate and efficient reconstruction of shower parameters (e.g. energy, direction, and particle type) is crucial for achieving the scientific goals of the CTAO. In this work, we use CTLearn to implement deep learning event reconstruction, as an alternative to the standard Random Forest method. CTLearn is built to be fully compatible with ctapipe, a framework for prototyping the low-level data processing algorithms for the CTAO, and can be seamlessly used for data analysis without changing the general framework. It implements convolution-neural-network based models that take the integrated charge and the relative peak time of calibrated pixels in cleaned images as an input, to infer the primary particle's properties. Using Crab Nebula observations as a validation sample, we explore three different approaches. The first is to train a model with Monte-Carlo (MC) simulations covering all possible altitude-azimuth coordinates of the Crab Nebula, resulting in a single model that can be used to reconstruct events from any Crab Nebula observations. The second approach is to train 10 models along this coordinate line, each incorporating a range of ~10° in altitude. The last method produces 10 similar models but trained using transfer learning from the single model. This drastically reduces training times and meets the demand for efficient computing. In this contribution, we present our investigation of the performance of CTLearn models, and highlight the potential of CTLearn for future data analysis in CTAO.
15:30		***Coffee Break***

Time	ID	**FAKT - TASK II: Exotic Atoms I** *Chair: Joachim Bosina, TU Wien*
	~~311~~	*cancelled*
16:00	312	**Muonic atom spectroscopy of U-238 for the extraction of nuclear properties** *Anastasia Doinaki, on behalf of the muX Collaboration, Paul Scherrer Institut, Villigen PSI, Switzerland* The muX experiment aims to determine the nuclear charge radius of Radium-226. Muonic atom spectroscopy is utilized to determine nuclear charge radii as muons orbit very close to the nucleus, making them highly sensitive to nuclear properties. Since radioactive isotopes, like Radium-226, are available only in microscopic quantities the muX collaboration developed a novel technique based on transfer reactions in a high pressure hydrogen/deuterium gas cell. Captured muons form muonic atoms and emit characteristic X-rays during de-excitation, revealing nuclear properties. For Uranium-238, the muonic spectrum was analyzed to investigate the cascade behaviors between direct and transfer muon capture.
16:15	313	**On the formation of molecules containing positronium** *Alina Weiser, Stefan Meyer Institute for Subatomic Physics, Austrian Academy of Sciences, Vienna, Austria* We have built a new positron beamline that includes a Na-22 source, buffer gas trap and high-resolution mass spectrometer. With this, we aim to observe molecules containing positronium such as PsH, PsO and PsF, which are of interest for applications in medicine and material science. The trap produces positron bunches with an energy spread $<$ 60 meV and 1-2 mm in diameter. The molecules are formed in collisions with a gas jet target. The molecule's binding energy can precisely determined by detecting fragments from the dissociation using a MCP and time-of-flight spectroscopy. We will describe the apparatus and present trapping results as well as initial spectrometer data.
16:30	314	**GRASIAN:** **Towards the first demonstration of gravitational quantum states of atoms.** *Carina Killian, Stefan Meyer Institute / Austrian Academy of Sciences, Wien, Austria* A low energy particle confined by a horizontal reflective surface and gravity settles in gravitationally bound quantum states. These gravitational quantum states (GQS) were so far only observed with neutrons, by Nesvizhevsky and his collaborators at ILL. However, the existence of GQS is predicted also for atoms. The GRASIAN collaboration pursues the first observation of GQS of atoms, using a cryogenic hydrogen beam. This endeavor is motivated by the higher densities, which can be expected from hydrogen compared to neutrons, the easier access, the fact, that GQS were never observed with atoms and the accessibility to complimentary hypothetical short range interactions.
16:45	315	**Antihydrogen formation in the ASACUSA-Cusp experiment** *Marcus Bumbar, CERN, University of Vienna, Geneva, Switzerland* The matter-antimatter asymmetry in the observable universe remains one of the major open questions in physics. Hydrogen, the most precisely measured atom, and its counterpart antihydrogen provide an ideal test bed for comparisons. The aim of the ASACUSA-Cusp experiment is to produce a beam of spin-polarized antihydrogen and to perform Rabi spectroscopy of the ground-state hyperfine splitting. By using a beam, spectroscopy can be performed in a low magnetic field region, thereby reducing the systematics associated with magnetic field gradients of atom-traps. Advances in the preparation of cold antiproton and positron plasma led to significant improvements in beam yield. This talk will cover some of the newly developed plasma techniques and give an outlook on necessary steps towards spectroscopy.

17:00	**316**	**From a Rabi- to a Ramsey-type apparatus for antihydrogen hyperfine spectroscopy** *Martin Simon, Stefan Meyer Institute of the ÖAW, Vienna, Austria* We have performed H-HFS putting new constraints on Lorentz/CPT symmetry, achieving the most precise beam result (0.44 ppb) and demonstrating the readiness for antihydrogen-spectroscopy with the caveat of now having to operate at the CERN-AD, a challenging environment wrt magnetic background-fields. With recent breakthroughs in the production of antihydrogen beams by ASACUSA the prospects for antimatter-spectroscopy are promising. LS3 at CERN shall be used to prepare a Ramsey-spectrometer. Superconducting pipes shall provide large, constant, and uniform fields well-shielded from perturbations as present at the AD. Inside those radio-frequency fields are required for Ramsey-spectroscopy. We will present considered solutions covering various cavity modes and devices as for instance split ring resonators as we have recently employed for deuterium hyperfine spectroscopy.
17:15	**317**	**LEMING - Cold muonium for atomic physics and gravity** *Francesco Lancellotti, ETH Zürich, Switzerland* The LEMING experiment is designing the next generation of laser spectroscopy and gravity experiments using a novel cold atomic beam of muonium (Mu = $\mu^+ + e^-$). The result of a Mu free-fall measurement would reveal a clean coupling of gravity to elementary (anti)leptons from the second generation. Here nanometer-sensitive measurements of Mu displacements due to gravitational acceleration are being developed, utilizing atom interferometry. A novel source of cold atomic Mu beam in vacuum has been established via muon conversion in a thin layer of superfluid helium (SFHe), synthesizing muonium atoms at velocity of v ~ 2.2 km/s. The particles subsequently undergo self-interference using newly engineered self-aligned diffraction gratings. Latest results in the interferometer setup and detection system are presented.
	~~318~~	*cancelled*
17:30		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

Tuesday, 19.08.2025, Room Senatssaal

Time	ID	FAKT - TASK III: NEUTRINO *Chair: Silke Möbius, Universität Bern*
14:00	**321**	**Status of DUNE Near Detector ND-LAr** *Saba Parsa, University of Bern, Switzerland* ND-LAr is a modular liquid argon time projection chamber (LArTPC) designed for the DUNE near detector complex. Located 574 meters downstream of the LBNF target, it provides high-resolution imaging of neutrino interactions with full 3D pixelated readout and integrated light detection. ND-LAr is optimized for the high interaction rates expected near the beam source and enables detailed reconstruction of final states, including hadrons and electromagnetic showers. Downstream, a Muon Spectrometer (TMS) complements ND-LAr by measuring the momentum and charge of exiting muons. Together, these systems provide precise constraints on neutrino flux and cross-section systematics, crucial for reducing uncertainties in DUNE's oscillation measurements and enabling detailed studies of neutrino-nucleus interactions in the GeV energy range.
14:15	**322**	**The liquid argon TPC at the DUNE Near Detector** *Jan Kunzmann, LHEP, Bern, Switzerland* The Liquid Argon Near Detector for the DUNE experiment is made up of 35 separate modules, each containing two detection time projection chambers (TPCs). The modular design leverages a pixelated charge readout and a high-coverage light detection system to manage the approximately 50 neutrino interactions every time a burst of neutrinos is sent through it with high fidelity. In November 2024, the first full-size module, with dimensions of 1 meter x 1 meter x 3 meters and an active mass of 3.8 ton, was built and operated under cryogenic conditions at the University of Bern, Switzerland, where it collected about 80 million cosmic interactions. This presentation will highlight the construction, testing, and performance of this full-scale demonstrator.
14:30	**323**	**Upgrade detector for the neutrino oscillation experiment T2K experiment near site** *Vedantha Kasturi, Federico Sanchez Nieto, Universite de Geneva, Switzerland* The discovery of neutrino oscillations indicates that neutrinos have mass, necessitating an extension to the Standard Model of particles. Japan's Neutrino physics program is at the forefront with the T2K and Hyper-Kamiokande (HK) experiments. T2K has observed a potential maximal violation of leptonic CP symmetry. Upgrades to thenear detector complex have been led by Swiss institutes like ETH Zurich and the University of Geneva. These enhancements, including a novel 3D-granular scintillator detector and Time-of-Flight detector, aim to improve the sensitivity to CP violation. With data collection underway, T2K is reducing systematic uncertainties in neutrino-nucleus interactions. Same detector complex will be use by the upcoming HK experiment, set to begin in 2027 to measure leptonic CP asymmetry with high precision.
14:45	**324**	**The neutrinoless double beta decay experiment LEGEND** *Gloria Senatore, University of Zurich, Switzerland* The Large Enriched Germanium Experiment for Neutrinoless ββ Decay aims to probe the Majorana nature of neutrinos by observing the neutrinoless double beta decay in high-purity germanium crystals enriched in ^{76}Ge in a low-background liquid argon environment. Located at Laboratori Nazionali del Gran Sasso, the experiment will reach a half-life discovery sensitivity of 10^{27} years in the first phase, LEGEND-200, using 200 kg of Ge detectors. In the second phase, LEGEND-1000, the discovery sensitivity will be boosted to 10^{28} years employing 1000 kg of detectors. This talk shows the results from the first science campaign, during which LEGEND-200 collected 61 kg × yr of data over one year of operation.

15:00	**325**	**Energy Reconstruction for LHC Neutrinos at FASER** *Jeremy Atkinson, Universität Bern, Switzerland* Collider neutrinos at the CERN-LHC are investigated by FASER in a dedicated TeV-scale neutrino physics programme throughout Run 3, measuring flavour-dependent neutrino cross-sections. Made up of alternating emulsion films and tungsten plates, the FASERν detector can characterise interactions of all three neutrino flavours, and has observed both electron and muon neutrino events. To measure the energy-dependent neutrino interaction cross-section, neutrino energy should be reconstructed using kinematic and topological variables of interaction daughters. A neutrino energy reconstruction method has been developed by investigating machine learning techniques. The performance has been evaluated using Monte Carlo data, including the relevant uncertainties. Recent FASER results and neutrino energy reconstruction in FASERν will be presented.
15:15	**326**	**Status of the Coherent Elastic Neutrino-Nucleus Scattering experiment NUCLEUS** *Jens Burkhart, HEPHY, Wien, Austria* The Standard Model well predicts Coherent Elastic Neutrino-Nucleus Scattering (CEvNS). Precision measurement of the CEvNS cross-section is a way to study neutrino properties and search for new physics. The NUCLEUS experiment aims to characterise CEvNS using reactor neutrinos in an ultra-low background environment. NUCLEUS will use 10 g of cubic $CaWO_4$ and Al_2O_3 crystals as target detectors. The experiment will be installed between two 4.25 GW reactors at the Chooz-B nuclear power plant in France. It was commissioned in the shallow underground laboratory at the Technical University of Munich (TUM) and is being relocated to the Chooz-B nuclear power plant. In this talk, I will provide an overview of the experiment's current status, focusing on the latest developments and milestones achieved.
15:30		***Coffee Break***
		FAKT - TASK IV: DARK MATTER *Chair: Gernot Eichmann, Universität Graz*
16:00	**331**	**Superconducting quantum bits as quasiparticle sensors** *Felix Wagner, ETH Zürich* Recent advances in superconducting qubits make them one of the most promising candidates for practical, error-corrected quantum computing. However, these devices are sensitive to their environment due to the low energy of the captured photon used to operate a quantum state and the fragility of the Cooper pair binding in the superconductor. Ambient photon backgrounds, such as microwave fields, infrared radiation, and cosmic rays, can disrupt this binding and generate Bogoliubov quasiparticles, which are unbound electrons in the superconductor. These quasiparticles are detrimental to qubit performance because they can interact with the trapped photon state, causing relaxation and dephasing. Conversely, their ability to interact with single quasiparticles renders superconducting qubits promising for quantum sensing applications. For example, in particle physics, the most sensitive direct detection dark matter experiments use superconducting sensors to detect quasiparticle populations but cannot yet detect a single quasiparticle. In this talk, we present our use of charge-sensitive superconducting qubits as quasiparticle sensors to investigate infrared backgrounds in quantum computing setups, as well as their potential use in other quantum sensing applications.
16:15	**332**	**Dark state pair-production in underground accelerators and their detection** *Maximilian Fahrecker [1], Josef Pradler [1,2], Helmut Eberl [2]* *[1] University of Vienna, Austria, [2] HEPHY, Vienna, Austria* We explore the possibility of new light fermionic particles with electromagnetic form factor interactions and their production and detection in underground low-energy high-intensity electron beams. The particles could be dark matter candidates. The detection will be facilitated by using a novel CCD-sensor. We calculate the corresponding cross sections while discussing constraints from cosmology, astrophysics and high-precision particle physics. These theoretical results can then be checked against measurements.

16:30	**333**	**Sensitivity of Dark Matter and Neutrino Experiments for Searches of Cosmic-Ray Boosted Dark Matter** *Richard Diurba [1], Helena Kolesova [2]* *[1] University of Bern, Switzerland, [2] University of Stavanger, Norway* Theories for dark matter include a wide range of models and detection methods. One model allows for dark matter interactions with nucleons. This model allows for the boosting of dark matter from cosmic-ray up-scattering. The boosting gives sub-GeV dark matter the energy required for detection in dark matter experiments. The model also allows for detection through nuclear recoils and DM-nucleon scattering. The latter method produces protons at energies that neutrino experiments are optimized for. Motivated by this overlap, we studied the capability of the Deep Underground Neutrino Experiment (DUNE) to search for cosmic-ray boosted dark matter. DUNE is a future neutrino experiment with 17-kiloton argon detectors. The presentation discusses the interaction model and sensitivities of various experiments, including DUNE.
16:45	**334**	**Towards a theory of dissipative Dark Matter I: the Born limit** *Garance Lankester-Broche, Josef Pradler* *University of Vienna and HEPHY, Wien, Austria* Self-interacting Dark Matter (SIDM) offers an alternative to ΛCDM on small scales, where cold, collisionless dark matter fails to match observations. A key feature of SIDM is the presence of a built-in dissipative channel beyond elastic scattering. In this work, we analyze six dissipative SIDM scenarios involving the radiation of either massless or light mediators, covering both short- and long-range interactions. This range of models forms a systematic framework for evaluating dissipation in SIDM phenomenology. Assuming non-relativistic velocities, we derive ready-to-use analytic expressions for the energy-differential cross section and energy loss rate within the Born approximation. We find that the leading-order emission amplitude is model-independent for massless emissions, while model dependence arises for massive emissions and at sub-leading orders.
17:00	**335**	**Recent results of the XENONnT Dark Matter experiment** *Luisa Hötzsch, Universität Zürich, Switzerland* The XENONnT experiment is designed for the direct detection of dark matter through elastic WIMP-nucleus scattering, employing a 5.9-tonne liquid xenon target in a dual-phase time projection chamber. Located at the Laboratori Nazionali del Gran Sasso in Italy, XENONnT has collected 281.6 live-days of data during its first two science runs. Thanks to its high discrimination power, low energy threshold, and record-low background rate, XENONnT achieves world-leading sensitivity to low-energy dark matter interactions and other rare processes such as neutrino scattering. In this talk, I will present the latest results from XENONnT, including limits on WIMP dark matter over a broad mass range (few GeV/c^2 to TeV/c^2), and the first indication of coherent elastic neutrino–nucleus scattering from solar ^{8}B neutrinos.
17:15	**336**	**COSINUS: Searching for Dark Matter with Cryogenic NaI Detectors** *Mariano Cababie, Atominstitut, Technische Universität Wien, Austria, & Institut für Hochenergiephysik der Österreichischen Akademie der Wissenschaften, Vienna, Austria* COSINUS (Cryogenic Observatory for SIgnatures seen in Next-generation Underground Searches) is a state-of-the-art cryogenic experiment in the field of dark matter direct detection research. Operating at millikelvin temperatures and utilizing ultrapure NaI detectors, COSINUS employs a two-channel readout system utilizing transition edge sensors (TESs), allowing for effective event-by-event particle discrimination. Conducted at the Laboratori Nazionali del Gran Sasso in Italy, COSINUS aims to model-independently verify the DAMA/LIBRA annual-modulated dark matter signal, which is in tension with results reported by other experiments using diverse target materials and detection techniques. This talk will provide insights into the latest results, updates on ongoing efforts, and perspectives for the future.

17:30	**337**	**Status of the CRESST-III Experiment** *Dominik Fuchs, Universität Wien / HEPHY, Wien, Austria* CRESST-III is looking for the direct detection of dark matter particles via their scattering off target nuclei in cryogenic detectors. Energy thresholds of O(10 eV) allow for the search of sub-GeV dark matter masses, making CRESST one of the leading experiments in the low-mass DM regime. At energies below ~ 200 eV an unexpected rise of events is observed, exceeding the expected background rates. This "Low Energy Excess" (LEE) is limiting the further improvement of sensitivity in CRESST. The primary focus of current data taking campaigns is therefore dedicated to study the origin of the LEE. We report on new DM results and observations of the LEE. Furthermore we give an update on future plans for the CRESST upgrade.
17:45	**338**	**Search for TeV Heavy Neutral Leptons with the ATLAS experiment** *Lucas Mollier, University of Bern, LHEP, Switzerland* The Standard Model (SM) of particle physics successfully describes fundamental particles and their interactions in our universe, yet it is incomplete. Moreover, the ΛCDM model requires Dark Matter, implying the existence of particles beyond the SM. A minimal extension introduces Heavy Neutral Leptons (HNLs), right-handed neutrinos, generating mass of left-handed neutrinos via the seesaw mechanism. They interact only through gravity or via their mixing with SM neutrinos, thus being good DM candidates. I will present a feasibility study conducted within the ATLAS experiment to search for HNLs in the TeV mass range. At this energy, the HNLs decay promptly into a W boson and a lepton, leading to a signature containing leptons and neutrinos or jets.
18:00	**339**	**Xenoscope:** **a vertical demonstrator for the next-generation liquid xenon observatory** *Sana Ouahada, University of Zurich, Switzerland* The XLZD (XENON–LUX–ZEPLIN–DARWIN) collaboration is developing the next-generation dark matter and rare-event observatory, based on a large-scale liquid xenon (LXe) detector. To significantly enhance the sensitivity of current LXe experiments, the baseline design features 60 tonnes of active xenon in a dual-phase time projection chamber (TPC) measuring 3 meters in both height and diameter. To address the technical challenges of this scale, we constructed Xenoscope, a large-scale TPC demonstrator, at the University of Zurich. Its primary objective is to demonstrate stable electron drift over 2.6 meters in LXe. Additional goals include studying electron cloud diffusion and characterizing the optical properties of LXe. This talk will provide an overview of the Xenoscope facility and present first results from its commissioning phase.
18:15		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

Thursday, 21.08.2025, Room HS 30

Time	ID	**FAKT - TASK V: Theory I** *Chair: Florian Reindl, TU Wien*
11:00	**341**	**Rapidity-Dependent Spin Decomposition of the Nucleon** *Florian Hechenberger, Stony Brook University* The string-based formalism to Generalized Parton Distributions (GPDs) introduced in Phys.Rev. Lett. 133 (2024) 24, 241901 offers a unique opportunity to study the three-dimensional structure of the nucleon without any fine-tuning of parameters. Leveraging next-to-leading order PDF fits to parametrize the moments used in the conformal moment expansion of GPDs, the approach satisfies by construction all constraints from experimental data as well as Lorentz covariance, polynomiality and support constraints. In this talk I will discuss the recent extension of this formalism to axial and helicity flip GPDs discussed in 2507.18615 [hep-ph] to address the spin decomposition of the nucleon at finite skewness and, for the first time, present results on helicity singlet GPDs.
11:15	**342**	**Tensor meson contributions to the muon g-2 from holographic models of QCD** *Jonas Mager, Luigi Cappiello, Josef Leutgeb, Anton Rebhan* *TU Vienna, Wien, Austria* In the Standard Model prediction for the anomalous magnetic moment of the muon, the theoretical error budget is dominated by contributions from nonperturbative QCD. Among those is hadronic light-by-light scattering, which is dominated by intermediate single particle states. Different computational methods agree reasonably well, except when spin-2 tensor mesons are exchanged. There holographic models place special emphasis on the currently unkown structure function F_3^T of the tensor meson transition form factor which ultimately changes the sign of the tensor contribution compared to previous dispersive estimates in the literature. We present the holographic approach to tensor mesons and comparisons to available data. We comment on the tensor contribution to longitudinal short distance constraints and explain the relation to resonance chiral theories.
11:30	**343**	**Dispersive evaluation of spin-2 resonances in the Hadronic Light-by-Light contribution to the muon g-2** *Emilis Kaziukenas [1], Massimiliano Procura [1], Peter Stoffer [2,3]* *[1] University of Vienna, Austria, [2] University of Zurich, Switzerland,* *[3] Paul Scherrer Institut, Villigen, Switzerland* Given the current experimental tensions with the Standard Model and the anticipated release of Fermilab's E-821 results in 2025, the muon magnetic moment is a particularly timely observable to study. The current precision goal demands a rigorous theoretical treatment of non-perturbative QCD effects, which can be achieved using dispersive methods, based on analyticity and unitarity. One of the leading sources of the uncertainty in the Hadronic Light-by-Light (HLbL) contribution is the tower of spin-2 resonances, starting with the $f_2(1270)$. I will report on the progress in the evaluation of these effects within the recently developed dispersive formalism in triangle kinematics, which is designed to lead to a robust and model-independent estimate of HLbL spin-2 contributions to muon g-2.
11:45	**344**	**LACTEL: a cosmic-ray detector in the Lac Léman** *Ettore Zaffaroni, Université de Genève, Switzerland* The LACTEL project proposes the development of a Water Cherenkov Detector Array for cosmic electron and gamma-ray observations, through the study of Extensive Air Showers (EAS). It aims to improve gamma-ray and electron observations above 10 TeV, suppressing the hadron background through muon tagging. The detector consists of several light-tight water tanks floating on the lake. Each tank accommodates a photomultiplier tube to detect the Cherenkov light produced by the charged particles of the showers. Repurposed optical modules from the ANTARES neutrino detector will be used. Two water tank prototypes have been installed in the Lac Léman, within the LéXPLORE research platform. The LACTEL scientific purpose, design, and results of the first prototype tests will be presented in this contribution.

12:00	**345**	**Search for dark matter with CTAO** *Seraphine Marti, Michele Weber, Universität Bern, Switzerland* The Cherenkov Telescope Array Observatory (CTAO) is a next-generation gamma-ray observatory with unprecedented sensitivity in the 20 GeV–300 TeV range. We evaluate CTAO's sensitivity to a possible dark matter (DM) signal using Monte Carlo simulations of one year of CTAO observations. The analysis targets gamma-ray emission from the annihilation of weakly interacting massive particles in dwarf spheroidal galaxies, especially Willman I and Sagittarius II. The primary objectives are to detect a potential DM annihilation signal, estimate the significance of the detection, and measure the integral flux. Analysis of the simulated data for Willman I shows an excess consistent with a DM signal at a statistical significance exceeding 6 sigma, which demonstrates CTAO's ability to detect DM signals.
12:15	**346**	**Latest results from the DAMPE experiment** *Manbing Li, Xin Wu, Andrii Tykhonov, Enzo Putti-Garcia, Paul Coppin, Andrea Serpolla, Hugo Boutin* *The particle physics department (DPNC), University of Geneva, Switzerland* The Dark Matter Particle Explorer (DAMPE) is a space-borne experiment designed to detect cosmic rays (CRs) in the GeV–PeV range. Over 9 years of operation, DAMPE has collected a rich dataset enabling precision studies of CRs. This talk covers DAMPE's latest results, including spectral breaks in the electron+positron flux, proton and helium spectra up to 100 TeV, and precise measurements of boron, carbon, and oxygen fluxes. DAMPE data have also contributed to hadronic cross-section studies and set strong limits on dark matter scenarios through gamma-ray observations. Additionally, the integration of machine learning has improved particle identification and analysis. DAMPE continues to advance our understanding of cosmic-ray origin, acceleration, and propagation, and remains a key observatory for high-energy astrophysics.
12:30		***Lunch***

Thursday, 21.08.2025, Room Großer Festsaal

Time	ID	FAKT - TASK VI: DETECTORS *Chair: Charlotte Cavanagh, CERN*
14:00	**351**	**Validation of the design of the TEPX system for the Phase-2 CMS Inner Tracker** *Filip Bilandzija, Universität Zürich, Switzerland* Before starting the High-Luminosity LHC runs, the CMS detector will be substantially upgraded to cope with the significant increase in instantaneous luminosity. The entire CMS Inner Tracker detector will be replaced, and the new detector will feature increased radiation hardness, higher granularity, and the capability to handle higher data rates and longer trigger latency. In this contribution, the new TEPX detector - a large forward end-cap detector - will be presented, with an emphasis on the validation of the new features compared to the Phase-1 system. The characterization in terms of electronic noise and data transmission performance of the pixel modules integrated on prototype disks and serially powered will be discussed. An overview of the thermal performance will be outlined.

14:15 | **352**

The Calibr-A-Ton: a novel method for calorimeter energy calibration

Jona Motta [1], Elena Vernazza [2], Olivier Davignon [3], Shamik Ghosh [3], Jean-Baptiste Sauvan [3], Emilia Becheva [3], Frédéric Magniette [3], Léa-Maria Rabour [3]
[1] Universität Zürich, Switzerland, [2] CERN, Geneva, Switzerland,
[3] Laboratoire Leprince-Ringuet, Palaiseau, France

The energy calibration of calorimeters at collider experiments, such as those at the CERN Large Hadron Collider, is crucial for achieving the experiment's physics objectives. Standard calibration approaches have limitations which become more pronounced as detector granularity increases. In this contribution, we propose a novel calibration procedure to simultaneously calibrate individual detector cells belonging to a particle shower by targeting a well-controlled energy reference. The method bypasses some of the difficulties that exist in standard approaches, and it is implemented using differentiable programming. In this work, simulated energy deposits in the electromagnetic section of a high-granularity calorimeter are used to study the method and demonstrate its performance, showing it can correct for biases in the energy response.

14:30 | **353**

The high-speed opto-electrical conversion system for the readout of the ATLAS ITk Pixel upgrade

Silke Möbius , Una Alberti, Daniele Dal Santo, Lucas Mollier, Marianna Glazewska, Michele Weber, Joseph Mariano, Camilla Tognina, Silas Bosco
University of Bern, Switzerland

After the current Run 3, the ATLAS detector will undergo many significant upgrades to cope with the harsher radiation environment and increased number of proton interactions per beam crossing in the high luminosity phase of the LHC. One key aspect of this upgrade is the ATLAS Inner Tracker (ITk). The pixel detector of the ITk must be read out with O(10’000) 1.28 Gb/s links in a high-radiation area and stringent space and data quality constraints. We report on the Optosystem, which performs the opto-electrical conversion of the signals from the pixel modules. As of now, the first 10 % of the whole system has been built and tested. We present results on the full readout chain performance and components testing during production.

14:45 | **354**

The Mu3e Vertex Detector: From Module Qualification to First Beam

Thomas Christian Senger, University of Zürich, Switzerland

The Mu3e experiment searches for $\mu^+ \to e^+ e^- e^+$ decays with a target sensitivity of 10^{-16}, requiring a tracking detector with minimal material budget and high rate capability. The vertex detector, based on HV-MAPS (MuPix11), has been fully assembled, installed, and integrated with power, cooling, and data services. This talk covers its realization in three stages: electrical and functional qualification of sensor modules, precision mechanical construction and insertion, and system commissioning with continuous readout. Particular focus is given to high-speed data transmission over micro-twisted pair cables and associated signal integrity constraints. As the presentation follows the June 2025 test beam campaign, first results from detector operation under beam conditions will also be discussed.

15:00 | **355**

Calibration of the LHCb magnetic field map

Aravindhan Venkateswaran, Ecole Polytechnique Federale de Lausanne, Switzerland

The precise calibration of the LHCb magnetic field is crucial for accurate momentum reconstruction. This task is challenged by the sparsity of available field measurements and the complexity of the field map. We present a hybrid calibration approach that fits measured field data to a Maxwell-consistent model expressed as a multipole expansion, ensuring the map remains as measurement-driven as possible. In regions lacking direct measurements, the model is complemented by detailed simulated calculations. This strategy significantly improves the accuracy of the magnetic field map, leading to measurable enhancements in the reconstructed masses and efficiencies of benchmark particles. These results demonstrate the effectiveness of the calibration in reducing systematic uncertainties in LHCb's charged particle tracking.

15:15	356	**qBounce: a Ramsey-type Gravitational Resonance spectrometer – Results and Outlook** *Joachim Bosina, Atominstitut, TU Wien, Austria* The qBounce collaboration operates a Ramsey-type gravitational resonance spectroscopy (GRS) setup at the Institute Laue-Langevin (Grenoble). Since the commissioning in 2018, the achievable sensitivityincreased significantly by a factor 42 with respect to previous implementations. In addition, gravitational state transitions were studied in detail which were never observed before ($1 \rightarrow 6$). This Ramsey-type implementation can not only test hypothetical variations of Newtonian potential at the micrometer scale, but also enables to probe the electric neutrality of the neutron. We present the results of the spectrometer including its first neutron charge measurements and give an outlook on further developments which are currently built.
15:30		***Coffee Break***
		FAKT - TASK VII: Theory II *Chair: Florian Hechenberger, Stony Brook University*
16:00	361	**Exotic hadron spectroscopy with functional methods** *Gernot Eichmann, University of Graz, Austria* Over the past years, there has been much progress in mapping out the spectrum of exotic hadrons including tetraquarks and pentaquarks. Here I will discuss recent applications of functional methods, in particular the combination of Dyson-Schwinger and Bethe-Salpeter equations, to exotic hadron spectroscopy. There are various ongoing efforts in investigating the properties of multiquark states ranging from four- and five- to six-quark states. Here I will mainly focus on four-quark states in the heavy-light sector and present first results on six-quark states such as the deuteron. Progress towards ab-initio calculations of hadron properties will also be highlighted.
16:15	362	**Sampling lattice field theories with diffusion models** *Thomas Ranner, TU Wien, Austria* I will present my work on the application of generative diffusion models in lattice field theory, a non-perturbative approach to quantum field theory. Diffusion models are a class of generative machine learning models which utilize stochastic processes to draw high-dimensional data from complex probability distributions. While they were introduced mainly for image-generation, they can be applied to a wide range of problems, including lattice field theory. We utilize them to draw field configurations of scalar and U(1) pure gauge lattice field theories. I will discuss the generative performance of the model, the main caveat of this method, and the physical interpretation of the trained neural network. Further, I will talk about the connection between diffusion models and renormalization group transformations.
16:30	363	**The (3+1)D dilute Glasma in the early stage of relativistic heavy-ion collisions** *Kayran Schmidt [1], Andreas Ipp [1], Markus Leuthner [1], David Müller [1], Sören Schlichting [2]* *[1] Institut für Theoretische Physik, TU Wien, Austria, [2] Universität Bielefeld, Deutschland* In relativistic heavy-ion collision experiments, atomic nuclei are accelerated to relativistic speeds and made to collide. These extreme conditions are sufficient to break the nuclei into their constituents, thereby allowing us to study their interactions as formulated within quantum chromodynamics. The Glasma describes the dynamical state directly after the collision and is characterized by strong color fields with high occupation numbers that evolve according to classical Yang-Mills equations. I will discuss the Glasma in the dilute approximation, which enables us to calculate the Glasma beyond the boost-invariant limit and take the longitudinal structure of the colliding nuclei into account. I will present our results for Pb+Pb and Au+Au collisions at various energies.

16:45	**364**	**Jet energy loss in the nonequilibrium quark-gluon plasma during the initial stages in heavy-ion collisions** *Florian Lindenbauer, TU Wien, Institut für Theoretische Physik, Wien, Austria* Relativistic heavy-ion collision experiments are used to investigate the high-temperature properties of the strong interaction at large particle colliders. In particular, the dynamics of the nonequilibrium quark-gluon plasma created during the early stages are still associated with large uncertainties but may affect the propagation of energetic partons, leaving potential imprints in jet-quenching observables. The energy loss of these energetic partons typically depends on only a single medium parameter, the jet quenching parameter. In this talk, I will present how we extract this parameter during the nonequilibrium initial stages and show results for the gluon emission spectrum in the nonequilibrium system.
17:00	**365**	**Automated calculation of non-global soft functions** *Rudi Rahn, Universität Wien, Austria* Predictions for realistic observables at collider experiments often suffer from poor perturbative convergence due to so called non-global logarithms. These logarithms can be resummed to all orders using an intricate procedure derived using Soft-Collinear Effective Theory to improve predictive power. This resummation requires the calculation of various observable-dependent ingredient functions that describe different regions of the phase space for QCD emissions, e.g. low-energetic soft radiation. In this talk I will present some progress towards the automated calculation of soft functions for generic non-global observables at collider experiments to next-to-next-to-leading order in the strong coupling, allowing for a significant increase in the precision of theoretical predictions for observables at the LHC and beyond.
17:15	**366**	**Determination of the strong coupling from electron-positron event shapes** *Andre Hoang [1], Miguel Benitez [4], Arindam Bhattacharya [3], Vicent Mateu [4], Matthew Schwartz [3], Iain Stewart [2], Gherardo Vita [5]* *[1] University of Vienna, Austria, [2] MIT, Cambridge, USA, [3] Harvard University, Cambridge, USA, [4] Universidad de Salamanca, Spain, [5] CERN, Geneva, Switzerland* Discussed are two new determinations of the QCD strong coupling from the thrust and heavy jet mass distribution data in the tail region obtained from electron-positron collider experiments based on factorised calculations in Soft-Collinear-Effective-Theory (SCET) at NNNLL order matched to third fixed-order perturbation theory. We argue that the resummation of logarithmic contributions to all orders, controlled by the SCET factorisation is essential. Special attention is given to the structure and parametrization of non-perturbative corrections and the estimate of the associated theoretical uncertainties. We obtain results for the strong coupling that are systematically lower than the current world average. We discuss possible theoretical avenues to better understand the origin of the discrepancy.
17:30	**367**	**Geons as gravity balls** *Axel Maas [1], Simon Plätzer [1,2], Felix Pressler [1]* *[1] University of Graz, Austria, [2] University of Vienna, Austria* Quantum gravity is a gauge theory. Similar to other gauge theories, like Yang-Mills theory, physical observables need to be build from composite operators. The analogy to glueballs are gravity balls, called geons, which may play a role from dark matter to black holes as gravstars. Results from non-perturbative simulations of causal dynamical triangulations, a candidate for a fundamental quantum gravity formulation, will be presented, which provides hints for the existence of geons. Moreover, it is found that their features depend on the evolution of the universe.

17:45	368	**Quantum gravity in static spherically symmetric spacetime** *Ali Riahinia, Benjamin Koch* *TU Vienna - Institute for theoretical physics & Atominstitut, Vienna, Austria* A new canonical quantization framework for static spherically symmetric spacetimes is presented. For a proof-of-principle, the Einstein-Hilbert action is considered. We recover the classical solution and further investigate the quantum uncertainty relations arising among the geometric operators. Our analysis uncovers an intriguing relation to black hole thermodynamics and generalized uncertainty relations. Moreover, for a given cosmological constant Λ, we obtain upper and lower limit of the mass that is allowed, where they have a stunning relation to observed bounds for the known Λ. Furthermore, the quantum version of the geodesics in quantum gravitational background is derived. The solution of the quantum geodesics equation recover the classical solution along with quantum correction terms in the limit of weak quantum effects.
18:00		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

Thursday, 21.08.2025, Room Senatssaal

Time	ID	**FAKT - TASK VIII: High Energy I, Higgs** *Chair: Axel Maas, Universität Graz*
11:00	**371**	**Search for Higgs boson pairs production in the bbtautau final state with the CMS detector using LHC Run3 data** *Jona Motta, Universität Zürich,Switzerland* The latest results on non-resonant Higgs boson pairs (HH) production in the bbtautau final state will be presented. Both the gluon fusion and vector boson fusion production mechanisms are investigated. This final state gives the best trade-off between a sizeable branching fraction (7.3 %) and the purity of the tautau selection, making this channel one of the most sensitive to HH. The latest updates using the full LHC Run3 data on the HH search and the related 'kappa-modifiers' studies will be presented. These results improve the latest ones published in 2022, profiting from novel analysis techniques that enhance the sensitivity of the search, i.e. extensive use of machine learning techniques for both event selection and signal extraction.
11:15	**372**	**Search for pair production of Higgs bosons in the *bbbb* final state with the ATLAS detector** *Una Alberti, Universität Bern, Switzerland* The discovery of the Higgs boson at the LHC has sparked significant interest in exploring its properties and couplings in great detail. Of special interest is the search for Higgs boson pair (di-Higgs) production. This process is particularly important as it provides direct sensitivity to the Higgs boson self-coupling, a fundamental parameter of the Standard Model. Precise measurements of di-Higgs production offer a powerful probe into potential physics beyond the Standard Model. In this talk, we present a search for di-Higgs in the all-hadronic *bbbb* final state. This channel, while experimentally challenging due to large backgrounds, offers the highest branching fraction of di-Higgs decay modes. Its complexity also makes it an ideal testing ground for developing advanced machine learning techniques.

11:30	373	**Search for New Physics in the ttbar+MET final state with the ATLAS experiment** *Silke Möbius, Daniele Dal Santo, University of Bern, Switzerland* The Standard Model of Particle Physics has demonstrated extraordinary accuracy in countless experiments, but remains incomplete: it doesn't explain dark matter and offers no insight into the physics between the electroweak and Planck scales, which could introduce large quantum corrections to the Higgs boson's mass. Supersymmetry offers a solution by cancelling these corrections. This work presents a search for pair-produced top squarks, the supersymmetric partners of the top quark, using data from LHC Run 2 and early Run 3. Focusing on the fully hadronic ttbar+MET final state, the analysis employs a parameterized graph neural network (GNN) trained across multiple signal hypotheses. Signal, Control, and Validation regions are defined using the GNN outputs, and exclusion limits are derived, including systematic uncertainties.
	~~374~~	*cancelled*
11:45	375	**Blueprint to a Numerical Collider** *Valentin Hirschi, University of Bern, Switzerland* Simulating high-energy particle collisions is inherently complex, yet indispensable for extracting maximal insight from the ever-increasing precision of Large Hadron Collider measurements. To accommodate both quantum and relativistic phenomena, we rely on Quantum Field Theory – a foundational framework in particle physics for nearly a century – despite the considerable computational challenges it presents. At the University of Bern, my group is developing an alternative perturbative method – dubbed Local Unitarity – that weaves together analytic manipulations and numerical algorithms to systematically tame the divergences of the theory, effectively functioning as a "virtual collider".
12:00	376	**Search for ggHbb in the resolved final state with the CMS experiment** *Giovanni Celotto, University of Zurich, Switzerland* Since the discovery of a new boson with a mass near 125 GeV by the ATLAS and CMS Collaborations, rapid progress in the understanding of its properties and couplings has revealed that the new particle is compatible with the standard model (SM) Higgs boson H. Among the others, the coupling to bottom quarks has only been observed in the associated production of the Higgs boson with other particles, mainly Z and W. This work presents a novel search targeting the gluon-fusion Higgs boson production and its decay in the bb final state. A repurposed trigger strategy, originally developed for flavour-physics analyses, is employed to significantly reduce the overwhelming QCD background, enabling new sensitivity in a phase space never explored before.
12:15	377	**Higgs Beyond the Standard Model:** **Probing Bosonic Resonant Decays to Hadronic VV$\tau\tau$ at CMS** *Fanqiang Meng, Univeristy of Zurich, Switzerland* This research investigates a new heavy bosonic resonance, X, decaying into HH or HY using CMS Run 2 and 3 pp collision data at the LHC. The fully hadronic VV$\tau\tau$ final state offers high-statistics sensitivity but remains unexplored in resonance searches. Motivated by anomalies at 95, 320 - 525, and 650 GeV, the analysis performs a multi-dimensional fit of mX and mY to identify excesses or constrain extended Higgs sectors. To suppress overwhelming QCD backgrounds, advanced machine learning methods, including Particle Transformer (ParT) and boosted decision trees, are employed for jet and ditau tagging. This pioneering study sets a benchmark for HL-LHC searches, aiming to discover new bosons or set the most stringent model-independent limits to date.
12:15		***Lunch***

Time	ID	**FAKT - TASK IX: High Energy II + R&D** *Chair: Felix Wagner, ETH Zürich*
14:00	**381**	**Reconstructing Missing Vertices in Tauonic B decays at LHCb - from $B \to \tau\nu$ to $B_s \to \tau\tau$** *Rita De Sousa Ataide Da Silva, Frédéric Blanc, Alexandre Brea Rodriguez* *École Polytechnique Fédérale de Lausanne, Switzerland* Tauonic B decays such as $B_c^+ \to \tau^+\nu_\tau$ and $B_s^0 \to \tau^+\tau^-$ are sensitive probes of the Standard Model and possible contributions from new physics. Both decays involve final states with two undetected neutrinos, making full kinematic reconstruction particularly challenging. In this presentation, we explore reconstruction techniques based on the common final state $\tau^+ \to \pi^+\pi^-\pi^+\bar{\nu}_\tau$, recovering the vertex information through topological and kinematic constraints. These methods, initially developed for the $B_c^+ \to \tau^+\nu_\tau$ analysis, are now being extended to the $B_s^0 \to \tau^+\tau^-$ decay. This strategy is designed to enhance sensitivity to these rare processes, despite the challenges posed by the hadronic environment of LHCb.
14:15	**382**	**Technology challenges to realize future HEP experiments: From ECFA Detector Roadmap to DRD collaborations** *Thomas Bergauer, Austrian Academy of Sciences, Institute for High Energy Physics, Wien, Austria* Instrumentation must not be the limiting factor to meet the needs of the long-term European particle physics program, but it should be the driver. Therefore, in response to the 2020 update of the European Strategy on Particle Physics, ECFA launched the Detector R&D Roadmap process, defining nine technology domains and critical Detector R&D Themes. Task forces structured around these themes led to the creation of Detector R&D Collaborations (DRDs), hosted at CERN. These collaborations are now operational and aligned with the strategic objective to ensure sustained detector innovation. Beyond high-energy physics, instrumentation may find broad applications in other areas. To enable this, the program must engage new communities, collaborate with industry, and re-think its strategic approach.
14:30	**383**	**Geometric and Optical Characterization of Double-Row Microlens SiPMs for LHCb SciFi Tracker Upgrade II** *Jou An Chen, EPF Lausanne, Switzerland* This study reports the latest characterization of double-row microlens-enhanced SiPM detectors produced by FBK, optimized for high photon detection efficiency (PDE). Detailed geometric and optical analyses were performed to evaluate the residual layer thickness (RLT) and microlens-to-pixel alignment. The influence of the residual layer thickness uniformity and microlens alignment accuracy on the PDE is investigated across different wavelengths. Both measured data and optical simulations are used to quantify performance improvements enabled by this novel implementation on the SiPM detectors.
14:45	**384**	**Silicon Carbide Radiation Detector R&D for High Energy Physics and Beyond** *Sebastian Onder, Jürgen Burin, Andreas Gsponer, Stefan Gundacker, Matthias Knopf, Daniel Radmanovac, Simon Waid, Thomas Bergauer* *Institute of High Energy Physics - Austrian Academy of Sciences, Vienna, Austria* Silicon carbide (SiC) is a wide bandgap semiconductor with promising properties for next-generation radiation detectors, including low dark currents at room temperature and after extreme irradiation, high thermal stability, and fast charge carrier drift. These features make SiC attractive for precision timing in high-energy physics, as it can operate without cooling, enabling more compact and lightweight detector systems. Further applications include medical/space dosimetry and diagnostics in high-temperature environments such as nuclear fusion. We present an overview of our ongoing R&D on SiC-based detectors, including sensor design and simulation, performance studies under high radiation exposure, and the development of fast readout electronics. Our goal is to demonstrate the viability of SiC for radiation detectors in demanding experimental conditions.

15:00	**385**	**Nonfactorizable Effects in Semileptonic Top Quark Decays** *Bernd Carmann, André Hoang, University of Vienna, Austria* We apply a novel factorization approach for inclusive semi-leptonic decays of boosted top quarks produced in electron-positron collisions within the framework of Soft Collinear Effective Theory and boosted Heavy Quark Effective Theory to analyze a new factorization function, the so-called ultracollinear-soft (ucs) function. It can be calculated analytically and encodes all non-factorizable effects from the interference of production- and decay-stage QCD radiation. In the narrow-width limit, which is used for many predictions at the Large-Hadron-Collider, these interference terms are neglected in an ad-hoc manner and the ucs function can be factorized further. We discuss the analytic properties of the non-factorizable contributions and their impact of top mass measurements at next-to-leading order in QCD perturbation theory.
15:15	**386**	**Measurement of $\mathcal{BR}(B_{(s)} \rightarrow K_S K_S)$ with Run 2 LHCb data** *Kerim Guseinov, Radoslav Marchevski, Luis Miguel Garcia Martin* *École polytechnique fédérale de Lausanne, Switzerland* The decays $B_{(s)} \rightarrow K_S K_S$ proceed via flavor-changing neutral currents that are suppressed in the Standard Model and therefore provide greater sensitivity to new physics. The latest measurements of their branching fractions exhibit some tension with the expectation. Since the time of the existing measurement, the LHCb experiment has collected a large amount of data and had several improvements to its online selection. This allows one to significantly improve the precision using Run 2 data. The current work presents a status report on the ongoing measurement of the $B_{(s)} \rightarrow K_S K_S$ and $B^0 \rightarrow K_S K_S$ branching fractions.
15:30		***Coffee Break***
		FAKT - TASK X: FLAVOUR PHYSICS *Chair: Martin Hoferichter, Universität Bern*
16:00	**391**	**Search for violation of leptonic universality** **in Semileptonic Hyperon Decays in LHCb** *Alexandre Brea Rodríguez, EPFL, Lausanne, Switzerland* Theoretical studies have demonstrated that Semileptonic Hyperon Decays (SHD) can be sensitive to BSM dynamics that break lepton flavour universality (LFU). The LFU test observable, defined as the ratio between muon and electron modes, is sensitive to non standard contributions. This talk will present the very recent $\Lambda \rightarrow p \mu \nu$ branching ratio measurement using Run 2 LHCb data. Additionally, prospects for other SHD measurements will be discussed.
16:15	**392**	**Study of the weakly decaying charmed baryons X_c^+ and X_c^0** **with 89/fb of Belle II data** *Nikolaus Schneider, Christoph Schwanda* *Institute of High Energy Physics, Austrian Academy of Sciences, Wien, Austria* We present a study of the weakly decaying charmed baryon states X_{c+} and X_{c0}. In particular, we measure the decays $X_c^+ \rightarrow \Sigma^+ K^- \pi^+$ and $X_c^0 \rightarrow \Omega^+ K^-$ with the subdecays $\Sigma^+ \rightarrow p\pi^0$, $\Omega^- \rightarrow \Lambda^0 K^-$, $\Lambda^0 \rightarrow p\pi^-$ and $\pi^0 \rightarrow \gamma\gamma$. The selection of these decay topologies was optimised on Monte Carlo simulated data and applied to a real data sample of 89/fb collected with the Belle II experiment at the SuperKEKB collider at the center-of-mass energy of the Upsilon(4S) resonance (10.58 GeV). The branching fractions of both decay modes were measured relative to the normalisation modes $X_c^+ \rightarrow X^- \pi^+ \pi^-$ and $X_c^0 \rightarrow X^- \pi^+$, respectively.

16:30	393	**Observation of the $K^+ \to \pi^+ + \nu\bar{\nu}$ decay at the NA62 experiment** *Xiafei Chang, École Polytechnique Fédérale de Lausanne, Switzerland* The $K^+ \to \pi^+ + \nu\bar{\nu}$ decay is a golden channel in flavor physics. It's highly sensitive to indirect effects of new physics up to O(100 TeV) scales. A new measurement of the $K^+ \to \pi^+ + \nu\bar{\nu}$ branching ratio by the NA62 experiment at the CERN SPS is presented. The dataset is collected in 2021 and 2022, after beamline and detector modifications, at a higher beam intensity with respect to the 2016 – 2018 data taking. Combining 2016 – 2022 data, a measurement of $Br = (13.0^{+3.3}_{-3.0}) \times 10^{-11}$ is reported. The $K^+ \to \pi^+ + \nu\bar{\nu}$ decay is observed with a significance exceeding 5 sigma. Updates on the analysis of 2023 – 2024 dataset is also presented.
16:45	394	**Measurement of the branching fraction ratio $\mathcal{B}(B^0 \to \omega K\pi)/\mathcal{B}(B^0 \to J/\psi K\pi)$ at LHCb** *Pasquale Andreola, University of Zurich, Switzerland* In recent years, the community has shown a growing interest in searches for physics beyond the Standard Model (BSM) and dark sector particles. Precision measurements of branching fraction ratios play a crucial role in these searches, tightening constraints on couplings of dark sector particles to Standard Model particles. This talk presents an overview of an ongoing measurement of the branching fractions ratio $\mathcal{B}(B^0 \to \omega K\pi)/\mathcal{B}(B^0 \to J/\psi K\pi)$ in the fully hadronic channel, using 5.7 fb^{-1} of pp-collision data collected by the LHCb detector during Run 2.
17:00	395	**Measurement of y_{CP} using 2024 Run 3 data at LHCb** *Dimitrios Kaminaris, École Polytechnique Fédérale de Lausanne, Switzerland* We present the current status of the analysis of the neutral charm meson mixing parameter y_{CP} using the high-statistics 2024 Run 3 dataset collected by the LHCb experiment. The measurement relies on comparing effective lifetimes of D^0 decays to CP-even final states K^+K^- and $\pi^+\pi^-$ with the Cabibbo-favored $D^0 \to K^-\pi^+$ mode. The analysis includes updates in selection criteria, kinematic matching and reweighting procedures. A refined fitting strategy is employed to extract y_{CP}, with preliminary results offering improved sensitivity to charm mixing.
17:15	396	**Search for the $B^+ \to \mu^+\mu^-\mu^+\nu$ decay at LHCb** *Pierre Mayencourt, EPFL, Lausanne, Switzerland* A search for the rare decay $B^+ \to \mu^+\mu^-\mu^+\nu$ is performed using data collected by the LHCb experiment during Run 2. The rate of this process is sensitive to a number of poorly known parameters of the Standard Model. The clean three-muon final state makes it possible to study this decay at a hadron collider, despite challenges due to presence of a neutrino in its final state. The previous search at LHCb provided an upper limit on its rate of $\mathcal{B}(B^+ \to \mu^+\mu^-\mu^+\nu) < 1.6 \times 10^{-8}$ at 95 % CL, which is of the same order of magnitude as the available theoretical predictions. The sensitivity can be improved thanks to a much larger available dataset and usage of novel analysis tools.
17:30	397	**Search for the rare $K_S \to \mu^+\mu^-$ decay using Run 3 data at LHCb** *Luis Miguel Garcia Martin, EPFL, Lausanne, Switzerland* Rare kaon decays offer unique sensitivity to physics beyond the Standard Model. Particularly, the rare $K_S \to \mu^+\mu^-$ decay stands out as a golden mode due to its precise theoretical predictions and extreme suppression. Any deviation would signal New Physics. Since 2011, LHCb has pursued this elusive decay without observing it. With the recent upgrade of the LHCb detector, the available data allows to probe sensitivities at the predicted branching ratio. Hereby, we detail the refined background suppression techniques, and overall advances that improve our search, bringing us closer than ever to a potential first observation or, alternatively, imposing stringent new constraints on New Physics scenarios.

17:45	**398**	**Search for the $B_s^0 \to \mu^+\mu^-\gamma$ decay with photon conversions.** *Raphael van Laak, EPFL, Lausanne, Switzerland* Flavor-changing neutral currents, forbidden at tree level in the Standard Model, serve as sensitive indicators of new physics. A particularly promising channel is the decay $B_s^0 \to \mu^+\mu^-\gamma$, which is unaffected by chiral suppression, unlike its nonradiative counterpart. Leveraging recent studies at LHCb, we introduce a novel detection technique that employs photon conversion in the VELO detector to analyze proton-proton collision data, corresponding to an integrated luminosity of 5.4 fb^{-1} at $\sqrt{s}$ = 13 TeV. This method aims to refine and extend the existing limits on the branching fraction, enhancing our understanding of the underlying physics.
18:00		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

Friday, 22.08.2025, Room Senatssaal

Time	ID	FAKT - TASK XI: Exotic Atoms II *Chair: Alexandre Brea Rodriguez, EPF Lausanne*
11:00	**401**	**The time-resolved Migdal Effect** *Stefan Nellen Mondragón [1], Josef Pradler [1], Mukul Sholapurkar [2]* *[1] HEPHY, ÖAW and Uni Wien, Austria, [2] HEPHY, Wien, Austria* We study finite interaction times in the Migdal effect for isolated atoms, important for extending sub-GeV dark matter detection. The standard impulse approximation assumes instantaneous nuclear recoil, but this can fail for interactions with long-range forces or slow momentum transfer. We develop a time-dependent framework where the nucleus follows a classical trajectory and the electrons respond continuously, interpolating between impulsive and adiabatic limits. We show how finite recoil timescales modify electronic transitions and existing rate calculations, impacting experimental signals. Our results systematically extend the Migdal formalism beyond the impulse approximation, improving its applicability for a broader range of dark matter interactions.
11:15	**402**	**LEMING - towards muonium interferometry** *Robert Waddy, Anna Soter, ETH Zürich, Switzerland* The LEMING experiment aims to measure muonium's gravitational acceleration ($\mu^+ + e^-$), a purely leptonic, exotic atom. The experiment will be a unique probe to test the weak equivalence principle on elementary, second-generation antimatter using a system without large contributions to the mass from the strong interaction. This talk will discuss the feasibility of making such a measurement to an error of $\approx$ 1 %. A 3 grating far-field, aperture near-field Talbot interferometer, is being designed for this purpose, where the interferogram's vertical phase encodes muonium's gravitational acceleration, which will be sampled by scanning a third grating. The main challenges include strict control over vibrational, displacement, and alignment constraints of a sub-nanometer measurement, while allowing for simultaneous X-ray calibration.

11:30	403	**Development of new superfluid helium-based muonium sources for the LEMING experiment** *Elizaveta Dourassova, Anna Soter, ETH Zürich, Switzerland* The LEMING experiment aims to measure muonium's gravitational acceleration (Mu = $\mu^+ + e^-$) using atom interferometry. This requires a coherent vacuum Mu source, developed by stopping a muon beam in superfluid helium (SFHe). Mu is emitted from SFHe as a low-divergence beam with a narrow velocity distribution. We designed a vertical SFHe target using a micron-scale silicon grating that traps SFHe via capillary action. By directly generating a horizontal atomic beam, this novel microfluidic target removes the need for a beam reflector, significantly reducing decay losses caused by the short lifetime of the atoms ($\tau_{Mu} = 2.2\ \mu s$). We present recent results of Mu emission from such targets and discuss their optimisation and integration into future interferometer setups.
11:45	404	**Antiproton-Nucleus Annihilations at Low Energies** *Viktoria Kraxberger, Stefan Meyer Institute, Austrian Academy of Sciences, Vienna, Austria* The detection of antimatter is primarily based on its annihilation, thus the understanding of the antiproton-nucleus ($\bar{p}A$) interaction is crucial. Despite its significance, current models show deviations from low-energy measurements. This work presents a study of $\bar{p}A$ annihilations at rest on a variety of solid targets. It will provide information on total multiplicity, energy, and angular distribution of various prongs and their dependence on nuclear mass. The 1-3 μm thick target foils allow heavily ionizing particles to escape, enabling the investigation of possible final state interactions triggered by the primary annihilation mesons. The detection system covers most of the solid angle around the target and consists of seven Timepix4 ASICs coupled to silicon sensors.
12:00	405	**Development and future prospects of a gamma-spectroscopy array for measurement of (n,xng) cross-section measurements at CERN n_{TOF}** *Michael Bacak, Erwin Jericha, Technische Universität Wien, Austria* One of the building blocks for the development of next generation nuclear technologies is the accurate knowledge of underlying relevant nuclear data. (n,xng) reaction cross-sections are particularly relevant for energy applications as well as space applications and electronics behaviour in neutron environments. Such data is furthermore of interest for fundamental nuclear physics, e.g. probing the collective nature of highly excited states in nuclei. CERN's neutron time-of-flight facility (n_{TOF}) features a pulsed neutron beam with excellent characteristics to measure inelastic reaction cross-sections. High resolution γ-ray spectroscopy is commonly employed to perform such measurements with low uncertainties. Our developments of a mixed $LaBr_3$(Ce) and HPGe detector array are presented in the context of measuring (n,xng) reactions up to 100 MeV at n_{TOF}.
12:15	406	**Geant4 Characterization of the High Altitude Scintillator Detector AMORE** *Sergey K. Ermakov, Wojtek Hajdas, Luka Marjanovic, Klaus Kirch, PSI Villigen* AMORE is a scintillator detector designed for a cosmic radiation monitoring network on commercial airplanes and hot air balloons. The high-altitude environment imposes constraints on detector size, weight, and data transmission/storage capabilities. These limitations require detailed characterization and efficient analysis techniques for the available data. We present Geant4 simulations of the response functions and scintillation optical properties. Additionally, we discuss methods for particle identification and determining the initial particle impact direction.
12:30		***Poster Awards and Closing Ceremony***
12:45		***Lunch***

Time	ID	FAKT - TASK XII: High Energy III *Chair: Jona Motta, Universität Zürich*
14:00	411	**Neutrino measurements with the FASER electronic detector at the LHC** *Charlotte Cavanagh, ETH Zürich, Switzerland* FASER is a small experiment in the far-forward region 480m upstream of the ATLAS collision point at the LHC. It is designed to detect highly-energetic neutrinos as well as to search for feebly-interacting new particles predicted by extensions of the Standard Model. Neutrino measurements from the electronic component of the detector, separate from the emulsion-based technology used in the sub-detector FASERν, have so far yielded results including the first measurement of the muon neutrino interaction cross section and flux at the LHC. There is ongoing work to also measure the properties of electron neutrinos, harnessing FASER's electromagnetic calorimeter as a potential signal region and building on knowledge from existing physics results, with the aim of a flux measurement.
	~~412~~	→ *moved to 377*
14:15	413	**FASERCal: Probing High-Energy Neutrinos at FASER in the HL-LHC Era** *Anna Mascellani, ETHZ, Zurich, Switzerland* The proposed FASERCal detector aims to measure both charged- and neutral-current interactions of high-energy neutrinos, produced at the LHC during Run 4, that reach the FASER experiment. Its design consists of 10 modules, each comprising 20 layers of 1 cm^3 plastic scintillator cubes inspired by the technology of the SuperFGD detector at T2K. These modules will be followed by an electromagnetic and a hadronic calorimeter to contain particle showers, while a downstream detector composed of scintillators and absorbers will allow muon identification. A prototype of a single module is under construction and will be installed at the FASER location in 2026. This talk will present an overview of the FASERCal design, its physics potential, and the developed prototype.
14:30	414	**Search for Neutrino Interaction Signature on SND@LHC with Machine Learning** *Zhibin Yang, EPFL, Lausanne, Switzerland* The SND@LHC is a compact experiment that aims to observe and measure high flux of energetic neutrinos of all flavours from the LHC. Identifying neutrino interactions against the large background from neutral hadrons and muons is one of the main challenges. The detector consists of two parts, the electronic detector and the emlusion target.Searching for neutrino signatures with only the data from electronic detectors could speed up the process of identifying neutrino interactions. We investigate the use of machine learning on raw hits from the electronic detectors to distinguish neutrino events from various backgrounds.
14:45	415	**Charmed Baryon Physics at Belle II and Measurement of Ξ_c Branching Fractions** *Cristhian Ricaurte, Christoph Schwanda, Institute of High Energy Physics (HEPHY), ÖAW, Vienna, Austria* Charmed Baryons present a unique environment where non-perturbative Hadron Physics meet the perturbative regime. Despite the significant experimental and theoretical progress of the past decade, our understanding of charmed baryons remains very limited, with many of their decay modes poorly measured or entirely unexplored. In this contribution, we present the strategies involved in the reconstruction of strange and charmed baryons at Belle II and provide new preliminary measurements of the ratio of branching fractions $\mathcal{B}(\Xi_c^0 \to \Lambda^0 K^- \pi^+)/\mathcal{B}(\Xi_c^0 \to \Xi^- \pi^+)$ and $\mathcal{B}(\Xi_c^+ \to \Lambda^0 K^- \pi^+ \pi^+)/\mathcal{B}(\Xi_c^+ \to \Xi^- \pi^+ \pi^+)$. These results highlight the capabilities of the Belle II detector in heavy flavor spectroscopy.

15:00	**416**	**Proton irradiation of a SciFi module to the dose profile expected in LHCb Upgrade 2** *Gauri Napoletano, École Polytechnique Fédérale de Lausanne, Switzerland* The LHCb detector is expected to collect 300 fb^{-1} of integrated luminosity during Upgrade 2. To investigate the performance of the SciFi Tracker at this radiation level, a 2.11 m long SciFi module, made of 4 layers of scintillating fibres, was irradiated with 24 GeV/c protons at the CERN PS IRRAD facility. The module was previously characterised in a test beam experiment at the CERN H8 zone. The light yields of the mat before and after the irradiation were characterised and compared. A translation table allowed to move the module during the irradiation transverse to the beam direction to obtainthe desired dose distribution. The delivered dose was then derived from a dosimetry analysis on the generation of the ^{24}Na isotope in two sets of aluminum strips placed in front of and behind the module. The outcomes of this analysis are presented in this contribution.
15:15		***END***

ID	FAKT - TASK POSTER
431	**SiPM development for LHCb SciFi Upgrade II** *Federico Ronchetti, EPFL, Lausanne, Switzerland* The LHCb SciFi detector will undergo a major upgrade in the framework of the LHCb Upgrade II, to cope with the expected higher delivered luminosity and the consequent increase in radiation damage, leading to an overall decrease of the hit detection efficiency. We present here the work on the SciFi SiPMs in view of the new detector under development. Microlens-enhanced SiPMs will allow to improve photo-detection efficiency. Cryogenic cooling with LN2 will allow to reduce significantly the noise and therefore ensure high hit detection efficiency at increased radiation. Finally, we present the monitoring of the radiation damage of the current SciFi detector which is important to assess the detector life time and improve the final design of the future one.
432	**Study of Signal-to-Background Discrimination in the muEDM experiment using Geant4** *David Höhl, Paul Scherrer Institut, Villigen, Switzerland* At PSI a high-precision experiment is being set up to search for the muon electric dipole moment (muEDM) employing the frozen-spin technique. A muEDM larger than the Standard Model prediction would be a sign for new physics. The search will eventually improve the current best direct limit by three orders of magnitude. The EDM signal is measured by detecting an emission asymmetry of decay positrons from stored muons in the bore of a solenoid. Muons that cannot be stored are stopped after injection, giving rise to background events. This poster will cover Monte Carlo simulations of the experiment after injection into the magnet using Geant4, focusing on background and signal events and their distinction by anomaly detection using neural networks.
433	**Measurement of the differential branching fraction of $B^+ \to K^+\pi^+\pi^-\mu^+\mu^-$** *Anni Kauniskangas, École Polytechnique Fédérale de Lausanne, Switzerland* Precision measurements of rare particle decays offer an indirect way of searching for new physics. In these indirect searches, the properties of the rare decays are measured in order to look for discrepancies between the experiment and the Standard Model predictions that could be caused by new particles intervening with the decay. This contribution describes an ongoing measurement of the differential branching ratio of the rare decay $B^+ \to K^+\pi^+\pi^-\mu^+\mu^-$ using data from the LHCb experiment at CERN. Measuring this decay channel allows to probe the highly suppressed $b \to s\ell\ell$ quark level transition, which is sensitive to new physics.

434

Low energy antimatter at the Stefan Meyer Institute

Ross Sheldon, SMI, ÖAW, Vienna, Austria

Low energy antimatter can be used to investigate the matter-antimatter asymmetry, and the binding of antimatter with matter. The ASACUSA-Cusp collaboration at the CERN Antiproton Decelerator produces an antihydrogen (positron-antiproton bound state) beam by slowly merging plasmas of positrons and antiprotons. This beam will be used to precisely measure the antihydrogen ground-state hyperfine splitting to compare with Hydrogen as a test of CPT symmetry violation. In Vienna a positron beam is used to measure the binding energy of molecules containing positronium (positron-electron bound state) to improve knowledge of antimatter chemistry which is relevant in medical and materials analysis techniques. A summary of these experiments will be presented, focusing on how low energy antimatter is a useful tool for precision studies.

435

The Spectroscopy Beamline of the ASACUSA Antihydrogen Experiment

Matti Cerwenka, Stefan Meyer Institute for subatomic physics, Austrian Academy of Sciences, Wien, Austria

The ASACUSA collaboration aims to conduct the first measurement of the ground state hyperfine transition frequency of antihydrogen in a beam. A rabi type spectrometer is going to be used for these measurements. It consists of a microwave cavity to drive energy level transitions as well as a sextupole magnet for spin selection. A low and homogeneous static magnetic field is applied in the interaction region to induce Zeeman splitting.
Using an anti atom beam, spectroscopy can be done in a low field free region increasing the achievable precision of the measurement.

436

Cesium Magnetometry for the n2EDM Experiment

Luz Sanchez-Real Zielniewicz, on behalf of the nEDM collaboration, ETH, Zürich & PSI, Switzerland

High-sensitivity cesium magnetometers are critical for precise magnetic field monitoring in the neutron electric dipole moment experiment (n2EDM) at the Paul Scherrer Institute. Recent progress has been made in the characterization and calibration of paraffin-coated cesium vapor cells, including relaxation time measurements and magnetic sensitivity. The magnetometers are calibrated using controlled field sweeps and vector field mapping techniques, and are being implemented on custom-designed non-magnetic plates for deployment within the n2EDM setup. These developments aim to optimize spatial field resolution and stability in the experiment's shielded environment. The results support improved magnetic field control, essential for suppressing systematic effects in the search for the neutron EDM.

Acknowledgement of grants: SNF 200441, 213222 and 236419.

437

Study of Exclusive Dimuon Photoproduction in Ultraperipheral Pb–Pb Collisions at $\sqrt{s_{nn}}$ = 5.02 TeV with the CMS Detector

Eslam Shokr, University of Zurich, Switzerland

The exclusive $\gamma\gamma \rightarrow \mu^+\mu^-$ process in ultraperipheral PbPb collisions at $\sqrt{s_{nn}}$ = 5.02 TeV is studied using CMS data. This analysis probes the photon flux from lead ions in strong electromagnetic fields, providing insight into the modeling of photon-induced processes in heavy-ion collisions. Measured dimuon yields are compared to predictions from several Monte Carlo generators that incorporate different theoretical models and nuclear form factors. Events without neutron emission (0n0n) are generally well described by models using the charged form factor. However, for events involving neutron emission from one or both nuclei (0nXn and XnXn), discrepancies appear between data and predictions, pointing to the need for improved modeling of photon flux in cases involving nuclear dissociation.

438	**Machine learning a fixed-point action for the O(3) non-linear sigma-model** *Liane Backfried, Andreas Ipp, David Müller, TU Wien, Austria* Machine learning in physics is a growing and exciting field of research. In the context of lattice field theory, symmetry-preserving neural networks can be used to approximate improved lattice actions. By employing these in simulations, continuum values of observables can be extracted from comparably small and coarse lattices. My poster presents the results of my Master thesis, where I employed convolution-based neural networks to approximate a type of improved action, a fixed-point action, for the O(3) non-linear sigma-model. I show how symmetries of the theory can be incorporated into the network architecture to reduce the number of required trainable weights and training samples. Two approaches to training are discussed, and the performance of the final models is tested.
439	**Cryogenic tracking detectors for the LEMING experiment** *Rebecca Gartner, Anna Soter, Damian Goeldi, Francesco Lancellotti, Robert Waddy, Elizaveta Dourassova, Paul Wegmann* *ETH Zürich, Switzerland* The LEMING experiment aims to measure the gravitational free fall of muonium, a purely leptonic, exotic atom, using a novel cold muonium beam created from superfluid helium. The latter requires detectors operating at cryogenic temperatures. To detect the decay position of muonium, tracking detectors need to be capable of tracking positrons in a large solid angle and at a ~1 mm spatial resolution. We have demonstrated efficient and reliable sub-kelvin positron detection with commercial silicon photomultipliers (SiPMs) coupled to thin scintillator segments. Presently, we are working on a silicon-strip-based tracker system, further increasing spatial resolution and solid angle coverage. In this poster, recent developments on the silicon-strip-based tracker and its track reconstruction software are shown.
440	**Decay of the Vortex neutron** *Rahul Singh, EPFL Lausanne, Switzerland* Vortex states provide a novel way to probe fundamental interactions. In this work, we analyze the beta decay of a free neutron prepared in a Bessel vortex state and compute the resulting Spectral-Angular and Angular distributions of the outgoing electron and proton. We incorporate corrections arising from the V-A theory, CKM matrix, and the Fermi function to enable a realistic comparison between vortex and plane-wave states. Initial results suggest that while electron distributions exhibit limited sensitivity to the vortex structure, the proton spectrum may offer a more viable channel for observing angular momentum effects.
441	**A visualization of the relativistic Terrell-Penrose effect** *Victoria Helm [1,2], Dominik Hornof [3,4], Enar de Dios Rodriguez [5,6], Thomas Juffmann [1,2], Philipp Haslinger [3,4], Peter Schattschneider [4]* *[1] University of Vienna, Faculty of Physics, VCQ, Vienna, Austria,* *[2] University of Vienna, Max Perutz Laboratories, Department of Structural and Computational Biology, Vienna, Austria,* *[3] TU Wien, Atominstitut, VCQ, Vienna, Austria,* *[4] TU Wien, University Service Centre for Transmission Electron Microscopy, Vienna, Austria,* *[5] Kunstuniversität Linz, Austria,* *[6] IFK, Internationales Forschungszentrum Kulturwissenschaften Kunstuniversität Linz in Wien, Austria* The Terrell-Penrose effect reveals that objects moving at relativistic speeds do not appear contracted in photographs, but instead visually rotated—a counterintuitive result of special relativity. Despite its theoretical prediction sixty-six years ago, this effect has never been directly observed. We present a laboratory demonstration of the Terrell-Penrose effect using picosecond laser pulses and ultra-fast imaging with gating times down to 300 ps. By synthetically reducing the speed of light to under 2 m/s, we create visualizations of deliberately Lorentz-contracted objects moving at near-light speeds. These visualizations include simulations and experimentally generated slow-motion sequences that capture the apparent rotation. This method opens avenues for a better understanding of relativistic phenomena.

Gravitational Waves

Thursday, 21.08.2025, Room Erika Weinzierl Saal

Time	ID	**Gravitational Waves I** *Chair: Philippe Jetzer, Universität Zürich*
14:00	**461**	**Overview of Austrian and Swiss GW communities** *Gianluca Inguglia, Institut für Hochenergiephysik der Österreichischen Akademie der Wissenschaften* *Steven Schramm, Université de Genève* This contribution will provide an overview of the Austrian and Swiss gravitational-wave science communities, with the aim of identifying common interests and fostering future collaborations.
14:20	**462**	**Challenges and opportunities of the Einstein Telescope** *Ulyana Dupletsa, Institute of High Energy Physics - Austrian Academy of Sciences, Vienna, Austria* The Einstein Telescope (ET) is a European project for a next-generation gravitational-wave detector designed to increase the sensitivity of current interferometers significantly. Its reference design features a triangular configuration of three nested detectors with 10 km arms, each hosting a 'xylophone' setup of two interferometers: one optimized for high frequencies, the other, cryogenic, for low frequencies. This design will significantly expand the observable volume of the Universe and improve source parameter estimation. In this contribution, we outline the key scientific objectives of the ET, and discuss the main detection and data analysis challenges. In particular, we focus on the role of machine learning techniques, such as anomaly detection for noise discrimination and fast inference methods for parameter estimation.
14:40	**463**	**Preparing for computing at the Einstein Telescope** *Steven Schramm, Université de Genève* The Einstein Telescope is set to revolutionise gravitational-wave science, with an anticipated signal rate 10^4 times higher than that of the current LVK sensitivity. Moreover, the signals will remain in band much longer due to increased sensitivity at lower frequency, thus the signal extraction computing cost will grow considerably. A naive scaling of current approaches could require quadrillions of CPU hours per month of data-taking [arXiv:2412.02651], which is not feasible. This contribution will provide an overview of the Einstein Telescope computing challenges, which must be overcome in order for the Einstein Telescope science programme to be feasible.
15:00	**464**	**Anomaly Detection of Gravitational Waves at the Einstein Telescope** *Gianluca Inguglia, Institut für Hochenergiephysik der Österreichischen Akademie der Wissenschaften* We present the implementation and preliminary results of a weakly supervised anomaly detection algorithm based on convolutional autoencoders for the detection of gravitational waves. The study is performed in the context of the Einstein Telescope and focuses on intermediate-mass black hole mergers. Incoming gravitational waves are assumed to be anomalies in the noise data. Using synthetic data produeced by Einstein Tellescope Collaboration, we show that such a tool can efficiently detect gravitational waves as anomalies in the data of an interforometer, with a recovery efficiency of the signal injected of up to 100 %, paving the way to further optimizations, refinement and the development of a fully automated search pipeline based.
15:20		
15:30		***Coffee Break***

Time	ID	GRAVITATIONAL WAVES II *Chair: Gianluca Inguglia, ÖAW*
	~~465~~	*cancelled*
16:00	466	**Identification and parameter estimation of gravitational-wave signals from extreme-mass-ratio inspirals with LISA** *Stefan Strub [1], Lorenzo Speri [2], Domenico Giardini [1]* *[1] ETH Zurich, Switzerland, [2] European Space Agency, Noordwijk, Netherlands* We present an innovative search method for gravitational wave signals from EMRIs. With the precise identification of the signal we are able to compute the posterior distribution of EMRI signals. This leads the path to the global fit of EMRI signals overlapping with other sources of gravitational wave signals.
16:20	467	**Deep source separation meets deep source inference: Toward a unified learning pipeline for high-dimensional gravitational-wave data** *Niklas Houba, ETH Zürich, Switzerland* LISA will detect overlapping gravitational-wave signals embedded in complex, nonstationary noise. Disentangling these signals and estimating their source parameters - known as the global fit problem - is a key challenge in LISA data analysis. We present a prototype deep learning pipeline that combines source separation and inference in a unified framework. Adapting techniques from audio processing, we use a multichannel autoencoder to recover clean waveforms from noisy TDI data. Compact latent embeddings are then passed to an ensemble of neural spline flows for fast, simulation-based parameter inference. Frequency-domain MCMC sampling is used for validation and comparison. Applied to synthetic LISA data, the approach shows early promise for scalable signal recovery and calibrated inference in future data analysis pipelines.
16:40	468	**Exploring nanoHz gravitational waves with pulsar timing arrays** *Michele Vallisneri, ETH Zürich, Switzerland* Two years ago, pulsar timing arrays reported evidence of a gravitational-wave background consistent with emission from supermassive black hole binaries at the centers of galaxies, although more intriguing sources have been proposed by many. I celebrate the surprising opportunity of nanoHz gravitational-wave detection via pulsar timing, discuss our quest for statistical evidence and the fight against systematics, present new AI-inspired tools and methods for pulsar-timing-array data analysis, and speculate about future milestones.
17:00		***END***
		Transfer to Dinner
19:30		***Conference Dinner***

Accelerator Science and Technology

Tuesday, 19.08.2025, Room Erika Weinzierl Saal

<table>
<tr><th>Time</th><th>ID</th><th>ACCELERATOR SCIENCE AND TECHNOLOGY
Chair: Mike Seidel, PSI Villigen</th></tr>
<tr><td>16:00</td><td>481</td><td>Superconducting-Magnet R&D for the Future Circular Collider at the PSI MagDev Laboratory

Bernhard Auchmann [1], Douglas Martins Araujo [1], André Brem [1], Jaap Kosse [1], Dmitry Sotnikov [1], Thomas Michlmayr [1], Henrique Garcia Rodrigues [1], Kirtana Puthran [1], Ines Santos Perdigao Peixoto [1], Jürgen Schmidt [1], Joep Van den Eijnden [1], Matteo Crescenti [1], Anna Stampfli [1], Christian Lindner [1], Collin Müller [1], Stéphane Sanfilippo [1], Ariel Haziot [1], Amalia Ballarino
[1] PSI, Villigen, Switzerland, [2] CERN, Geneva, Switzerland

The MagDev Laboratory at PSI was created through the CHART program (Swiss Accelerator Research and Technology) to carry out innovative R&D in superconducting magnets for the Future Circular Collider. In this contribution, we give an overview of ongoing activities at the MagDev laboratory, from Nb_3Sn high-field dipoles to REBCO technology for bending magnets, to REBCO no-insulation solenoids. We conclude with a series of synergistic activities with other fields that generate societal impact of HEP-related R&D.</td></tr>
<tr><td>16:15</td><td>482</td><td>Towards multi-scale modelling of Nb_3Sn cable for accelerator magnets

Joep Van den Eijnden [1], Douglas Araujo [2], Bernhard Auchmann [2], Xiang Kong [1], Theo Tervoort [1], Jasmin Smajic [1], Jürg Leuthold [1]
[1] ETH Zürich, Switzerland, [2] Paul Scherrer Institute, Villigen, Switzerland

Under the Swiss Accelerator Research and Technology (CHART) initiative, we are developing simulation tools to advance superconducting magnet technology in support of the Future Circular Collider. To achieve dipole magnetic fields exceeding 14 T, it is critical to understand and predict how mechanical stress affects the performance of Nb_3Sn magnets. The Lorentz forces acting on these meter-long magnets influence the superconducting behavior of micrometer-scale filaments. To address this, we develop a multiscale approach, utilizing measured material properties, that downscales to a submodel resolving individual strands and capturing cabling-induced deformation. This enables links to performance reduction observed in experiments at PSI. Once validated, we aim to integrate the work into the PyMBSE framework and extend this approach to high-temperature superconductor cables.</td></tr>
<tr><td>16:30</td><td>483</td><td>Quench Protection based on Smart Insulation for the Final Cooling Solenoid of the Muon Collider

Matteo Crescenti [1,2], Bernhard Auchmann [1], André Brem [1], Michal Duda [1], Jaap Kosse [1], Jürgen Schmidt [1], Carmine Senatore [2]
[1] PSI, Center for Accelerator Science and Engineering (CAS), Villigen PSI, Switzerland,
[2] University of Geneva, Department of Quantum Matter Physics, Geneva, Switzerland

In the framework of the Horizon Europe Mucol, we investigate the use of materials with strong thermo-resistive behavior as “smart insulation” to improve quench protection in high-field magnets based on high-temperature superconductors (HTS). A finite element model was developed to analyze the thermal-electromagnetic behavior of a 40 T solenoid under design for final muon beam cooling in a 10 TeV Muon Collider concept. Several "smart" materials triggered by temperature or voltage were screened, and a method was developed to fine-tune turn-to-turn contact resistance in the winding. The approach aims to enhance the electro-thermal stability by locally decreasing the turn-to-turn resistance during a quench, avoiding damage while preserving the benefits of insulated magnets.</td></tr>
</table>

Time	No.	Contribution
16:45	484	**Update on Beam Halo Removal Studies for HL-LHC** *Milica Rakic [1], Pascal Hermes [2], Stefano Redaelli [2]* *[1] EPFL, Lausanne, Switzerland, [2] CERN, Meyrin, Switzerland* Measurements throughout LHC operation have shown that the transverse beam halo can contain a non-negligible fraction of the total stored beam energy. With the increased stored energy in the High-Luminosity LHC (HL-LHC), risks associated with the beam halo become more significant. Accurate halo modelling is therefore essential for simulating beam losses during HL-LHC failure scenarios involving sudden orbit shifts. Based on Run3 data, the HL-LHC halo model has been revised and replaced by two new q-Gaussian models: one optimized for best agreement with measured data, and a more conservative variant slightly overestimating the halo population. This contribution presents the updated halo models and evaluates the halo depletion efficiency of Hollow Electron Lenses for HL-LHC, comparing performance with the previous model.
17:00	485	**Accelerating Mixed Ion Beams for Treatment Monitoring Research** *Matthias Kausel [1,2], Claus Schmitzer [1], Elisabeth Renner [2], Albert Hirtl [2], Thomas Bergauer [3], Felix Ulrich-Pur [3,4], Andreas Gsponer [3], Hermann Fuchs [5]* *[1] EBG MedAustron GmbH, Wiener Neustadt, Austria, [2] TU Wien, Austria,* *[3] Austrian Academy of Sciences, Vienna, Austria,* *[4] GSI Helmholtz Institute for Heavy Ion Research, Darmstadt, Germany,* *[5] Medical University of Vienna, Austria* Irradiation with mixed helium and carbon ion beams is emerging as a promising approach to treatment monitoring in ion beam therapy. In this scenario, the carbon ions are used to irradiate the tumor, whereas the specific energy loss of the helium ions downstream of the patient serves as range probe. This talk presents the ongoing research on generating and accelerating such a mixed beam at the MedAustron accelerator facility in Wiener Neustadt, focusing on the developments that allowed for the delivery of a mixed $^{4}He^{2+}$ and $^{12}C^{6+}$ beam for the first time using a sequential injection scheme into the MedAustron synchrotron.
	~~486~~	*cancelled*
17:15	487	**The Upgrade of the Swiss Light Source and Characterization of its Beam Optics** *Jesus Avila Pulido, Jonas Kallestrup, Paul Scherrer Institute PSI, Villigen, Switzerland* The Swiss Light Source upgrade, SLS2.0, is currently undergoing commissioning. This next-generation storage ring features an ultra-low emittance lattice based on a seven-bend achromat design and operates at an electron beam energy of 2.7 GeV. Each unit cell incorporates a combination of longitudinal gradient bends and reverse bend magnets to achieve the desired optical performance. Following an introduction to the Swiss Light Source and its upgrade, the key characteristics of the SLS2.0 storage ring will be presented, alongside measurements of several quantities and their comparison with simulation results. Emphasis will be placed on the measurement of the beta functions since the knowledge and control of the linear optics is essential for the optimal machine performance.
17:30	488	**Implementation of the Synchrotron Radiation Integrals in Xsuite** *Simon Buijsman, CERN, Switzerland* High-precision simulation of beam dynamics in storage rings is essential for accelerator design. Xsuite, a Python-based package, is primarily tailored to hadron rings, and work is being performed to extend its applicability to electron rings, where synchrotron radiation (SR) plays a dominant role. While Xsuite includes sophisticated SR models, their results are difficult to trace to individual beam line elements. Radiation integral calculations based on orbit curvature have been implemented, enabling support for non-planar bends and improved interpretability. Benchmarking against Chao's formalism across various accelerator configurations shows agreement within 10^{-3} for equilibrium emittances and 10^{-4} for exponential damping times. This new functionality allows for attributing SR effects to specific elements, aiding optics design in Xsuite.

17:45	**489**	**Energy-efficient ERL-based accelerators from a beam dynamics perspective** *Lode Vanhecke [1], Mike Seidel [2], Tatiana Pieloni [1]* *[1] École Polytechnique Fédérale de Lausanne, Switzerland,* *[2] Paul Scherrer Institute, Villigen, Switzerland* Sustainability requirements are becoming an increasingly important aspect of accelerator physics. Providing an energy-efficient and sustainable solution, Energy Recovery Linac (ERL) concepts enable the generation of high-intensity beams while keeping electrical power consumption comparatively low. ERL accelerators meet these demands with the use of superconducting radio-frequency (SRF) technology. The Innovate for Sustainable Accelerating Systems (iSAS) initiative aims to integrate various energy-saving advancements into a next-generation, energy-efficient cryomodule design. This work analyses the iSAS SRF cavity design from a beam dynamics perspective, identifying coherent beam instabilities and providing feedback on higher-order mode resonances for further optimisation. The integration of this cryomodule into ERL-based systems is investigated. These results aim to contribute to the implementation of high-performance, environmentally responsible accelerating systems.
18:00		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

Energy, Sustainability and Environment

Tuesday, 19.08.2025, Room HS 30

Time	ID	Energy, Sustainability and Environment *Chair: Robert Hauser, FH Kärnten; Christoph Reichl, AIT*
16:00	**501**	**Nature-Inspired Nanopores for Osmotic Energy Conversion** *Yunfei Teng, EPFL* Osmotic energy, or blue energy, harnesses electricity from ion movement driven by salinity gradients. Reversed Electrodialysis (RED) utilizes selective membranes to convert this ionic flux into electrical potential, but optimizing both performance and scalability remains difficult. We present a solid-state membrane featuring stalactite-shaped HfO_2 nanopores formed via anisotropic deposition on silicon nitride. The asymmetric geometry enhances charge separation efficiency while maintaining structural robustness. Integrating with micro-fabrication, our approach enables pore densities up to 10^8 cm^{-2}, offering a scalable and stable platform for practical osmotic energy applications.
16:30	**502**	**The Vienna Environmental Research Accelerator (VERA) for applications in Earth and Environmental sciences** *Karin Hain, Stephanie Adler, Oscar Marchhart, Martin Martschini, Silke Merchel, Peter Steier, Carlos Vivo-Vilches, Andreas Wiederin, Alexander Wieser, Robin Golser* *University of Vienna, Faculty of Physics, Isotope Physics, Vienna, Austria* VERA has been continuously upgraded to expand the range of radionuclides measurable with accelerator mass spectrometry (AMS) at low MeV ion beam energies. A major milestone was the implementation of Ion-Laser Interaction Mass Spectrometry (ILIAMS), which effectively removes isobaric background—previously a key limitation for AMS in the mid-mass range. Many of these radionuclides are crucial for applications in Earth and Environmental sciences e.g., surface exposure dating, tracing environmental mass transport (ice, water, sediments,...), identifying contamination sources, and supporting nuclear decommissioning. VERA's contributions to the search of the "golden spike" for the proposed geological age of the "Anthropocene" and to the identification of anthropogenic uranium sources using the new $^{233}U/^{236}U$ isotope signature, with applications in oceanography, will be highlighted.
16:45	**503**	**High-Power, Low-Noise Mid-Infrared Optical Frequency Combs for Precision Spectroscopy** *Vito Fabian Pecile [1], Filipp Lausch [1,2], Maximilian Prinz [1,2], Norbert Modsching [3], Valentin J. Wittwer [3], Thomas Südmeyer [3], Oliver H. Heckl [1]* *[1] Optical Metrology Group, Faculty of Physics, University of Vienna, Boltzmanngasse 5, AT-1090 Wien,* *[2] Vienna Doctoral School in Physics, University of Vienna, Boltzmanngasse 5, AT-1090 Wien,* *[3] Laboratoire Temps-Fréquence (LTF), Institut de Physique, Université de Neuchâtel, Avenue de Bellevaux 51, 2000 Neuchâtel, Schweiz* Precision spectroscopy in the mid-infrared using optical frequency combs is a novel technique to investigate broadband spectral regions. It has gained significant attention over the past years due to its elevated importance for many practical, medical and industrial applications, ranging from human breath analysis to pollution monitoring. An ongoing challenge is to provide highly accurate reference data, as precision spectroscopy techniques have rigorous demands on the used light source in terms of high average powers and stability. Such sources remain technologically challenging and are currently unavailable. Here, we present a record-high power, low-noise frequency comb system operating in the 3 - 5 µm region, which has sufficient characteristics for a first-time performance of broadband cavity-enhanced saturation spectroscopy in the mid-infrared.

17:00	**504**	**Data-Driven Fault Detection in PV Plants Based on IV Curve Analysis and Artificially Generated Fault Scenarios** *Felix Korbelius, TU Wien* The aim is to present a data-driven monitoring approach of PV plants to detect underperformance at string level of photovoltaic power plants. PV plants are monitored based on operational data (power, voltage, current, ...) and environmental data (irradiance, temperature, ...). Scans of the total IV-curve of different strings attached to an inverter contain information about the condition of the strings at specific moments. The methodology involves simulating a PV plant using software packages that model solar cells up until string level and inserting predefined artificially generated fault conditions based on the underlying Shockley Diode Model. A Machine Learning model is being trained on this artificially generated data set which allows classification of real-world errors to aid in operation maintenance of large scale commercial PV plants.
17:15	**505**	**Enhancing Heat Pump Installation Through Frequency-Based Acoustic Directivity Information: An Open Database Initiative** *Luisa Stöckl [1], Christoph Reichl [1], Francois Bessac [2], Georg Klein [1], Martin Czuka [1]* *[1] AIT Austrian Institute of Technology, Vienna, Austria, [2] CETIAT, Villeurbanne, France* Heat pumps are gaining popularity due to their efficiency, carbon neutrality, and use of renewable energy. Air-to-water models are favored for low cost and easy installation. However, proper placement to reduce noise is essential. Current noise assessments lack detailed frequency and directivity data. Standard certification tests provide frequency-resolved partial sound power levels for five surfaces around the unit, offering basic directivity insights. As part of IEA HPT Annex 63, an anonymous database was created, combining heat pump dimensions, operating conditions, and surface types with their frequency spectra. Initially, it includes data from about 30 units measured at CETIAT and AIT, with expansion planned in 2025, inviting contributions from other laboratories. This contribution introduces the database and shows a first exploitation.
17:30	**506**	**Decentralized heat pump solutions and their safety concepts for natural refrigerants in multi-family houses** *Stephan Preisinger [1], Felix Hochwallner [2], Heinz Moisi [1], Christoph Reichl [2]* *[1] Ochsner Wärmepumpen GmbH, Amstetten, Austria,* *[2] AIT - Austrian Institute of Technology, Vienna, Austria* In large cities, for example Vienna, about one half of households in multi-family homes use gas boilers for heating or domestic hot water preparation. The aim of the FFG-project "Gasthermenersatz" was to tackle this problem by developing a prototype of a decentralized, sound-optimized heat pump solution. In this context, access to the heat source either from the outside air or geothermal heat is crucial and analyzed within this contribution. The recently started FFG-project "WISE" focusses on safety concepts to adhere to the limit of 150 g R290 releasable charge, while increasing the refrigerant circuit charge. In our talk, we will highlight the most important results of "Gasthermenersatz" and report on the current research activities in "WISE".
17:45	**507**	**IEA HPT Annex 61 – Integration of Heat Pumps in Positive Energy Districts** *Christoph Reichl [4], Fabian Ochs [1], Carsten Wemhoener [2], Christoph Rohringer [3]* *[1] University of Innsbruck, Innsbruck, Austria,* *[2] OST, University of Applied Science, Rapperswil, Switzerland,* *[3] AEE INTEC, Gleisdorf, Austria , [4] AIT - Austrian Institute of Technology, Vienna, Austria* Cities contribute to 60 % of global greenhouse gas emissions. Districts and cities are highly complex, but unlike individual buildings, they allow for synergies, like load balancing or waste heat recovery. Therefore, districts appear to be a suitable application for integration of heat pump (HP) systems with the vision of future positive energy districts (PEDs). PED definitions and policy frameworks were identified, and technologies in existing PEDs, applied planning and simulation tools, and certification systems were analyzed. HPs are the main heating systems in PEDs, typically powered by on-site photovoltaics and supplemented with green electricity. We report on IEA HPT Annex 61, which examines HP integration concepts into PEDs as a future perspective for accelerating the energy transition in urban contexts.
18:00		***END***

		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

ID	Energy, Sustainability and Environment Poster
521	**Automatic focusing system for laser thermal annealing setup: toward effective wafer back contact annealing.**

521 **Automatic focusing system for laser thermal annealing setup: toward effective wafer back contact annealing.**

Martin Buessler, Institut für Angewandte Physik, Wien, Austria

Laser Thermal Annealing (LTA) is crucial for semiconductor fabrication, offering precise heating with minimal thermal spread. Unlike traditional furnace annealing, LTA uses high-intensity laser pulses for targeted heat application, enhancing dopant activation. This precision is vital for creating quality back contacts in devices like power electronics, CMOS, and solar cells.
Conventional LTA setups lack real-time control over focus alignment and energy absorption, causing inconsistencies. To improve this, we introduced an automatic focusing routine to maintain wafer focus during LTA. Additionally, a reflectance-based monitoring system was implemented to measure the ratio of reflected to incident light, providing real-time feedback on absorbed energy. These advancements enable both geometric and energetic optimization, significantly improving back contact uniformity.

~~522~~ → *moved to 587*

523 **Extended aerosol optical depth (AOD) time series analysis in an alpine valley: a comparative study from 2007 to 2023**

Jochen Wagner, Alma A. Ubele, Verena Schenzinger, Axel Kreuter
Medical University of Innsbruck, Austria

This study extends aerosol optical depth (AOD) measurements at 501 nm in Innsbruck, Austria, from 2007 to 2023 and compares them with data from Davos, Switzerland. Building on earlier work (Wuttke et al., 2012), we analyze 17 years of daily median AODs (requiring ≥ 3 measurements per day) and monthly geometric means (≥ 5 valid days), covering 83 % of months in Innsbruck and 79 % in Davos. Advanced statistical methods (Sayer et al., 2019) reveal significant negative AOD trends at both sites. For the first time, we also derive the diurnal AOD climatology for each station.

Acknowledgments go to PMOD/WRC and AERONET-Europe/ACTRIS for sunphotometer maintenance; funding was provided by the Medical University of Innsbruck.

524 **IEA HPT Annex 63 - Placement Impact on Heat Pump Acoustics - Overview and Austrias Contribution to the Network**

Christoph Reichl [1], Christian Kaseß [2], Michael Wernhart [3], Maximilian Noisser [4], Fabian Ochs [5]
[1] AIT Austrian Institute of Technology, Wien, Austria,
[2] Österreichische Akademie der Wissenschaften - Institut für Schallforschung, Vienna, Austria,
[3] Technische Universität Graz, Institut für Wärmetechnik, Graz, Austria,
[4] Technische Universität Wien, Institut für Werkstofftechnologie, Bauphysik und Bauökologie, Austria,
[5] Universität Innsbruck, Institut für Konstruktion und Materialwissenschaften, Innsbruck, Austria

IEA HPT Annex 63 builds on Annex 51 to address the growing impact of acoustic issues on heat pump deployment. While Annex 51 laid the groundwork, Annex 63 focuses on the influence of placement, aiming to reduce noise-related market barriers. It expands to include cooling mode acoustics, psychoacoustics, and specific use cases such as urban and building environments. Each installation scenario is unique, highlighting the need for revised guidelines and digitally supported placement tools. Annex 63 fosters international collaboration, standardizes data, and supports the continued growth of heat pumps as a leading renewable and energy-efficient HVAC solution. This contribution gives an overview of the activities within IEA HPT Annex 63 especially focussing on Austrias contribution within the network.

Applied Physics

Tuesday, 19.08.2025, Room Elise Richter Saal

Time	ID	APPLIED PHYSICS I *Chair: Fabio Avino, EPF Lausanne*
14:00	551	**^{44}Ti – A new Trace Isotope for Astrophysics**
14:15	552	**M^2 as a Quantitative Measure of Beam Quality**
14:30	553	**Production and characterization of an isotopic Np spike for mass spectrometry**

14:00 — 551 — ^{44}Ti – A new Trace Isotope for Astrophysics

David Krebs [1], Martin Martschini [1], Silke Merchel [1], Karin Hain [1], Zeynep Talip [2]
[1] University of Vienna, Faculty of Physics, Isotope Physics, Vienna, Austria,
[2] Paul Scherrer Institute PSI, Laboratory of Radiochemistry, Villigen, Switzerland

The radioisotope ^{44}Ti can be detected in some rare core-collapse supernovae remnants, produced primarily via ^{40}Ca(α,γ)^{44}Ti. Its measurement by Accelerator Mass Spectrometry (AMS) has been hindered by intense isobaric interference from stable ^{44}Ca, necessitating large tandem accelerators (>10 MV). ^{44}Ti detection is investigated at the 3 MV Vienna Environmental Research Accelerator (VERA) using Ion-Laser InterAction Mass Spectrometry (ILIAMS). The AMS technique employs negative ion acceleration, molecular dissociation in a terminal stripper, and high-resolution magnetic/electric separation. Critical ^{44}Ca suppression was achieved through ion-gas reactions in the ion cooler (ILIAMS) and reduced ^{44}Ca backgrounds by $> 10^6$, allowing for measurements of ^{44}Ti/^{48}Ti around 5×10^{-14}. This enables ^{44}Ti measurements at VERA for cross section measurements of the reaction ^{40}Ca(α,γ)^{44}Ti.

14:15 — 552 — M^2 as a Quantitative Measure of Beam Quality

Filipp Lausch [1,2], Vito F. Pecile [1], Oliver H. Heckl [1]
[1] University of Vienna - Optical Metrology Group, Vienna, Austria,
[2] University of Vienna - Vienna Doctoral School in Physics, Vienna, Austria

Beam quality is a fundamental aspect for evaluating the performance of laser sources. M^2-measurements serve as the gold standard for beam quality assessment since the 1990s. The measured M^2-parameter indicates similarity to the fundamental Gaussian mode by describing a beams' divergence. However, in terms of the higher-order mode contribution, it acts as a qualitative measure that does not permit a quantitative statement. We introduce a framework to assess the fundamental mode content of a beam using M^2-measurements and establish a link between beam divergence and its mode composition. Our results enhance the utility of M^2-measurements in evaluating laser sources, coupling efficiencies, focusing performance, and long-distance propagation. This repositions M^2 from a qualitative figure to a quantitative tool in modern photonics.

14:30 — 553 — Production and characterization of an isotopic Np spike for mass spectrometry

Karin Hain [1], Andreas Wiederin [1], Martin Martschini [1], Aya Sakaguchi [2], Peter Steier [1], Akihiko Yokoyama [3]
[1] University of Vienna, Faculty of Physics, Vienna, Austria,
[2] University of Tsukuba, Institute of Pure and Applied Sciences, Tsukuba, Japan,
[3] Kanazawa University, Institute of Science and Engineering, Kanazawa, Japan

The second most abundant anthropogenic actinide in the environment ^{237}Np has great potential as an oceanographic tracer. An isotopic Np spike would provide a reliable normalization method for mass spectrometric ^{237}Np measurements. Such material has been produced via the ^{232}Th(^{7}Li,3n)^{236}Np reaction at the RIKEN Nishina center. The mass spectrometric separation of the co-produced isobars ^{236}U, ^{236}Pu presented a challenge for the spike characterization. An approach that combines Accelerator Mass Spectrometry, Anion Formation Isobar Analysis and the first non-chemical isobar separation in the actinide range using Ion Laser InterAction Mass Spectrometry has been developed to characterize a pilot Np spike.

This work was funded by the Austrian Science Fund (FWF): [I4803-N] and a Dimitrov Fellowship of the Austrian Academy of Sciences.

14:45 | **554**

Dark Field MOKE as a laboratory-based characterization tool for complex 3D magnetic nanostructures

Jakub Jurczyk [1], Naëmi Leo [2], Miguel Angel Cascales Sandoval [1], Amalio Fernández-Pacheco [1]
[1] Institute of Applied Physics, TU Wien, Austria,
[2] Department of Physics, School of Science, University of Loughborough, United Kingdom

The dark field magnetooptical Kerr effect (DF-MOKE) utilizes a laser beam to characterize magnetic properties of 3D nanostructures and so far has been used to investigate nanostructures with one reflection plane only. However, the development of 3D nano-printing methods, like focused electron beam induced deposition (FEBID) and two photon lithography (TPL), introduce a need for reliable method of magnetic characterization of structures with multiple reflection planes. Here we discuss possibilities and limitations of DF-MOKE for this purpose, by presenting the measurements of simplified system containing single nanostructures as well as arrays of them to provide multiple reflection planes.

EC Horizon 2020 Program, Contract No. 101001290 (3DNANOMAG).

15:00 | **555**

Ultrashort Picosecond Ion Pulse Generation by Laser-Stimulated Desorption

Alexander Redl, Markus Goldberger, Richard A. Wilhelm
TU Wien, Institute of Applied Physics, Vienna, Austria

Our novel laser-stimulated desorption technique enables generation of tunable picosecond ion pulses using an electrochemically etched tungsten nanotip (~150 nm tip radius), irradiated by a pulsed femtosecond 259 nm ultraviolet laser. Ion pulses are produced as the laser ionizes adsorbates on the tip, yielding time-of-flight pulse widths (FWHM) below 100 ps at ion kinetic energies of 8.5 keV. Operating in an ultrahigh vacuum chamber with minimal laser energy (~15 nJ/pulse), our setup enables generation of various elemental ions. The built-in synchronization between ion and optical pulses allows precise pump-probe experiments to investigate ion-solid interactions, including the study of surface dynamics or defect formation. This flexible, compact approach significantly advances capabilities in ultrafast materials science, surface analysis, and simulation validation.

15:15 | **556**

Femtosecond two-photon-absorption laser-induced-fluorescence in fusion-relevant hydrogen plasmas

Michael Goddijn [1], Marcelo Baquero-Ruiz [1], Michele Puppin [2], Simon Vincent [1], Yanis Andrebe [1], Arnaud Clément [1], Fabrizio Carbone [2], Ivo Furno [1]
[1] EPFL, Swiss Plasma Center (SPC), Lausanne, Switzerland,
[2] EPFL, Lausanne Centre for Ultrafast Science (LACUS), Lausanne, Switzerland

Two-photon-Absorption Laser-Induced Fluorescence (TALIF) is an established diagnostic for measuring neutral densities in low-temperature plasmas. We study the feasibility of femtosecond-pulsed TALIF in fusion-relevant plasmas, which could enable fast density measurements of atomic hydrogen (H) and its isotopes.

For this purpose, we develop a laser system that consists of a fs-pulsed laser and a fourth-harmonic generator. The system generates stable high-energy deep-UV pulses. The large bandwidth of the fs pulses allows us to excite the complete H population without scanning of the laser wavelength.

We perform fs-TALIF measurements in a krypton gas, which characterises the fluorescence and which will be used for calibration purposes. We perform initial fluorescence observations in steady-state H plasmas in the RAID linear device.

15:30 | *Coffee Break*

Time	ID	**Applied Physics II** *Chair: Fabio Avino, EPF Lausanne*
16:00	**561**	**Nanoscaled Spin-Wave Frequency Selective Limiter (FSL) and Delay Line for 5G Technology** *Kristýna Davídková [1], Khrystyna Levchenko [1], Florian Bruckner [1], Roman Verba [2], Rostyslav Serha [1], Fabian Majcen [1], Qi Wang [3], Morris Lindner [4], Carsten Dubs [4], Vincent Vlaminck [5], Jan Klíma [6], Michal Urbánek [6], Dieter Suess [1], Andrii Chumak [1]* *[1] University of Vienna, Faculty of Physics, Boltzmanngasse 5, Vienna, Austria,* *[2] V. G. Baryakhtar Institute of Magnetism of the NAS of Ukraine, Kyiv, Ukraine,* *[3] School of Physics, Huazhong University of Science and Technology, Luoyu Road 1037, Wuhan, China,* *[4] INNOVENT e. V. Technologieentwicklung, Prussingstrase 27 B, Jena, Germany,* *[5] IMT Atlantique, Lab-STICC—UMR 6285 CNRS, Technopole Brest-Iroise CS83818, Brest, France,* *[6] CEITEC BUT, Brno University of Technology, Purkyňova 123, Brno, Czech Republic* The ongoing demand for faster 5G communication systems requires RF devices to operate at higher frequencies, specifically 24.25 – 27.5 GHz. However, conventional RF components, such as power limiters, filters, and delay lines, face challenges due to increased noise, switching delays, and enhanced damping. Spin-wave-based devices offer a promising alternative, maintaining high efficiency at GHz frequencies, although they have predominantly been studied at the macroscale. We demonstrate a proof of concept for a nanoscale frequency-selective limiter and delay line based on spin-wave transmission in a 97-nm-thin YIG film. Spin waves are excited and detected using 250 nm-wide transducers. Devices are tested up to 25 GHz for two spin-wave modes, with key parameters such as power threshold, delay time, and insertion losses extracted.
16:15	**562**	**Novel InAs/AlSb interband detectors** *Stefania Isceri, Andreas Windischhofer, Miriam Giparakis, Rolf Szedlak, Werner Schrenk, Gottfried Strasser, Benedikt Schwarz, Aaron Maxwell Andrews* *TU Wien, Vienna, Austria* Quantum cascade detectors are room-temperature photovoltaic infrared devices based on intersubband transitions. We designed and grew four different InAs/AlSb QCDs on GaSb substrates and utilized the interband transitions to realize a short-wavelength infrared detector. Operating between 1.7 and 2.7 μm. We calculated the QCD absorption with applied electric fields between -16 – 16 kV/cm, including both the out-of-plane and in-plane contributions. By applying an electric field, the absorption peaks shift to different energies and the intensity increases. The room-temperature peak responsivities of the IB transitions was measured as a function of a bias voltage. At zero bias they are 2.8 – 24.8 mA/W for different designs and increase up to two orders of magnitude in the considered bias voltage range.
16:30	**563**	**Wavefront correction over large fields of view via cone tomography** *Juan David Munoz Bolanos, Johanes Locher, Maria Borozdova, Kibum Nam, Simon Moser, Monika Ritsch-Marte, Alexander Jesacher* *Medical University of Innsbruck, Innsbruck, Austria* Imaging objects in scattering media requires the correction of complex wave distortions. Adaptive optics and wavefront shaping can correct these distortions, but aberrations are rarely isoplanatic and vary spatially over the field of view. We propose a tomographic approach to reconstruct a scatterer's local refractive index distribution, allowing the calculation of aberration maps for larger fields of view. Wavefront measurements guide the approach at test points around the target area. We demonstrate the ability of our tomographic approach to provide spatial aberration maps through numerical simulations and proof-of-concept experiments.

16:45	**564**	**Towards Monte Carlo based Full Spectrum Modeling of Airborne Gamma-Ray Spectrometry Systems** *David Breitenmoser, PSI Villigen* Airborne gamma-ray spectrometry (AGRS) enables rapid identification and quantification of anthropogenic radionuclides over large areas, serving as an essential tool in emergency response to nuclear accidents and nuclear weapon detonations. This work presents a full spectrum modeling approach that overcomes critical limitations in AGRS calibration and data evaluation for emergency scenarios. The methodology integrates high-fidelity Monte Carlo simulations within a Bayesian inversion framework and has been extensively validated under laboratory and field conditions. It enables accurate quantification of any gamma-ray-emitting radionuclide, significantly expanding the detection capabilities and operational scope of AGRS systems worldwide.
17:15	**565**	**ILIAMS-assisted accelerator mass spectrometry measurements of long-lived radionuclides produced in nuclear fusion environment** *Carlos Vivo-Vilches [1], Esad Hrnjic [1], Martin Martschini [1], Lee W. Packer [2], Silke Merchel [1], Johannes H. Sterba [3], Karin Hain [1], Robin Golser [1]* *[1] University of Vienna, Faculty of Physics, Isotope Physics, Vienna, Austria,* *[2] UKAEA, Culham Campus, Abingdon, United Kingdom,* *[3] Center for Labelling and Isotope Production, TRIGA Center Atominstitut, TU Wien, Austria* To reliably assess the radionuclide inventories of future nuclear fusion reactors, different materials were irradiated in the Joint European Torus. The activities of long-lived radionuclides are too low for radiometric techniques. At the Vienna Environmental Research Accelerator (VERA), the potential of accelerator mass spectrometry for the detection of ^{91}Nb, ^{94}Nb and ^{93}Mo is investigated. Their measurement requires the use of VERA's Ion-Laser InterAction Mass Spectrometry (ILIAMS) setup for laser photodetachment to suppress their stable isobars. For ^{91}Nb and ^{94}Nb, ^{91}Zr and ^{94}Zr are suppressed just by collisions with the He buffer gas. This suppression is enhanced by photons from a 355 nm laser, which also suppress ^{94}Mo. For ^{93}Mo, isobaric ^{93}Nb is suppressed by photons from a 637 nm laser.
17:30	**566**	**Impact of divertor leg length on plasma-wall interaction in the TCV boundary plasma using self-consistent, global turbulence simulations** *Sergio Garcia Herreros, Christian Theiler, Paolo Ricci, EPFL - SPC, Lausanne, Switzerland* Different experimental campaigns at the TCV tokamak have focused on studying the impact of magnetic geometry on the power exhaust at the divertor region, showing a weak dependence on the poloidal leg length of the geometry. In order to achieve a deeper understanding of the role of turbulence when changing magnetic geometry, we perform different simulations of the TCV plasma changing the leg length of the magnetic configuration. This is done by means of GBS, a self-consistent 3D plasma turbulence code developed at the Swiss Plasma Center (SPC).
17:45	**567**	**Design of a Fast Reciprocating Diagnostic to Characterize the Boundary Plasma in the Tokamak à Configuration Variable** *Alysée Khan, Olivier Février, Christian Theiler, Hammam Elaian, TCV Team* *[1] Ecole Polytechnique Fédérale de Lausanne, Switzerland* Tokamaks are promising devices for achieving fusion energy, yet they involve complex plasma physics in the boundary of the confined plasma, where strong turbulent transport and plasma flows set heat and particle loads on the first wall. To establish, benchmark, and refine models describing these mechanisms, in-situ measurements of plasma parameters are essential. At the Swiss Plasma Center, the Fast Reciprocating Diagnostic (FReDi) is being developed for the Tokamak à Configuration Variable to measure boundary profiles of ion and electron temperatures, density, electric fields, and plasma flows using a flexible Langmuir probe array, Mach probes and Retarding Field Analyzers. In this talk, we detail the design of the diagnostic head to investigate the aforementioned processes under stringent environmental conditions.

18:00	**568**	**Trajectoids: Rolling stones downhill.** *Jean-Pierre Eckmann, University of Geneva, Switzerland* A cylinder will always roll downhill along a straight line. The question we ask: Given any curve, can one construct an object which will roll along that given curve? The answer is "for almost all curves it is possible". I will explain how one constructs (and 3d-prints) such objects, and, if time permits, what are the theoretical challenges. This talk is based on work, published in Nature, Notices AMS, and PRL.
18:15		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

ID	Applied Physics Poster
581	**Influence of impurity injection location on a tokamak plasma performance** *Riccardo Morgan, Christian Theiler, Olivier Février* *École Polytechnique Fédérale de Lausanne, Swiss Plasma Center (SPC), Switzerland* In tokamaks, intense heat fluxes strike localized areas of the reactor walls, risking damage and plasma contamination through erosion. Future reactors must therefore operate in a detached regime, where heat loads and plasma temperatures near the walls are greatly reduced. This can be achieved by seeding impurity gases, which promote radiative cooling in the boundary plasma. However, minimizing impurity penetration into the core plasma is critical. Nitrogen seeding experiments on TCV reveal that the choice of injection location strongly influences core contamination: seeding in the private flux region best preserves core purity, while still yielding optimal detachment access, which appears independent of the injection site. These results highlight the potential to optimize seeding strategies for future devices.
582	**Interpretation of Neutral Pressure Measurements and Design of a Novel Pressure Diagnostic Array for the TCV Tokamak through Monte Carlo Modelling with MolFlow** *Benjamin Brown, Olivier Février, Holger Reimerdes, Christian Theiler, Hammam Elaian, Marcello Baquero, Elena Tonello* *Swiss Plasma Center, EPFL, Lausanne, Switzerland* Neutral particles interacting with the plasma in the scrape-off-layer of tokamaks play an important role for plasma fueling and heat load mitigation. On the Tokamak à Configuration Variable (TCV), neutral pressure is inferred using Baratron Pressure Gauges (BPGs) and ASDEX type Pressure Gauges (APGs). These gauges are cross calibrated, in vacuum, with ambient temperature gas injection; however, significant discrepancies emerge during plasma discharges. Monte Carlo based free molecular flow simulations of the tokamak using the software MolFlow identified sources of transient and steady-state disagreement between the APGs and BPGs, in line with observed trends. The findings were further used to inform the design of novel APG array to be installed in 2026 with the Tightly-Baffled Long-Legged Divertor Upgrade on TCV.
583	**Design of 3D Printed Tips for Advanced Magnetic Force Microscopy** *Dominik Schramm [1], Jakub Jurczyk [1], Sabri Koraltan [1], Claas Abert [2], Amalio Fernández-Pacheco [1]* *[1] TU Wien, Austria, [2] University of Vienna, Austria* With the advancement in 3D nanofabrication techniques such as Focused Electron Beam Induced Deposition (FEBID), manufacturing of complex magnetic nanostructures emanating more complex stray fields becomes feasible. To quantify these fields, the development of a modified Vector- Magnetic Force Microscope (MFM), resolving all three spatial components of the stray field while still maintaining industrial feasibility, is targeted. To design an optimized MFM tip, highly sophisticated micromagnetic simulation frameworks (NeuralMag, magnum.pi) are leveraged to simulate an MFM signal. The simulator allows us to study for the first time the impact of tip geometry, inclination angle, magnetic state as well as additional oscillatory modes on the output.

584	**Action Spectroscopy of He-Tagged, Anionic Coinage Metal Clusters** *Martin Schmidt [1], Johannes Reichegger [1], Anna Maria Reider [1], Paul Scheier [1], Olga Lushchikova [2]* *[1] University of Innsbruck, Austria, [2] Kyushu University, Fukuoka, Japan* The production and spectroscopic investigation of anionic clusters is challenging due to their instability. By utilizing superfluid helium nanodroplets (HNDs), we successfully produced and stabilized small anionic silver and gold clusters ($Ag_{1}–_{9}$, $Au_{1}–_{9}$) in sufficient quantity for He-tagged VIS spectroscopy. HNDs are formed via supersonic expansion of precooled helium (~10 K) and cool further to 0.37 K by evaporative cooling. Subsequent electron impact creates multiply charged HNDs capable of picking up volatile dopants. Cluster formation and Penning ionization occur at the charge centers within the HNDs, while excess energy is dissipated through helium evaporation. Upon collision with a stainless-steel surface, the doped HNDs splash, releasing singly negatively charged, helium-tagged, low-temperature dopant clusters for spectroscopic analysis.
585	**Development of a quasi-optical high-magnetic-field millimeter-wave spectrometer** *Levente Hegyessy, Bence Szász, Dávid Szaller* *Budapest University of Technology and Economics, Budapest, Hungary* Electron spin resonance (ESR) in magnetically ordered systems typically occurs in the millimeter-wave range under standard laboratory magnetic fields. Here, we present a newly developed quasi-optical millimeter-wave spectrometer at the Budapest University of Technology. The instrument offers continuous frequency coverage from 50 to 250 GHz and supports both transmission and reflection experimental geometries. It operates without cryogens over a broad temperature range of 10 – 300 K and in magnetic fields up to 9 T. This versatile setup provides a powerful tool for investigating previously inaccessible optical phenomena related to low-frequency magnetic and magnetoelectric resonances.
586	**Updates on CREScent:** **High-Precision Electron Spectroscopy using Cyclotron Radiation Emissions** *Alberto Jose Saavedra Garcia, Hartmut Abele, Irina Pradler, Johannes Schilberg* *Atominstitut - TU Wien, Vienna, Austria* High-precision measurements of angular correlations in neutron beta decay address a number of questions which are at the forefront of particle physics. For a new generation of beta decay experiments, like the PERC (Proton Electron Decay Channel) experiment currently under construction in Munich, frequency-based beta spectroscopy methods using the cyclotron radiation emitted by electrons in a homogeneous magnetic field have been emerging as new approaches for high-precision beta spectroscopy. The CREScent experiment is a proof-of-principle experiment aiming to combine the CRES (Cyclotron Radiation Emission Spectroscopy)-technique with the signal amplification qualities of a RF cavity, naturally compensating for the extremely weak signal power of the expected cyclotron radiation pulses.
587	**Upgrade of the proton induced x-ray emission setup** **at the Vienna Environmental Research Accelerator (VERA)** *Leopold Unterweger, Michael Pavlenko, Karin Hain, Martin Martschini, Robin Golser* *University of Vienna, Faculty of Physics – Isotope Physics, VERA Laboratory, Wien, Austria* Proton Induced X-ray Emission (PIXE) is a non-destructive, multi-elemental analysis technique especially for light elements. This project extends the PIXE setup at VERA for thick sample analysis, such as air filters, by installing two new silicon drift detectors (SDDs). The new instrumentation has been characterized in terms of efficiency, resolution, solid angle, sensitivity and geometry dependent x-ray transmission. In addition, two beam normalization methods are being developed for quantitative analysis: using either Si x-rays from a Si_3N_4 window or Ar x-rays excited in ambient air. Since Ar can interfere with key elemental peaks (S, K, Cl), a He atmosphere is introduced to suppress Ar emission and whereby, simultaneously x-ray transmission is enhanced by factor (16.7 ± 0.2) for Si Kα.

Atomic Physics and Quantum Optics

Thursday, 21.08.2025, Room Elise Richter Saal

Time	ID	Atomic Physics and Quantum Optics I *Chair: Helmut Ritsch, Universität Innsbruck*
14:00	601	**Low Temperature Quantum Sensing with Single Nitrogen-Vacancy Centers in Diamond** *Jodok Happacher, Juanita Bocquel, Patrick Siegwolf, Patrick Maletinsky, Department of Physics, University of Basel* The Nitrogen-Vacancy (NV) center in diamond is a versatile quantum sensor with exceptional optical and spin properties, enabling high-sensitivity magnetic field detection and nanoscale imaging. We investigate the strain and magnetic field dependent photophysics of individual NV centers from cryogenic to ambient conditions. Our experimental data, supported by model predictions, provide new insights into the structure of the NV's excited states and its impact on the optical spin contrast, and thus on the performance of NVs as quantum sensors. Moreover, these findings pave the way for a novel all-optical electric field sensing method, for which we present initial imaging results.
14:30	602	**Quantum synchronization of twin limit-cycle oscillators** *Tobias Kehrer [1], Christoph Bruder [1], Parvinder Solanki [2]* *[1] Department of Physics, University of Basel, Klingelbergstrasse 82, CH-4056 Basel,* *[2] Institut für Theoretische Physik, Universität Tübingen, Auf der Morgenstelle 14, DE-72076 Tübingen* Limit cycles in classical systems are closed phase-space trajectories to which the system converges. Their quantum counterparts exhibit steady-state phase-space representations with ring-like structures of stable radius but no phase preference. Acting with an external drive on such quantum oscillators leads to phase localization of their steady state, i.e., phase synchronization. In this work, we propose a quantum system whose classical analogue hosts two limit cycles that are separated by their basins of attraction. In the quantum case, both limit cycles coexist and localize to distinct phases when coupled to an external drive. Furthermore, we demonstrate that coupling two such twin limit-cycle oscillators leads to simultaneous synchronization and synchronization blockades between different limit cycles of oscillator A and B.
14:45	603	**Rapid and Robust Hyperfine Qudit Gates in Trapped Neutral Atoms** *Johannes Krondorfer, Matthias Diez, Andreas Hauser* *Institute of Experimental Physics, Graz University of Technology, Graz, Austria* We investigate the optical control of nuclear spin qudits in trapped neutral ^{87}Sr atoms. Transitions between hyperfine levels in the electronic ground state are driven via detuned, polarized, and amplitude-modulated laser light near the $^1S_0$ to $^3P_1$ optical transition. We propose a strategy for the realization of rapid and robust single-qudit gates and demonstrate selective and coherent manipulation across the full qudit manifold. We identify the magnetic fields, laser parameters, and driving conditions required for high-fidelity single-qudit gates, and show through simulations that gate operations can surpass the fault-tolerance threshold even in the presence of realistic noise sources. These results highlight a scalable approach for high-dimensional quantum information processing, quantum memories, and advanced quantum technologies based on trapped neutral atoms.

15:00	**604**	**Detection of Spin System Dynamics in Transmission Electron Microscope** *Antonin Jaros, Michael Seifner, Martin Balaban, Johann Toyfl, Benjamin Czasch, Santiago Beltrán-Romero, Isobel Bicket, Philipp Haslinger* *Vienna Centre for Quantum Science and Technology, Wien, Austria* Microwave spectroscopy is used to probe key material properties. Spin states are altered by their local environment, providing insights into the specimen's atomic and chemical structure. However, these methods lack nanoscale spatial resolution. We present a novel experimental approach that synergically integrates microwave spectroscopy with transmission electron microscopy to leverage its high spatial resolution. Our technique enables in-situ detection of microwave-driven spin dynamics via free-space electron probe, realized through picoradian-scale deflections of the electron beam. These results represent a significant step forward in the emerging field of quantum electron microscopy, bridging spin physics and high-resolution electron optics. This platform offers broad potential in applications where high-sensitivity and high-resolution mapping of spin excitations is critical.
15:15	**605**	**Spectroscopy of Multilevel Disordered Atomic Clouds** *Aleksei Konovalov, Institute for Theoretical Physics, University of Innsbruck, AT-6020 Innsbruck* We theoretically investigate the excitation spectrum of a disordered superradiant cloud composed of multilevel atoms. Dipolar interactions between individual atoms in such systems give rise to cooperative effects, notably the collective Lamb shift (CLS) and cooperative decay rate (CDR). The multilevel atomic structure introduces various dipole transitions, which are not necessarily degenerate. Although often neglected, these transitions can interfere with one another, giving rise to cross-interference terms. We show that these terms significantly modify the interatomic dipolar interactions, leading to substantial changes in the CLS, particularly in high-density clouds. We consider two types of atomic ensembles: spherically symmetric clouds with homogeneous and Gaussian spatial distributions.
15:30		***Coffee Break***
		Atomic Physics and Quantum Optics II *Chair: Murad Abuzarli, Universität Wien*
16:00	**611**	**A minimalistic mirrorless laser** *Helmut Ritsch [1], Anna Bychek [1], Raphael Holzinger [2]* *[1] Universtät Innsbruck, Austria, [2] Harvard University, Boston, USA* We present a comprehensive study of collective 'free-space' lasing in a dense nanoscopic emitter arrangement where dipole-dipole coupled atomic emitters synchronize their emission and exhibit lasing behaviour without the need for an optical resonator. The total radiated power transitions from sub-radiant suppression under weak pumping to super-radiant enhancement at stronger pumping, while exhibiting directional emission confined to a narrow spatial angle. At the same time multiple independent spectral emission lines below the lasing threshold merge towards a single narrow spectral line at high pump power. Several spectral emission lines below the lasing threshold merge towards a single narrow spectral line at high pump power.
16:30	**612**	**Progress in matter-wave interference of mesoscopic metal nanoparticles** *Richard Ferstl, Sebastian Pedalino, Bruno Ramírez-Galindo, Hannah Foltas, Severin Sindelar, Stefan Gerlich, Markus Arndt* *Faculty of Physics, University of Vienna, Austria* Metal nanoparticles are a promising platform for universal near-field matter-wave interference experiments with scalable masses. Such experiments require innovative methods for beam formation, coherent beam splitters and efficient detectors. Here we discuss the state of the art in our work towards interference with photodepletion beam splitters using 266 nm deep ultraviolet light gratings. We also present the generation of intense, DUV laser light with wavelengths below 230 nm for the next generation of interferometers, aiming at clusters in the 10^6 amu range. The photon energy suffices to address a wide range of ionizable materials, as demonstrated recent cluster absorption measurements.

Time	No.	Contribution
16:45	613	**Enhanced Polarization-Based Dark-Field Microscopy via Controlled Beam Decollimation** *Fabian Maier, Martin Kernbach, Andreas W. Schell* *Institute of Semiconductor and Solid State Physics, JKU, Linz, Austria* Achieving high-contrast detection of single emitters at 4 K demands enhanced suppression of excitation-beam leakage. To address this, we present advancements in polarization-based dark-field microscopy optimized for single-emitter detection at cryogenic temperatures. Specifically, we introduce a novel approach that leverages controlled decollimation of the excitation beam to optimize the suppression of unwanted cross-polarized light while preserving probe-induced signal strength. Experimentally and numerically, we demonstrate how adjusting the initial collimation condition systematically affects the final coupling efficiencies into a single-mode fiber. Coupling efficiencies were estimated via non-sequential Zemax simulations and are currently being validated through targeted experiments. This methodology aims to improve detection sensitivity for quantum optics experiments and provides a suitable platform for exploring single-photon sources and nanoscale optical interactions.
17:00	614	**Source technologies for matter-wave interferometry with large metal clusters** *Severin Sindelar, Bruno E. Ramirez-Galindo, Sebastian Pedalino, Stefan Gerlich, Markus Arndt* *University of Vienna, Austria* Metal nanoparticles are currently the main candidates for direct interferometric tests of the quantum superposition principle within the 1 MDa mass range, providing not only a considerable improvement upon the current 28 kDa milestone but also opening a promising window for interferometric studies on the properties of metals at the interface to the bulk. A compatible source has to offer long-duration, high-brilliance beam of metal nanoparticles with masses up to 1 MDa and velocities below 30 m/s to be suited for the next generation of near-field matter-wave interferometers. Here we present our approach to such a cluster source, which is based on a thermal source inside a liquid nitrogen cooled aggregation chamber and an aerodynamic lens array.
17:15	615	**Driving Electron Spin Resonance with the Non-Radiative Near-Field of a Modulated Electron Beam** *Matthias Kolb [1], Thomas Spielauer [1], Thomas Weigner [1], Giovanni Boero [2], Dennis Rätzel [3], Philipp Haslinger [1]* *[1] Vienna Center for Quantum Science and Technology, TU Wien, Atominstitut, Austria,* *[2] École Polytechnique Fédérale de Lausanne, Switzerland,* *[3] ZARM, University of Bremen, Germany* The Franck-Hertz experiment first demonstrated the quantization of atomic energy levels using electrons, leveraging inelastic scattering. In this talk I will show promising preliminary results of a quantum system being coherently driven by the non-radiative near-field of a spatially deflected electron beam. The electron beam of an adapted Philipps XL30 Scanning Electron Microscope is electrostatically deflected and passes by an electron spin active sample (BDPA) sample to perform continuous wave Electron Spin Resonance (ESR), which is read out using a microcoil and a lock-in detection scheme. This approach could enable higher spatial resolution and non-destructive analytics by combining ESR and electron microscopy, especially by leveraging tailor-made near-fields modulated electron beams as painted potentials.

17:30	**616**	**Impact of Intensity Fluctuations on the Second-Order Coherence of High-Harmonic Emission** *Rafael T. Winkler, Denitsa Baykusheva, IST Austria, Klosterneuburg, Austria* The second order correlation function (g(2)) is a standard measure to distinguish between different photon sources, in particular between classical (coherent states) and quantum. Recently, this correlation function has been applied to investigate photon emission originating from high-harmonic generation (HHG), a highly non-perturbative process driven by high-intensity ultrashort laser pulses. In particular HHG generated in correlated materials is expected to carry quantum signatures of the underlying electronic correlations. We investigated, both theoretically and experimentally, how intensity fluctuations of the driving pulses influence g(2) of the upconverted radiation. Our analysis indicates that the intensity distribution of classical laser pulses significantly affects g(2), and we establish a link between driving pulse fluctuations and the observation of photon distribution in the harmonic emission.
17:45	**617**	**Deep ultraviolet laser light for cluster interferometry** *Hannah Foltas University of Vienna, Austria* Here we discuss the need for and recent progress in realizing a light source that can fulfill the requirements for photodepletion gratings for cluster matterwaves: A standing deep-ultraviolet (DUV) light wave shall ionize metallic or dielectric nanoparticles by single-photon-absorption and thus form a diffraction grating. Ionization can be achieved if the photon energy exceeds the cluster ionization energy, which depends on the material, size and charge state of the particle. We target a wavelength below 230 nm and a photon energy of 5.5 eV. Starting from a TiSa laser, we quadruple the lights frequency over two consecutive frequency-doubling cavities. We demonstrate the usefulness of this light source in absorption tests on cluster beams.
	~~**618**~~	*cancelled*
18:00		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

Friday, 22.08.2025, Room Elise Richter Saal

Time	ID	ATOMIC PHYSICS AND QUANTUM OPTICS III *Chair: Helmut Ritsch, Universität Innsbruck*
14:00	621	**Electron-Photon Entanglement** *Alexander Preimesberger [1,2], Sergei Bogdanov [1,2], Isobel Bicket [1,2], Philia Rembold [1], Philipp Haslinger [1,2]* *[1] Vienna Center for Quantum Science, Atominstitut, TU Wien, Austria, [2] USTEM, TU Wien, Austria* Entanglement is a key resource of emerging quantum technologies; it describes correlations between particles that defy classical physics. Although electron microscopes are well-established tools with unparalleled spatial resolution, quantum correlations arising in the electron-sample interaction so far remain unexploited. In this contribution, we will present recent progress in the study of entanglement in electron-photon pairs generated via cathodoluminescence in a transmission electron microscope. Employing coincidence-imaging techniques adapted from photonic quantum optics, we reconstruct near- and far-field “ghost” images of various transmission masks. This allows us to probe correlations in position and momentum – the continuous variables at the heart of imaging. We hope our studies will bridge the fields of electron microscopy and quantum optics.
14:15	622	**A cavity-microscope for micrometer-scale control of atom-photon interactions.** *Ekaterina Fedotova, Francesca Orsi, Rohit Bhatt, Michael Eichenberger, Léa Dubois, Jean-Philippe Brantut* *Institute of Physics and Center for Quantum Science and Engineering, EPFL, Lausanne, Switzerland* Cavity quantum electrodynamics (cQED) studies the strong interaction between atoms and the electromagnetic field of an optical cavity, enabling fast, sensitive measurements and quantum simulations. A major limitation is the loss of spatial information, as cavity-based measurements average atomic properties across the cavity mode. To tackle this, we built a cavity microscope that integrates a high-finesse cavity on-axis with high numerical-aperture lenses, enabling control of the light-matter coupling in a localized region within the atomic cloud. With this ability to control light-matter interactions, I will report our progress in understanding superradiant many-body systems using cQED with optical methods to randomize cavity-mediated interactions. These building blocks are key steps towards analog quantum simulations of arbitrary, all-to-all interacting systems like the SYK.
14:30	623	**Restoring thermalization in long-range quantum magnets with staggered magnetic fields** *Lucas Winter, Pietro Brighi, Andreas Nunnenkamp, University of Vienna, Austria* Quantum systems with strong long-range interactions often resist thermalization due to discrete spectra. We demonstrate that applying a staggered magnetic field to a strong long-range Heisenberg antiferromagnet restores thermalization for many initial states by breaking permutational symmetry. Using self-consistent mean-field theory and exact diagonalization, we reveal the energy spectrum, though composed of discrete subspaces, collectively forms a dense spectrum. Equilibration time is system-size independent, depending only on initial state fluctuations. For low to intermediate energy initial states, the long-time average matches the microcanonical ensemble. However, for energies in the middle of the spectrum ergodicity breaks down due to quantum scar-like eigenstates localized near unstable classical points. Our findings are testable on experimental platforms like Rydberg atoms or optical cavities.

14:45	624	**Subradiance and superradiant long-range excitation transport among quantum emitter ensembles in a waveguide** *Martin Fasser, Laurin Ostermann, Helmut Ritsch, Christoph Hotter* *1Institut für Theoretische Physik, Universität Innsbruck, Austria* In contrast to free space, in waveguides the dispersive and dissipative dipole-dipole interactions among quantum emitters exhibit a periodic behavior over remarkably long distances. We propose a novel setup exploiting this long-range periodicity in order to create highly excited subradiant states and facilitate fast controlled collective energy transport amongst far-apart ensembles coupled to a waveguide. In the optimally enhanced case this fast transfer appears as superradiant emission with subsequent superabsorption, yet, without a superradiant decay after the absorption. The highly excited subradiant states as well as the superradiant excitation transfer appear as suitable building blocks in applications like active atomic clocks, quantum batteries, quantum information protocols and quantum metrology procedures such as fiber-based Ramsey schemes.
15:00	625	**Hybrid Atom-Optomechanical System in the Quantum Regime** *Gian-Luca Schmid, University of Basel, Switzerland* Strong coupling between two systems enables the implementation of various quantum protocols, such as state swaps and entanglement generation. In our experiment, we couple the collective spin of a cold atomic ensemble to a mechanical oscillator separated by 2 meters. This is achieved via a free-space laser beam in a looped geometry, which mediates a versatile interaction between the two systems. In a first set of experiments, the coupling between the two systems was used to coherently cool the mechanical oscillator by the atomic spin in a room-temperature environment to T = 216 mK. By enhancing the light–matter interaction in each subsystem, we achieve high quantum cooperativity at both interfaces. These coherent interactions enable quantum-coherent coupling between the two systems.
15:15	626	**Self-organized momentum entanglement of atoms in a cavity** *Ivor Kresic [1], Gordon Robb [2], Gian-Luca Oppo [2], Thorsten Ackemann [2]* *[1] Technical University of Vienna, Austria, [2] University of Strathclyde, Glasgow, United Kingdom* Nearly all past studies of optomechanical self-organization of condensates in a cavity have focused on the semiclassical limit, where quantum correlations between the atomic degrees of freedom are neglected. We have recently discovered a mechanism by which significant quantum correlations can occur in this system. Using a few collective momentum mode expansion for a condensate field in a cavity allowed a numerical demonstration of self-organization into multiparticle entangled momentum states of identical atoms, also called Dicke-squeezed states. Such systems with translational U(1) symmetry turn out to also be ideally suited for SU(1,1) atom interferometry in a cavity. Here, the four-wave mixing processes occurring above self-organization threshold works as a parametric amplifier, enhancing the number of atoms in the sideband modes.
15:30	627	**Laser-Induced Quenching of the ^{229}Th nuclear clock isomer in CaF_2** *Fabian Schaden [1], Thomas Riebner [1], Ira Morawetz [1], Luca Toscani De Col [1], Georgy Kazakov [1], Kjeld Beeks [1], Tomas Sikorsky [1], Thorsten Schumm [1], Ke Zhang [2], Vishal Lal [2], Gregor Zitzer [2], Johannes Tiedau [2], Maksim Okhapkin [2], Ekkehard Peik [2]* *[1] Vienna Center for Quantum Science and Technology, Atominstitut, TU Wien, Austria,* *[2] Physikalisch-Technische Bundesanstalt, Braunschweig, Germany* The 10-minute radiative lifetime of the first excited $^{229}Th^{4+}$ nuclear state in ionic crystals leads to narrow spectroscopic linewidths, making it a promising candidate for solid-state nuclear clocks. However, this prolonged lifetime limits clock performance, as conventional electronic readout and state initialization methods, used in atomic clocks, are not applicable. We present Laser-Induced Quenching (LIQ) as a solution to control the $^{229}Th^{4+}$ nuclear isomer in CaF_2. Our findings show that sub-bandgap photons effectively shorten the isomer's lifetime, enabling LIQ for both depumping and state initialization. We also explore the influence of CW laser power, temperature, and dopant concentration on quenching, providing valuable insights for optimizing future solid-state nuclear clock technology.

15:45	628	**Optical Coherent Feedback Control of a Mechanical Oscillator** *Manel Bosch Aguilera, Universität Basel, Switzerland* Feedback is a powerful and ubiquitous technique both in classical and quantum system control. In quantum physics, measurements not only read out the state of the system but also modify it irreversibly. Coherent feedback instead coherently processes and feeds back quantum signals without actually measuring the system. We report on the realization and analysis of a coherent feedback platform to control the motional state of a nanomechanical membrane in an optical cavity, allowing us to control its resonance frequency and its damping rate, which we use to cool the membrane close to the quantum ground state, to a state with 4.9 phonons in a 20 K environment.
16:00		***END***

ID	Atomic Physics and Quantum Optics Poster
641	**Non-Hermitian Dynamics and Nonreciprocity of two Optically Coupled Nanoparticles** *Murad Abuzarli [1], Manuel Reisenbauer [1], Henning Rudolph [2], Livia Egyed [1], Klaus Hornberger [2], Anton V. Zasedatelev [1], Benjamin A. Stickler [3], Uroš Delić [1]* *[1] University of Vienna, Boltzmanngasse 5, AT-1090 Vienna,* *[2] University of Duisburg-Essen, Lotharstraße 1, DE-47048 Duisburg* *[3] Ulm University, Albert-Einstein-Allee 11, DE-89069 Ulm* Optical levitation of dielectric objects in vacuum provides a unique optomechanical platform due to versatile optical control of potentials and good isolation from the environment. Recently, tunable and nonreciprocal optical interactions have been measured between two nanoparticles, levitated in two distinct optical tweezers, with single-site readout of particle motion. I will present our experimental platform for tweezer arrays of nanoparticles, and show our recent results on non-Hermitian collective dynamics of two nonreciprocally interacting nanoparticles. We also observe a mechanical lasing transition once a threshold coupling rate is achieved, supported by our nonlinear theory model. Nonreciprocal interactions are expected to result in an even richer phase diagram of nonequilibrium dynamics for larger arrays of nanoparticles. This work paves the way towards upscaling this platform to such multiparticle arrays, in view of studying their nonequilibrium and collective mechanical behaviour in the quantum regime.
642	**A quantum processor with non-local interactions and programmable connectivity** *Johannes Schabbauer [1], Stephan Roschinski [1], Franz von Silva-Tarouca [1], Benjamin Czasch [1], Julian Léonard [1,2]* *[1] TU Wien, Atominstitut, Wien, Austria, [2] Institute of Science and Technology Austria, Klosterneuburg* Creating multiparticle entanglement deterministically is a big challenge for quantum information processing. While this was achieved locally in several systems, e.g. using Rydberg interactions between atoms, we present an experiment to engineer non-local interactions between single atoms in optical tweezers by strong coupling to an optical cavity. In our experiment we reach the single-atom strong-coupling regime using a fiber cavity (C=80). Our cavity setup enables optical access for high resolution microscopes, which are used for trapping, site-resolved imaging and addressing of single atoms. Our experiment enables us to study multi-particle entangled states and many-body systems with programmable interactions. The dispersive shift of the cavity resonance can be used to perform non-destructive measurements and to implement protocols for dissipative state preparation.

643	**Vibrationally Induced Molecular Magnetism** *Johannes Krondorfer, Matthias Diez, Albert Hirtenfelder, Andreas Hauser* *Institute of Experimental Physics, Graz University of Technology, Graz, Austria* Among magnetic dipole interactions in molecules, couplings between nuclear spin and nuclear motion – rotation and vibration – remain comparatively underexplored. Though much weaker than electron-spin interactions, this hyperfine interaction bears the potential of linking conventional infrared excitation techniques to nuclear spin control. We build a general theoretical framework for the interaction of nuclear motion and external magnetic fields or nuclear spins. Within this framework, we derive the concept of nuclear spin–vibration coupling, which appears in sufficiently symmetric molecular systems. Benchmark calculations are performed on selected molecules of current as well as historical, experimental relevance. Our results suggest that pseudo-rotational excitations can induce measurable shifts in NMR spectra, indicating a possible technological link between vibrational spectroscopy and nuclear spin dynamics.
644	**Bistable and oscillating phases in ordered atomic arrays** *Simon Panyella Pedersen, Thomas Pohl, TU Wien, Institute for Theoretical Physics, Austria* We study limit state phases of driven-dissipative 2D arrays of either two- or three-level emitters. It is known the former shows bistable and oscillating phases in the mean field for sufficiently small lattice spacings. We find such phases also for infinite arrays in the mean field. However, introducing either second order cumulants or considering finite arrays, the situation becomes less clear. For small lattice spacings the mean field approximation is in general poor, and going beyond we find neither bistable nor oscillating phases. For resonant lattice spacings the infinite case shows bistable and oscillating phases beyond mean field, but finite systems suffer from extremely slow convergence of the collective energies.
645	**Towards quantum metrology with ultracold Cesium** *Shreyas Gulhane [1,2], Stephanie Manz [1], Maximilian Lerchbaumer [1,2], Swadheen Dubey [1],* *Leon Domazetovski [1], Benedikt Gerstenecker [1], Thorsten Schumm [1,2]* *[1] Atominstitut, TU Wien, Austria,* *[2] VCQ - Vienna Center for Quantum Science and Technology, Wien, Austria* We report on our progress toward quantum sensing using ultracold cesium atoms confined in magnetic and optical traps on an atom chip. Our work explores the suitability of cesium for quantum sensing applications, with a particular focus on how the control of atomic interactions can enhance protocols that rely on non-classical states. As a case study, we demonstrate a trapped-atom interferometer implemented in an optical dipole trap.
646	**Free expansion of charged nanoparticles via electrostatic compensation** *David Steiner [1,2], Gregor Meier [2], Stefan Lindner [2], Yaakov Y. Fein [2], Markus Aspelmeyer [1,2], Nikolai Kiesel [2]* *[1] Institute for Quantum Optics and Quantum Information (IQOQI) Vienna, Austrian Academy of Sciences, Vienna, Austria,* *[2] Faculty of Physics, Vienna Center for Quantum Science and Technology (VCQ), University of Vienna, Austria* Levitated optomechanics allows for strong environmental isolation with precise optical control and readout, making nanoparticles a promising platform for exploring macroscopic quantum mechanics. A challenge is the small ground-state wave packet, typically a few pm for 150 nm silica nanoparticles, making preparation and readout of wavepacket features difficult. It is possible to expand this wavepacket by free evolution, where the trap is turned off, but charged particles are sensitive to stray electric fields as well as gravity, thereby limiting evolution times. Here, we release particles from an optical tweezer and use electrode pairs to compensate background forces during the free expansion. Wehave demonstrated evolution times up to 300 μs, which is an important step for experiments producing non-Gaussian states.

647

NQR Spectroscopy of $^{229}Th:CaF_2$ crystals

Michael Bartokos, Tomas Sikorsky, Martin Pimon, Thorsten Schumm, TU Wien, Austria

In the dawn of a solid-state nuclear clock, a readout scheme is needed to identify the current nuclear state. Nuclear Quadrupole Resonance (NQR) offers a promising method by driving hyperfine splitting caused by the interaction of the nuclear quadrupole moment with the crystal's electric field gradient. Unlike atomic clocks, which suffer from measurement dead-time, NQR allows simultaneous excitation and readout.
Even with the recent successes in exciting the nuclear transitions via lasers and resolving the hyperfine structure of ^{229}Th doped in CaF_2, directly driving the RF transitions remains challenging.
This work presents the current progress of NQR experiments using $^{229}Th:CaF_2$ crystals at TU Wien.

648

Towards two photon excitation of ^{229}Th nuclei in CaF_2 crystals

Ira Morawetz, Universität Wien, Austria

The recently achieved direct laser excitation of the ^{229}Th nucleus is a critical step towards developing a nuclear clock in a solid state system. However, the development of narrowband VUV laser systems at 148 nm has proven to be challenging. To circumvent this we propose a two-photon excitation approach. We present two experiments: A symmetric two-photon excitation using a CW-laser source at 296 nm and an asymmetric approach using the 3rd and 4th harmonic of a 1038 nm femtosecond laser source.

649

Scalable high-bandwidth quantum network platform with a room temperature quantum memory and a quantum dot single photon source.

Suyash Gaikwad, University of Basel, Switzerland

An efficient quantum network will comprise of a chain of quantum memories that are scalable, broadband and easy to build. Recently, we showed that quantum memories implemented in hot atomic vapor can show successful storage of non-classical photons. Further, as a part of a national collaboration 'Scalable high bandwidth Quantum Network (sQnet)', we aim to build a robust quantum network platform using a quantum dot single photon source, and interface it with a GHz bandwidth quantum memory implemented in MEMS-fabricated vapor cells. The retrieved photons will then be converted to telecom wavelengths for lossless transmission over large distances. This hybrid network architecture will exploit the properties of solid state devices and atomic physics to demonstrate entanglement distribution.

650

Collective cavity scattering by arrays of nanoparticles

Iurie Coroli [1], M. Raderer [1], Markus Aspelmeyer [1], U. Delic [2]
[1] University of Vienna, Faculty of Physics, Vienna Center for Quantum Science and Technology (VCQ), 1090 Vienna, Austria
[2] Atominstitut, TU Wien, 1020 Vienna, Austria

Polarizable objects, such as atoms, molecules, or nanoobjects, behave as induced dipoles if illuminated by a laser far away from any internal tran- sitions, where the emission is dominated by Rayleigh scattering, preserving phase coherence with the drive. A signature of the preserved coherence of the light scattering is the classical "super-" and "subradiance" of dipole emitters, where the total scattered light intensity scales as N^2 with an increasing number of scatterers in the case of constructive interference. The recent advances of tweezer arrays for neutral atoms enabled detailed probing of superradiance in cavity QED experiments in few-body regime, however, the collective en- hancement never reaches the superradiant N^2 scaling, either due to scattering at a not closed optical transition or ultimately limited by the large zero-point fluctuation of atoms compared to the laser wavelength.
In this work, we present an experiment that deterministically populates a one-dimensional tweezer array of silica nanoparticles within a high-finesse optical cavity. We use the particle as a cavity probe and the coherently scattered light to measure the Purcell factor of the cavity and the quantum cooperativity. We exploit the exquisite localization of nanoparticles due to their large mass and their large scattering rates to demonstrate nearly perfect constructive and destructive interference of coherently scattered light, where we observe superradiant scaling $\propto N^2$ and subradiance.

Coherent Optical Metrology Beyond Electric-Dipole-Allowed Transitions

This session has been organised in collaboration with the SFB COMB.AT

Friday, 22.08.2025, Room Erika Weinzierl Saal

Time	ID	Coherent Optical Metrology Beyond Electric-Dipole-Allowed Transitions (COMB.AT) *Chair: Mikhail Lemeshko, Institute of Science and Technology Austria*
11:00	671	**Theory of angular momentum transfer from light to molecules** *Mikhail Maslov [1], Georgios M. Koutentakis [1], Mateja Hrast [1], Oliver H. Heckl [2], Mikhail Lemeshko [1]* *[1] Institute of Science and Technology Austria (ISTA), Klosterneuburg, Austria,* *[2] Optical Metrology Group, Faculty of Physics, University of Vienna, Austria* Structured light carrying orbital angular momentum is instrumental to quantum control, spectroscopy, and sensing, yet a general theoretical framework for its interaction with complex particles has been missing. We present a symmetry-based Hamiltonian—applicable to arbitrary beam profiles and point-group symmetries—that couples spherical gradients of the light field to a particle's multipole moments. In ro-vibrational spectroscopy, our model quantifies how spin and orbital angular momenta of light are transferred to the molecular rotation and its center-of-mass motion, and reveals that transitions forbidden for plane waves can be strongly enhanced. Our analytical approach offers practical guidance for beam shaping and advances the use of light's angular momentum in precision spectroscopy, quantum technologies, and chiral sensing.
11:15	672	**Optical Vortex–Induced Orbital Angular Momentum Transfer in Ro-Vibrational Spectroscopy** *Georgios Koutentakis [1], Mikhail Maslov [1], Monika Bahl [2], Mateja Hrast [1], Tom Jungnickel [2], Timo Gaßen [2], Oliver H. Heckl [2], Mikhail Lemeshko [1]* *[1] Institute of Science and Technology Austria (ISTA), Klosterneuburg, Austria,* *[2] Optical Metrology group, Faculty of Physics, University of Vienna, Austria* Optical vortex beams carry both orbital (OAM) and spin angular momentum. We demonstrate that their helical phase excites ro-vibrational transitions that are forbidden with conventional light. In particular, the gradients of the structured electric field couple to molecular multipoles, permitting quadrupole and higher-order OAM exchange. Analytical and numerical studies reveal that, beyond modal purity quantified by the R-index, OAM transfer relies on the interplay of intrinsic and extrinsic orbital angular momentum. This allows us to classify all paraxial beam profiles in terms of a single figure of merit and identifies checkerboard modes as optimal for light-molecule OAM interaction. Such structured beams enable routes to manipulate molecular dynamics and herald future OAM-enabled spectroscopy for chiral molecules, biomolecules, and complex nanoparticles.
11:30	673	**The R-Index metric for evaluating OAM Content and mode purity in optical fields** *Monika Bahl [1], Georgios M. Koutentakis [2], Mikhail Maslov [2], Tom Jungnickel [1], Timo Gaßen [1], Oliver H. Heckl [1]* *[1] University of Vienna, Austria,* *[2] Institute of Science and Technology Austria (ISTA), Klosterneuburg, Austria* Light fields can carry orbital angular momentum (OAM), enabling rotational motion through light-matter interactions. Manipulating this momentum has driven major technological advances. Recent work by Maslov et al. on OAM interactions with molecules has renewed interest in using spectroscopy to observe otherwise forbidden transitions. We aim to identify optical fields with optimal OAM that could induce quadrupole transitions in cold molecules. This work introduces the R-index, a novel metric that quantifies the intrinsic canonical momentum or the OAM content in optical fields. The index is also used to assess the purity of a field, offering insight into the fidelity and robustness of OAM generation.

11:45	**674**	**Technical Developments of Multi-Pulse CPA for Nonlinear Spectroscopy** *Vinzenz Stummer [1], Edgar Kaksis [1], Matthias Schneller [1], Aref Imani [1], Paolo Carpeggiani [1], Hongtao Hu [1], Audrius Pugžlys [1,2], Andrius Baltuška [1,2]* *[1] TU Wien, Institut für Photonik, Vienna, Austria,* *[2] Center for Physical Sciences & Technology, Vilnius, Lithuania* Millijoule-energy, picosecond-spaced ultrashort pulses are advancing nonlinear spectroscopy, including ^{229}Th optical nuclear spectroscopy. Recent burst-mode amplification progress to boost spectral brightness for applications is reported.
12:00		***END***
12:30		***Poster Awards and Closing Ceremony***

ID	COMB.AT POSTER
681	**Shaped light in spectroscopy: how using light carrying OAM can enhance molecular spectroscopy** *Timo Gaßen [1], Mikhail Maslov [2], Georgios M. Koutentakis [2], Mirela Encheva [1], Tom Jungnickel [1], Monika Bahl [1], Oliver H. Heckl [1]* *[1] University of Vienna, Austria, [2] Institute of Science and Technology Austria, Klosterneuburg, Austria* Tailoring light to a spectroscopic application is common practice in high performance molecular spectroscopy this includes changing the properties of light by altering its frequency profile or pulse duration. However, changing the spatial structure of light is a practice underutilized in modern spectroscopy. Spatially shaped light could therefore open a new avenue in spectroscopy, studying fundamental light-molecule interactions. One such interaction was proposed in a publication of Maslov et al. where light carrying orbital angular momentum (OAM) modifies the underlying selection rules of the observed transitions. An experiment studying the influence OAM can have on the selection rules was brought forth, with the potential to not only learn about the molecule but also the nature of light carrying OAM.
682	**Towards the measurement of orbital angular momentum-enabled transitions in molecules** *Tom Jungnickel [1], Monika Bahl [1], Timo Gaßen [1], Georgios M. Koutentakis [2], Mikhail Maslov [2], Oliver H. Heckl [1]* *[1] University of Vienna, Austria, [2] Institute of Science and Technology Austria, Klosterneuburg, Austria* To measure orbital angular momentum enabled-transitions in the ro-vibrational spectrum of molecules sets unique requirements for the preparation of these molecules. OAM-enabled transitions only affect the magnetic quantum number and to split these degenerate transitions, we use the Stark effect. Furthermore, we utilise buffer gas cooling to limit the Doppler broadening of these transitions. The molecules will then interact with a mid-IR optical frequency comb inside of an enhancement cavity which will determine the transition positions using a Fourier-transform spectrometer. The symmetry of the OAM-carrying beams (e.g. Laguerre Gaussian beams) requires the electric field in the cell to be parallel to the beam. This work combines different simulations to design an optimal experimental setup for this complex experiment.
683	**Bottom-up Analysis of Ro-Vibrational Helical Dichroism** *Mateja Hrast, Georgios M. Koutentakis, Mikhail Maslov, Mikhail Lemeshko* *Institute of Science and Technology Austria, Klosterneuburg, Austria* Helical dichroism (HD) is a proposed method for the resolution of molecular chirality, employing the orbital angular momentum (OAM) of light and hypothesized to arise from electric-dipole–electric-quadrupole interactions. Going beyond the conventional assumptions, we propose a rigid theoretical framework for the analysis of HD, based on molecular symmetries and rotational eigenstates. Using our recently developed model of molecule-light interaction Hamiltonian we derive the rotational selection rules, which clearly establish that HD only emerges from spin-orbit coupled light, even for beams without far-field OAM or spin. Our findings refine the conditions for observing HD, shedding light on the outcome of prior experiments and guiding future designs for chiral sensing using structured light.

684 Coherent Optical Metrology Beyond Electric-Dipole-Allowed Transitions (COMB.AT)

Mikhail Lemeshko [2], Oliver Heckl [1], Andrius Baltuska [3], Thorsten Schumm [3], Adriana Palffy-Buss [4]
[1] Faculty of Physics, Wien, Austria, [2] ISTA, Klosterneuburg, Austria, [3] TU Wien, Austria,
[4] University of Würzburg, Germany

Coherent Optical Metrology Beyond Electric-Dipole-Allowed Transitions (COMB.AT) is a Special Research Program targeting disruptive advances in precision spectroscopy. We combine optical frequency combs carrying orbital angular momentum (OAM) with mid-IR and VUV spectroscopy to access dipole-forbidden transitions. The University of Vienna group (Heckl) pioneers OAM-enabled molecular spectroscopy; ISTA (Lemeshko) develops the theory of OAM–molecule interactions; TU Wien (Baltuška) provides ultrafast tailored light sources; TU Wien (Schumm) leads laser-driven nuclear spectroscopy with ^{229}Th; and Uni Würzburg (Palffy-Buß) advances nuclear excitation theory. In the long term, COMB.AT aims to test variations of fundamental constants—such as the fine-structure constant and proton-to-electron mass ratio—and to lay the groundwork for future molecular and nuclear clocks as precision tools beyond the Standard Model.

Surfaces, Interfaces and Thin Films

Tuesday, 19.08.2025, Room HS 2

Time	ID	**SURFACES, INTERFACES AND THIN FILMS I** *Chair: Anna Niggas, TU Wien*
14:00	**701**	**Angle-Selective Infrared Reflection Absorption Spectroscopy on Oxide Surfaces** *David Rath, Jiri Pavelec, Moritz Eder, Nail Barama, Ulrike Diebold, Michael Schmid, Gareth S. Parkinson* *TU Wien, Institute of Applied Physics, Austria* Infrared (IR) spectroscopy is a versatile tool to identify molecular species and their structures based on their characteristic vibrational frequencies, which is crucial in investigating single- atom catalysts (SACs), making Infrared Reflection Absorption Spectroscopy (IRAS) an ideal spectroscopic method due to its high surface sensitivity. In this contribution, an IRAS design optimized for SACs on oxide substrates in UHV will be presented. A novel approach was developed to perform incidence-angle-selective IRAS, which enhances peak heights while reducing noise levels. The first measurement results on the rutile TiO_2(110) surface will also be presented.
14:30	**702**	**Atomically-resolved surface structure: The prerequisite for understanding surfaces at the atomic level** *Ulrike Diebold, TU Wien, Austria* Solid surfaces often exhibit reconstructions—structures with unit cells that differ significantly from a simple bulk truncation. These reconstructions form to minimise the surface energy, and can change in response to the chemical potential, whichdepends on sample temperature and the gas pressure. Knowing the surface structure is essential for understanding surface chemistry and is critical for density functional theory (DFT) calculations. I will present results on resolving the often extensive reconstructions occurring at oxide surfaces, particularly in multi-component oxides. I will also highlight our group's efforts to revive LEED-IV, the technique best suited for determining accurate surface geometries, and recent work on predicting surface structures using machine learning techniques.
14:45	**703**	**Valence Band states of copper phthalocyanines on Ag(111): hybridised states or spin splitting?** *Francesco Presel, Mike Ramsey, Martin Sterrer, University of Graz, Austria* Copper phthalocyanines have shown great promise for applications in organic electronics, light harvesting and as single-molecule magnets. Their adsorption on metal substrates has important implications on their electronic and magnetic properties, as charge transfer can lead either to quenching, or to an enhancement of the magnetic momentum, with completely opposite effects on different substrates. For this reason, a precise characterization of the molecular orbitals involved is crucial. Here we show that upon adsorption on the Ag(111) surface, several new states are observed in the valence band. By a comprehensive mapping of the reciprocal space with Photoemission Orbital Tomography, we could disentangle the roles of hybridization and of the combination of spins in the molecular orbitals.

15:00 | **704**

The surface structure of $Al_2O_3(0001)$

Jan Balajka [1], Johanna Hütner [1], Andrea Conti [1], David Kugler [1], Florian Mittendorfer [1], Georg Kresse [2], Michael Schmid [1], Ulrike Diebold [1]
[1] TU Wien, Austria, [2] University of Vienna, Austria

Aluminum oxide (Al_2O_3) is a key material in nanotechnology, electronics and catalysis. Despite the broad technological application, the surface structure of Al_2O_3 basal (0001) plane has long evaded precise determination due to its structural complexity and insulating character. Non-contact atomic force microscopy (nc-AFM), was used to directly visualize the distribution of surface O and Al atoms within the ($\sqrt{31} \times \sqrt{31}$)R ± 9° reconstructed surface. Computational modeling provided the structure of the subsurface layers.
Furthermore, we show that the unreconstructed (1 × 1) structure is metastable and present only in small regions within an otherwise rough and disordered surface. A flat and stable surface is only achieved upon annealing at high temperatures via direct transformation to the ($\sqrt{31} \times \sqrt{31}$)R ± 9° structure.

15:15 | **705**

Stabilization of the polar spinel $MgAl_2O_4(001)$ surface by an Al-rich reconstruction

David Kugler [1], Andrea Conti [1], Johanna I. Hütner [1], Soumyajit Rajak [2], Matthias Meier [1], Nan Jiang [2], Florian Mittendorfer [1], Michael Schmid [1], Ulrike Diebold [1], Gareth S. Parkinson [1], Jan Balajka [1]
[1] Institute of Applied Physics, TU Wien, Austria,
[2] Department of Chemistry, University of Illinois Chicago, USA

The atomic-scale surface structure of spinel oxides is key to understanding their catalytic properties. Magnesium aluminate ($MgAl_2O_4$, spinel) is a wide-gap insulator and poses considerable challenges for experimental surface structure determination. Noncontact atomic force microscopy (nc-AFM) with a qPlus sensor and a well-defined tip apex allowed us to directly resolve the surface structure with atomic resolution and chemical sensitivity. The $MgAl_2O_4(001)$ surface adopts a c(2 × 4) reconstruction accompanied by an increase of the Al/Mg ratio, as detected by x-ray photoelectron spectroscopy (XPS). The reconstructed surface is enriched in aluminum and contains ordered pairs of octahedrally coordinated magnesium atoms replacing their tetrahedral bulk sites. This charge redistribution within the reconstructed surface layer stabilizes the otherwise polar $MgAl_2O_4(001)$ termination.

15:30 | ***Coffee Break***

Surfaces, Interfaces and Thin Films II

Chair: Margareta Wagner, TU Wien

16:00 | **711**

Charging, metalation and tautomerization of 2H-Phthalocyanine on ultrathin MgO films

Martin Sterrer, Max Niederreiter, Francesco Presel, Institute of Physics, Graz, Austria

In this contribution, we present a detailed characterization of the adsorption and self-assembly of 2H-Phthalocyanine on the surface of ultrathin MgO(001) films grown onAg(001). Using, STM/STS, XPS, NEXAFS and photoemission orbital tomography, we have characterized the charge state, the thermally-driven self-metalation reaction, and the tautomerization reaction of the molecules. Special focus is put on the tautomerization reaction, which has been in detailed studied with STM. Additionally, the charge state of the molecules has been manipulated using workfunction tuning of the MgO(001)/Ag(001) substrate. Our studies shows that control over the metalation and charge state of the molecules can be achieved.

16:15	**712**	**Atomic-Scale Insights into Copper Cluster Growth on Tunable Magnesium Oxide Thin Films on Ag(100)** *Maximilian Laßhofer, University of Graz, Institute of Physics, NAWI Graz, Austria* Well-controlled magnesium oxide (MgO) thin films on Ag(100) serve as ideal decoupling layers for studying metal nanostructures and charge transfer phenomena. Using Scanning Tunneling Microscopy (STM), we investigate growth conditions that yield consistent MgO morphology and demonstrate post-growth oxygen treatments for tuning the work function. In the submonolayer regime, stoichiometric conditions produce bilayer islands with ⟨100⟩ edges, embedded one layer deep in the Ag substrate, whereas oxygen-deficient growth favors ⟨110⟩ edges. Upon deposition, single Cu atoms exhibit partial charge transfer, with approximately one-third appearing negatively charged. Thermal annealing induces three-dimensional cluster formation, with non-planar geometries emerging for clusters of three atoms or more - enabling the study of quantum size effects of Cu clusters on an ultrathin insulating support.
16:30	**713**	**Atomic-scale surface chemistry of $CaSiO_3$: interaction with water and carbon dioxide** *Giada Franceschi [1], Luca Lezuo [1], Andrea Conti [1], Alexander Hoheneder [1], Elena Vaníčková [2], Domitilla Aloi [1], Rainer Abart [3], Florian Mittendorfer [1], Michael Schmid [1], Ulrike Diebold [1]* *[1] TU Wien, Austria, [2] Brno University of Technology, Czechia, [3] Uni Wien, Austria* Wollastonite ($CaSiO_3$) is a mineral with high reactivity towards atmospheric CO_2 sequestration. To gain a mechanistic understanding of this process, we cleave (100)-oriented samples in ultrahigh vacuum and expose them to controlled amounts of H_2O and CO_2 while maintaining the surface at 100 K. Using non-contact atomic force microscopy with functionalized tips, combined with ab-initio density functional theory, we determine the atomic structure of the cleaved surfaces and the adsorption configurations of H_2O and CO_2. The cleaved surface exposes calcium atoms and silica tetrahedra in a rectangular pattern. At low coverage, water adsorbs molecularly without a barrier in a configuration not reported in previous literature, and reacts with CO_2 to form stable carbonates. At larger coverages, it forms one-dimensional stripes.
16:45	**714**	**Characterization of CO_2 adsorption configurations on In_2O_3(111)** *Sarah Tobisch [1], Andreas Ziegler [2], Marco Knapp [1], Michael Schmid [1], Ulrike Diebold [1], Bernd Meyer [2], Margareta Wagner [1]* *[1] TU Wien, Austria, [2] FAU Erlangen-Nürnberg, Erlangen, Germany* Promising catalysts for the hydrogenation of CO_2 to methanol are highly desired to address the pressing issue of rising carbon emissions. In_2O_3 has gained attention as a powder catalyst due to its high selectivity for methanol synthesis from CO_2 reduction. Since the important reactions take place at the interface,understanding the fundamental properties and behavior of molecular species on well-defined surfaces is crucial for designing model catalysts. Here, the adsorption of CO_2 molecules on the In_2O_3(111) surface was investigated in detail at the atomic scale and under ultra-high vacuum (UHV) conditions via non-contact atomic force microscopy (nc-AFM), and compared to results from temperature programmed desorption (TPD) and x-ray photoelectron spectroscopy (XPS) measurements, as well as density functional theory calculations (DFT).
17:00	**715**	**A Multi-Technique Approach to Characterize Responsive Nanostructures** *Sumea Klokic [1], Benedetta Marmiroli [1], Giovanni Birarda [2], Rupert Kargl [1], Heinz Amenitsch [1]* *[1] Technical University of Graz, Austria, [2] Elettra Sincrotrone, Trieste, Italy* Responsive crystalline nanostructures that react to stimuli like light offer strong potential for energy storage, drug delivery, and gas sequestration. A key challenge, especially in thin films, is accurately determining the extent and duration of the structural photo-response—essential for designing systems with tunable, remote-controlled kinetics. Using metal-organic frameworks as model systems, we show that dynamic behavior depends on crystallite geometry, morphology, and composition. A multi-technique approach is crucial to capture these interdependencies and assess response timescales. We demonstrate that time-resolved grazing incidence X-ray scattering, infrared spectroscopy, and quartz crystal microbalance with dissipation monitoring (QCM-D) effectively track light-induced structural changes, highlighting the promise of photo-responsive nanostructures in CO_2 capture and mechanical energy storage.

17:15	**716**	**Surface Resonant Raman Scattering from Cu(110)** *Sarang Bhasme, Mariella Denk, Simon Kalteis, Peter Zeppenfeld* *Surface Science Department, Institute of Experimental Physics,* *Johannes Kepler University, Linz, Austria* We have recently demonstrated the possibility to investigate surface phonons on metals by surface resonant Raman spectroscopy (SRRS), in which the Raman cross section is significantly enhanced by resonant excitation of optical transitions involving surface electronic states. Expanding on this work, we investigate the phonon and electron scattering mechanism on clean and adsorbate-modified Cu(110) surfaces using SRRS and reflectance difference spectroscopy under ultra-high vacuum conditions and variable temperatures. While modifications of the Cu(110) surface via ion bombardment and by adsorption of molecules O_2, CO are expected to influence Raman signals, our results indicate that such effects are strongly dependent on the excitation wavelength. We plan to further explore this wavelength dependence and perform complementary measurements with 1.9 eV laser excitation.
17:30	**717**	**Multi-technique characterization and stabilization of single-atom catalysts: $Rh_1/TiO_2(110)$** *Faith Lewis, Moritz Eder, Johanna Hütner, Panukorn Sombut, Maosheng Hao, David Rath, Jan Balajka, Ulrike Diebold, Michael Schmid, Jiri Pavelec, Florian Libisch, Gareth Parkinson* *TU Wien, Austria* In single-atom catalysis (SAC), metal atoms are assumed to stay isolated on oxide supports, but rhodium adatoms tend to sinter into clusters on $TiO_2(110)$ above 150 K. Interestingly, CO exposure causes these clusters to redisperse into stable geminal dicarbonyls ($Rh(CO)_2$), a behavior seen through IR on powders. Using a newly integrated IRAS system, a procedure for forming these gem-dicarbonyls on a TiO_2 single crystal was established. I will present a multi-technique characterization of these species using STM, nc-AFM, IRAS, XPS, and DFT. Our results provide detailed new geometric and electronic insights, highlighting the value of surface science for understanding SAC behavior and supporting theoretical models.
17:45	**718**	**Thermal Stability of Platinum Adatoms on $Fe_2O_3(1\bar{1}02)$** *Ali Rafsanjani-Abbasi [1], Florian Buchner [2], Faith J. Lewis [1], Lena Puntscher [1], Florian Kraushofer [1], Panukorn Sombut [1], Moritz Eder [1], Jiří Pavelec [1], Erik Rheinfrank [1], Giada Franceschi [1], Viktor Birschitzky [3], Michele Riva [1], Cesare Franchini [3,4], Michael Schmid [1], Ulrike Diebold [1], Matthias Meier [1,3], Georg K. H. Madsen [2], Gareth S. Parkinson [1]* *[1] Inst. of Applied Physics, TU Wien, Austria, [2] Inst. of Materials Chemistry, TU Wien, Austria,* *[3] Faculty of Physics & Center for Computational Materials Science, University of Vienna, Austria,* *[4] Dipartimento di Fisica e Astronomia, Università di Bologna, Italy* We investigated how Pt atoms bind to $Fe_2O_3(1\bar{1}02)$, a common support in single-atom catalysts (SACs). We showed using STM, XPS, a computational evolutionary search, and DFT that Pt atoms reconfigure the lattice to form pseudolinear coordination with surface oxygen. Here we present new results on the thermal stability of this system. We performed annealing under UHV and O_2 background conditions and observed that O_2 promotes the formation of Pt dimers, trimers, and hexamers on the surface. These results, supported by STM and XPS, highlight the crucial role of oxygen in Pt aggregation and restructuring, offering valuable insights into the behavior of SAC systems under reactive environments.

18:00	**719**	**A complex temperature-dependent Rashba spin splitting in ferroelectric topological crystalline insulator** *Tetiana Zakusylo [1], Mahdi Hajlaoui [1], Takuya Takashiro [1], Lakshmi Sajeev [2], Marcin Rosmus [3], Ondřej Caha [2], Natalia Olszowska [3], Gauthier Krizman [4], Gunther Springholz [1]* *[1] Institute of Semiconductor and Solid State Physics, Johannes Kepler University, Linz, Austria,* *[2] Department of Condensed Matter Physics, Masaryk University, Brno, Czech Republic,* *[3] National Synchrotron Radiation Centre SOLARIS, Jagiellonian University, Kraków, Poland,* *[4] Laboratoire de Physique, ENS, Paris, France* Topological crystalline insulators (TCIs) possess a non-trivial electronic band structure featuring topologically protected surface states arising from band inversion and global symmetries. Of particular interest are systems where non-trivial topology can be linked with ferroelectricity, leading to a novel class of ferroelectric TCIs. A new approach presented in this work is to induce ferroelectricity in IV-VI TCI material by alloying it with Ge. For this purpose, we investigated the band structure of PbSnGeSe quantum well (QW) heterostructures epitaxially grown on BaF_2(111) substrates. By means of ARPES, we reveal the complex temperature-dependent Rashba type spin splitting in PbSnGeSe QWs that occurs below the Curie temperature of the ferroelectric phase transition, uncovering the effect of ferroelectricity on the topological band structure.
18:15		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***

Thursday, 21.08.2025, Room HS 2

Time	ID	**Surfaces, Interfaces and Thin Films III** *Chair: Martin Sterrer, Universität Graz*
11:00	**721**	**Angle-resolved ion-induced electron emission spectroscopy from surfaces** *Anna Niggas, Victoria Vojtech, Filip Vuković, Friedrich Aumayr, Richard A. Wilhelm* *TU Wien, Austria* Secondary electron emission is a key energy dissipation process when ions impact a surface. While total electron yields were studied extensively, angle- and energy-resolved data on low-energy electrons remain scarce. We installed an electron-beam ion source at ASPHERE III (DESY), enabling angle-resolved ion-induced electron emission spectroscopy. We find that angular electron emission patterns depend on the ion charge: singly-charged ions yield a cosine-like distribution, while higher charge states produce larger yields and broader angular spreads with a decrease along the surface normal. We explain this through space charge effects, causing repulsion of electrons starting near the surface normal. An angular distortion may be expected also for other (photo-)electron spectroscopy methods, where the total electron yield is significantly larger than unity.
11:30	**722**	**Artificial Intelligence for Surface-Sensitive Materials Characterization: A Transformer for High-Throughput Quantitative X-ray Photoelectron Spectroscopy** *Florian Simperl, Wolfgang Werner, TU Wien, Austria* X-ray photoelectron spectroscopy (XPS) is a surface-sensitive (< 10 nm) characterization technique employed to probe material properties such as chemical composition, layer thickness, and oxidation states. Conventional XPS analysis requires expert-driven, iterative peak fitting routines, which are both time-intensive and highly subjective. We developed an automated quantitative XPS analysis pipeline integrating our Simulation of Electron Spectra for Surface Analysis (SESSA) software with a transformer-based neural network. The model was trained, validated, and tested on 8.2 million simulated spectra derived from 7587 organic and inorganic bulk materials. It correctly identifies 82 % of materials in the test set, with 80 % of predicted elemental concentrations falling below a typical experimental quantification threshold of 20 % for element-wise concentration, demonstrating robust performance for automated spectral interpretation.

11:45	**723**	**The Response of a High-Sensitivity Quartz Crystal Microbalance to MeV Ion Irradiation** *Martina Fellinger [1], Michael Schmid [1], Eduardo Pitthan [2], Christian Cupak [1], Friedrich Aumayr [1], Daniel Primetzhofer [2]* *[1] Institute of Applied Physics, TU Wien, Austria,* *[2] Department of Physics and Astronomy, Uppsala University, Sweden* Quartz Crystal Microbalances (QCMs) can detect mass changes with high precision and are widely used in thin film deposition and sputtering studies. QCMs can only measure total net mass changes and cannot resolve contributions from individual elements. To provide elemental information, QCMs can be combined with Ion Beam Analysis (IBA). IBA, however, uses MeV-ion irradiation and the response of a QCM to such high localized thermal loads has not been investigated previously. Therefore, this study investigates QCM behaviour under such conditions, revealing a twofold response. Systematic tests and FEM simulations allow us to explain the observed effects. These findings allow conclusions about the feasibility of integrating QCMs with IBA for erosion studies.
12:00	**724**	**Oscillator-Model-Based Analysis of Ellipsometric Spectra in Combinatorial Unary and Binary Material Samples** *Máté Podráczki [1], Péter Petrik [2]* *[1] Budapest University of Technology and Economics Department of Physics, Budapest, Hungary,* *[2] Photonics Laboratory at the Centre for Energy Research of the Eötvös Loránd Research Network, Budapest, Hungary* Combinatorial materials enable rapid, high-throughput exploration of composition-structure-property relationships by synthesizing and screening large composition spreads in parallel, accelerating discovery of functional materials across electronics, energy, and photonics applications. Spectroscopic ellipsometry oscillator models, such as Lorentz, Tauc–Lorentz, and Gaussian oscillators, enforce Kramers–Kronig consistency and physically represent interband, vibrational, and free-carrier resonances, ensuring accurate extraction of dielectric functions (ε_1, ε_2) across graded material libraries. Applying these models to combinatorial unary and binary samples allows systematic mapping of optical constants (n, k), bandgap energies as functions of composition, facilitating data-driven materials optimization.
12:15		
12:30		***Lunch***
		SURFACES, INTERFACES AND THIN FILMS IV *Chair: Giada Franceschi, TU Wien*
14:00	**731**	**Revealing Solar Wind Erosion of Lunar Regolith through High-Precision Experiments and 3D Modeling** *Johannes Brötzner [1], Herbert Biber [1], Paul Stefan Szabo [2], Noah Jäggi [3], Martina Fellinger [1], Gyula Nagy [1], Eduardo Pitthan [4], Daniel Primetzhofer [4], Richard Arthur Wilhelm [1], Peter Wurz [5], André Galli [5], Friedrich Aumayr [1]* *[1] TU Wien, Institute of Applied Physics, Austria,* *[2] University of California, Space Sciences Laboratory, Berkeley, USA,* *[3] University of Virginia, Material Science and Engineering Department, Charlottesville, USA,* *[4] Uppsala University, Department of Physics and Astronomy, Uppsala, Sweden,* *[5] University of Bern, Physics Institute, Space Science and Planetology, Bern, Switzerland* The Moon's exosphere forms through processes like micrometeoroid impact vaporization and solar wind sputtering, but their relative importance remains uncertain. Here, we present the first direct, high-precision measurements of solar wind sputtering using real lunar material (Apollo 16 sample 68501), supported by advanced 3D simulations. We find sputtering yields up to an order of magnitude lower than previously assumed, mainly due to surface roughness and porosity suppressing particle ejection. Our results offer experimentally validated sputter yields, resolving key uncertainties in exosphere models. This work is crucial for interpreting data from upcoming missions like Artemis and BepiColombo and advances our understanding of surface evolution on rocky bodies across the solar system.

14:15	**732**	**Quantification of nanoparticle adhesion using atomic force microscopy** *Markus Kratzer [2], Aydan Çiçek [1], Christian Mitterer [1], Christian Teichert [2]* *[1] Department of Materials Science, Technical University of Leoben, Austria,* *[2] Chair of Physics, Department Physics, Mechanics and Electrical Engineering, Technical University of Leoben, Austria* Nanoparticle-surfaces-adhesion is crucialfor their performance in many applications. However, it is extremely difficult to gain direct access to these properties. Here, we examine the adhesion of copper nanoparticles (NPs) to silicon substrates. The NPs were fabricated and deposited via a DC magnetron sputtering gas aggregation source under varying operating parameters. Atomic force microscopy (AFM) was utilized for NP manipulation and to measure lateral forces necessary for their displacement. The work of adhesion was deduced from lateral forces and manipulation distance. Interesting dependencies on nanoparticle size and landing conditions were found, suggesting a rather complex deposition scenario. This study underscores the suitability of AFM in characterizing adhesion on the nanoscale and offers insights into future strategies for tailoring nanoparticle/substrate interactions.
14:30	**733**	**Ion adsorption at charged interfaces:** **visualization and quantification of ion-specific effects and water structure** *Markus Valtiner, Matteo Olgiati, Florian Altmann, Alper Celebi, Laura Mears* *Technische Universität Wien, Austria* Resolution on the hydration structure of solid/liquid interfaces has lately gained significant interest due to the emerging electrochemistry-based technologies for green energy production and storage. At electrified (solid-liquid) interfaces, charged or dipolar molecules (e.g., ions, water molecules) can re-organize at the surface and influence reactivity. Here I will show how the energetics of a solid-liquid interface can be visualized experimentally with high-resolution AFM. Our approach allows to visualize the populations of adsorbing of ions at charged surfaces, revealing adsorption mechanisms for weakly and strongly hydrated ions, respectively. Understanding such competition as a function of type and concentration of ions allows us to unravel the interfacial thermodynamics directly from AFM data, which has been so far mainly exclusive to MD simulations.
14:45	**734**	**How is the hydrophobic force modified by an oscillation frequency in saline conditions?** *Chiara Wagner, Paul Stöcher, Laura Mears, Markus Valtiner* *Institute for Applied Physics, Vienna University of Technology, Austria* There have been many investigations over the years regarding the mechanism behind the hydrophobic force and over how long a range it can be felt. We present a detailed set of AFM force measurements of hydrophobic SAM modified surfaces, with varying salt concentration and oscillation frequency (0 - 2kHz). We observe dynamic changes in the force curve characteristics with both salt concentration and oscillation frequency. The changes lead to a reduction of the average force with increasing applied frequency, while multiple distinct characteristic curves are present and enhanced by certain conditions. We also notice changes in the range of the force away from the surface. Altogether, the results we will present bring new insight into the mechanism of hydrophobic interactions.

15:00	**735**	**Laser-Induced Phase Transformations at the Ti/SiC Interface: Microstructural and Chemical Insights** *Elahe Akbari, Martin Irma Mickael Buessler, Rishikesh Maity, Andreas Nenning, Markus Valtiner* *Christian Doppler Laboratory for Surface and Interface Engineering, TU Wien, Austria* Silicon carbide (SiC) is widely used in high-frequency, high-temperature, and high-power applications due to its wide bandgap and high breakdown field. Understanding metal/SiC interactions is critical for ensuring reliable device performance. In this study, we investigate the effect of laser thermal annealing (LTA, 1.6 – 5.2 J/cm^2) on the thermal decomposition of SiC and subsequent phase formation in Ti/SiC systems. A custom in-house LTA setup enables precise thermal control, promoting localized interfacial reactions. Our results show that LTA induces Si and C segregation from the SiC layer, facilitating the formation of Ti–Si–C ternary phases. The interface microstructure and chemistry were characterized using transmission electron microscopy (TEM) and electron energy loss spectroscopy (EELS), offering insights into tailoring metal/SiC interfaces for device optimization.
15:15		
15:30		***Coffee Break***
Time	**ID**	**Surfaces, Interfaces and Thin Films V** *Chair: Jan Balajka, TU Wien*
16:00	**741**	**$SrCrO_3$/$LaCrO_3$ Superlattices: Transport, Magnetic and Structural Properties** *Simon Jöhr [1], Annabella Drewanovsky [1], Jonathan Spring [1], Gabriele De Luca [2], Andreas Suter [3], Bernat Mundet [4], Marta Gibert [5]* *[1] University of Zurich, Switzerland, [2] ICMAB-CSIC, Bellaterra, Spain,* *[3] Paul Scherrer Institut, Villigen, Switzerland,* *[4] ALBA Synchrotron Light Source, Cerdanyola del Vallès, Spain,* *[5] Technical University of Vienna, Austria* Recently, we have shown our ability to grow high-quality epitaxial $SrCrO_3$ thin films and confirmed the coexistence of an antiferromagnetic metallic phase in this material. Moreover, we unveiled a metal-to-insulator transition upon application of both tensile and compressive strain. This achievement allowed us to fabricate superlattices consisting of alternating $SrCrO_3$ and $LaCrO_3$ layers. Combining these metallic and insulating materials containing Cr^{4+} and Cr^{3+} oxidation states (in $SrCrO_3$ and $LaCrO_3$, respectively) could lead to a charge transfer at the interfaces, potentially opening ways to novel functionalities. Here, we present a study of the structural, transport and magnetic properties of $SrCrO_3$/$LaCrO_3$ superlattices as a function of strain and periodicity. Detailed scanning transmission electron microscopy and muon spin relaxation measurements will be presented.
16:15	~~**742**~~	*→ moved to 719*

16:30	743	**Modulation of room temperature ferromagnetism in talc via iron-implantation.**

Muhammad Zubair Khan [1], Nico Klingner [2], Gregor Hlawacek [2], Ulrich Kentsch [2], Oleg E. Peil [3], Christian Teichert [1], Rainer T. Lechner [1], Jelena Pesic [4], Andrijana Solajic [4], Ronald Bakker [5], Maik Zimmermann [5], Monika Feichter [5], Daniel Knez [6], Andreas Ney [7], Aleksandar Matković [1]
[1] Chair of Physics, Department Physics, Mechanics and Electrical Engineering, Montanuniversität Leoben, Austria,
[2] Institute of Ion Beam Physics and Materials Research, Helmholtz-Zentrum Dresden Rossendorf, Dresden, Germany,
[3] Group of computational materials design, Materials Center Leoben Forschung GmbH, Leoben, Austria,
[4] Laboratory for 2D Materials, Center for Solid State Physics and New Materials, Institute of Physics, University of Belgrade, Serbia,
[5] Chair of Resource Mineralogy, Montanuniversität Leoben, Austria,
[6] Institute of Electron Microscopy and Nanoanalysis, Graz University of Technology (NAWI Graz), Austria,
[7] Institut für Halbleiter und Festkörperphysik, Johannes Kepler Universität, Linz, Austria

2D magnetic insulators hold great potential for spintronics. However, their practical implementation in devices is often hampered by ambient instability. Strategies to overcome this include discovering stable magnetic compounds or inducing magnetism in air stable non-magnetic 2D matrices. This study demonstrates a method to induce magnetic ions in natural (non-magnetic) phyllosilicate via broad beam irradiations. Talc is ambient stable, wide band gap insulators, with ability to incorporate Fe via substitution of Mg in the octahedral sites. This study uses single crystals, possible to mechanically cleave and integrate into heterostructures. Post-implantation analysis confirms structural stability and room-temperature ferromagnetism. Results reveal a correlation between Fe concentration and magnetic response, indicating a path to design air stable 2D magnetic insulators with higher T_c.

16:45	744	**Skyrmion formation mechanisms and pinning in Ir/Co/Pt multilayers**

Reshma Peremadathil Pradeep [1], Emily Darwin [1], Andrada-Oana Mandru [1], Silvia Tacchi [2], Giovanni Carlotti [3], Hans Josef Hug [1,4]
[1] Empa, Dübendorf, Switzerland, [2] Istituto Officina dei Materiali-IOM, Perugia, Italy,
[3] Dipartimento di Fisica e Geologia, Università di Perugia, Italy,
[4] Department of Physics, University of Basel, Switzerland

Magnetic skyrmions are prime candidates for next-generation data storage and computing technologies, yet their practical application requires a deeper understanding of their formation mechanisms and stability. In this study, we address this by investigating Ir/Co(t)/Pt multilayers with Co thicknesses ranging from 0.35 to 1.8 nm. We observe stable skyrmions in both ultrathin (~0.45 nm) and thicker (1.4 – 6 nm) regimes. Reduced effective anisotropy (Keff), driven by strain effects enable skyrmion formation in the lower thickness regime. Our findings suggest that local material inhomogeneities rather than differences in energy barrier drive the transformation from stripe domains to skyrmions. Return point memory measurements confirm this and reveal strong skyrmion pinning, underscoring the impact of inhomogeneities and the challenges they pose for reliable skyrmion-based device integration.

17:00	745	**Surface effects in infinite-layer nickelates**

Leonard Verhoff [1], Liang Si [1,2], Karsten Held [1]
[1] Institute of Solid State Physics, TU Wien, Austria,
[2] School of Physics, Northwest University, Xi'an, China

Nickelates show intriguing similarities to cuprates, and have emerged as a compelling platform for studying high temperature superconductivity. While the bulk structure of infinite-layer rare-earth (R) nickelates, $RNiO_2$, has been extensively studied computationally, the samples that exhibit superconductivity in experiments are thin nickelate films.
Here, we explore surface effects in $RNiO_2$ films by studying the formation and electronic structure of various surfaces within the framework of density functional theory and dynamical mean-field theory. While perfect stoichiometry favors a NiO_2-terminated surface, the presence of excess apical oxygen might stabilize an RO-terminated surface. Furthermore, the atomic structure at the surface is found to strongly influence the local electronic structure.
We acknowledge support by the Austrian Science Funds; FWF Grant-DOI:10.55776/I5398.

17:15	746	**Designing and Understanding Cuprate-Analog Superconductivity: Electronic Structure Engineering and Lattice Dynamics in Nickelate Systems** *Wenfeng Wu [1,2,3], Eric Jacob [1], Viktor Christiansson [1], Liang Si [4], Karsten Held [1]* *[1] Institute of Solid State Physics, TU Wien, Austria,* *[2] Key Laboratory of Materials Physics, Institute of Solid State Physics, HFIPS, Chinese Academy of Sciences, Hefei, China,* *[3] University of Science and Technology of China, Hefei, China,* *[4] Northwest University, Xi'an, China* Recent discoveries of nickelate superconductors have renewed interest in designing cuprate analogs with strongly correlated single dx2-y2-bands near the Fermi level. We propose two theoretical strategies to this end: (1) hydrogen intercalation in La_2NiO_4 to realize a two-dimensional dx2-y2 Mott insulator with predicted d-wave superconductivity above 20 K; (2) the prediction of fluoride compounds $KNi(Pd)F_2$. Using dynamical vertex approximation (DGA), we show that heterostructure tuning of $KPdF_2$ can enhance T_C up to 62.73 K. Separately, to establish a baseline for nickelate lattice properties, we present time-of-flight neutron scattering on $LaNiO_2$. The observed dispersive phonon modes, analyzed via density functional perturbation theory, provide understanding structural effects in nickelate superconductivity. We acknowledge support by the Austrian Science Funds; FWF Grant-DOI:10.55776/I5398.
17:30		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

ID	SURFACES, INTERFACES AND THIN FILMS POSTER
751	**Forces between hydrophobic surfaces: solvent influence** *Luis N. Ponce-Gonzalez, José L. Toca-Herrera, Institut für Biophysik, BOKU, Austria* Molecular and colloidal forces drive phenomena such as self-assembly, aggregation, and protein folding, where hydrophobic interactions are paramount. However, the origin of hydrophobic interactions remains unknown. Advances in techniques like atomic force microscopy (AFM) have improved our ability to study this topic. Hydrophobic interactions are stronger and longer-ranged than van der Waals (vdW) forces, potentially arising from water structuring, polarization, and entropic effects. In this work, fluorocarbon surfaces were prepared via chemical vapor deposition (CVD) to explore the impact of water:DMSO mixtures on hydrophobic interactions. Force–distance curves measured with AFM were fitted to an extended vdW model, disclosing the influence of the medium polarity on the interactions.
752	**PEEM and LEED insights into the growth of ultrathin CoPc and F16CuPc films on Ag(100) surfaces** *Robert Heller [1], Błażej Gołyszny [2], Thorsten Wagner [1], Peter Zeppenfeld [1], Grażyna Antczak [2]* *[1] Johannes Kepler University, Institute of Experimental Physics, Linz, Austria,* *[2] University of Wrocław, Faculty of Physics and Astronomy, Wrocław, Poland* Thin layers of metal phthalocyanines are studied due to their promising applications as active layers in optoelectronics devices. In this contribution, we will present a study on the physical vapor deposition of cobalt phthalocyanine (CoPc) and fluorinated copper phthalocyanine (F16CuPc) on silver (100) surfaces maintained at room temperature. The molecules have opposite effects on the work function of the substrate. Up to a coverage of about one monolayer (ML) CoPc decreases, whereas F16CuPc increases the work function of Ag(100). Photoemission Electron Microscopy (PEEM) with a xenon (Xe) lamp was used to study the changes in electron yield (EY) during the deposition of monomolecular and bimolecular layers.

753

Spatially resolving the cone of reaction for a single molecule

Matthew Timm [1], Ilias Gazizullin [1], Qifan Chen [2], Stefan Hecht [3], Pavel Jelínek [2], Leonhard Grill [1]
[1] Institute of Chemistry, University of Graz, Austria,
[2] Institute of Physics, Czech Academy of Sciences, Prague, Czechia,
[3] Department of Chemistry and Center for the Science of Materials Berlin, Humboldt-Universität, Germany

The outcome of molecular collisions depends on the collision energy, the relative alignment of reactants, and the miss-distance between the colliding species' centers of mass (termed impact parameter). The impact parameter in on-surface reactions can be selected using a 'surface-molecular-beam' of CF2 'projectiles' which travel along the Cu-rows of the Cu(110) surface. Here we demonstrate simultaneous control over the impact parameter and relative alignments of reagents using a singly-debrominated molecular 'target' which can adopt multiple possible adsorption alignments relative to the incoming CF2 projectile. Thus, this study demonstrates an unprecedented ability to map how collision geometry contributes to collision outcome.

754

Automatic data acquisition and magnetic field compensation in LEED I(V)

Florian Dörr [1], Michael Schmid [1], Alexander M. Imre [1], Christoph Pfungen [1], Stefan-Sebastian Mitterhöfer [1], Lutz Hammer [2], Ulrike Diebold [1], Michele Riva [1]
[1] Institute of Applied Physics, TU Wien, Austria, [2] Solid State Physics, FAU, Erlangen, Germany

We designed a system capable of acquiring and evaluating quantitative low-energy electron diffraction [LEED I(V)] data, the Vienna package for Erlangen LEED (ViPErLEED). The system contains three parts: One part performs data acquisition, another part focuses on the extraction of LEED-I(V) curves from image series, and the last part concerns the simulation of I(V) spectra for quantitative structure optimization.
This contribution will discuss the open-source software, firmware, and hardware we are currently designing to support the automation of data acquisition in LEED I(V). While establishing how this solution is integrated into the ViPErLEED project, we will present an outlook on real-time magnetic field compensation to aid data quality and explain why this feature is necessary.

755

AFM Study of Lipid Monolayer Modulation Factors

Wisnu Sudjarwo, Jose Toca-Herrera, BOKU University, Wien, Austria

Our study employs atomic force microscopy (AFM) to investigate the structural and morphological responses of dipalmitoylphosphatidylcholine (DPPC) monolayers to environmental variables such as subphase composition, temperature, lipid fluidity, and protein interactions. Results demonstrate that DPPC monolayer morphology is highly sensitive to subphase conditions, with divalent ions ($CaCl_2$) promoting tighter lipid packing than monovalent ions (KCl). Temperature-dependent phase transitions are observed, with coexistence of liquid-expanded and liquid-condensed phases at lower temperatures (15–20°C) and homogeneous phases at 25°C. The addition of dioleoylphosphatidylcholine (DOPC) increases monolayer fluidity and disrupts DPPC domain organization. Protein interaction studies reveal that lysozyme and human serum albumin (HSA) disrupt domain structures, indicating potential implications for membrane integrity. Across all conditions, elevated surface pressure enhances monolayer uniformity.

756

Computational modeling of ice on silver iodide

Andrea Conti [1], Johanna Hütner [1], David Kugler [1], Franziska Sabath [2], Angelika Kühnle [2], Michael Schmid [1], Ulrike Diebold [1], Jan Balajka [1], Florian Mittendorfer [1]
[1] TU Wien, Austria, [2] Bielefeld University, Germany

Silver iodide (AgI) is widely used in cloud seeding due to its efficient ice-nucleating ability, yet its atomistic mechanism remains unclear. Noncontact atomic force microscopy shows that the Ag-terminated (0001) surface adopts a (2 × 2) reconstruction with ordered Ag vacancies, maintaining a hexagonal template ideal for ice epitaxy. Modeling AgI is challenging because of the strong ion polarizability and the crucial role of van der Waals interactions. Our standard density functional theory (DFT) often misestimates lattice constants depending on the chosen exchange-correlation functional. In contrast, random phase approximation (RPA) calculations match experimental bulk properties and yield reliable structural models. Based on this benchmark, we found the PBE-D3 functional as an efficient and accurate alternative for simulating the AgI-water interface.

757

Revealing the character of coordination bonding in two-dimensional MOFs by photoemission tomography

Dominik Brandstetter [1], Simone Mearini [2], Andreas Windischbacher [1], Yan Yan Grisan Qiu [2], Daniel Baranowski [2,3], Vitaliy Feyer [2,4], Claus Micheal Schneider [2,4,5], Peter Puschnig [1]
[1] Institute of Physics, University of Graz, Austria,
[2] Peter Grünberg Institute (PGI-6), Jülich Research Centre, Germany,
[3] Physical and Computational Sciences Directorate and Institute for Integrated Catalysis, Pacific Northwest National Laboratory, Richland, USA,
[4] Faculty of Physics and Center for Nanointegration Duisburg-Essen (CENIDE), University of Duisburg-Essen, Germany,
[5] Department of Physics and Astronomy, UC Davis, USA

Two-dimensional metal-organic frameworks (MOFs) have drawn significant attention as a new class of versatile materials. Recently, our investigations have shown indications for a metal-organic hybrid band structure as well as intricate charge transfer characteristics and magnetic properties in 2D MOFs. In our poster, we explore the nature of the coordination bonds in 2D MOFs by examining a well-ordered nickel tetracyanoquinodimethane (Ni-TCNQ) monolayer on a Ag(100) substrate. Notably, we observed a splitting in the valence band photoemission data into bonding and anti-bonding states, resulting from the interaction between the Ni d-states and the ligand orbitals. We are able to unambiguously reveal signatures of covalent bonding between the ligands and the metal by identifying fingerprints of the involved orbitals in momentum space.

758

Surface roughness characterization of biobased nanostructured coatings and nanocomposites

Maximilian Alexander Molnar [1], Jürgen Glettler [2], Markus Kratzer [1], Jürgen Lackner [2], Christian Teichert [1], Reinhard Kaindl [2], Wolfgang Waldhauser [2]
[1] Chair of Physics, Leoben, Austria, [2] JOANNEUM RESEARCH Forschungsgesellschaft mbH Materials Institute for Sensors, Photonics and Manufacturing Technologies, Niklasdorf, Austria

As part of this work, the surface topography and phase formation on the surface of two different nanomaterial coating systems were analysed using Atomic Force Microscopy (AFM) measurements in tapping mode. A comprehensive surface roughness analysis of the AFM images was undertaken.
Two bio-based coating systems were studied. First, nano-rough diamond-like carbon (DLC) coatings were produced via high-vacuum deposition with embedded carbon nanostructures (e.g., nano-onions). The latter are expected to transform into graphitized/graphene-like nanolayers under tribological testing and to be identifiable via AFM analysis. Second, micro-rough carbon powder-based coatings were produced by atmospheric pressure plasma deposition (APPD) of carbonized wood dust on Polyamide 12. These coatings are also expected to form graphitized/graphene-like surface layers within tribological wear tracks.

759

Simulating solid-liquid interfaces with machine-learned force fields

Andreas Kretschmer, Alper Tunga Celebi, Markus Valtiner
Institute of Applied Physics, TU Wien, Wiedner Hauptstraße 8-10, 1040 Wien, Austria

We train and compare force-fields for water with 7 different exchange-correlation functionals to perform large-scale molecular dynamics (MD) simulations. Training is done on-the-fly during a 50000-time-step heating ramp from 200 to 400 K. The best-performing exchange-correlation-functional RPBE-D3 underestimates the experimental density by 3 %. Force-field simulations with 512 molecules show that the translational and orientational distribution functions are well preserved even after 1 ns. In the next step, different ionic salts are added to the training data by running simulations of bulk, surface, and dissolved structures. After this training, MD simulations of solid/liquid interfaces with ~800 atoms are performed for time spans > 1 ns to study the interaction of the salts on initial contact with water.

760

Dielectric relaxation in scanning tunneling microscopy

Stefan Müllegger, Johannes Kepler University Linz, Austria

We report different experimental routes for increasing the sensitivity of dielectric spectroscopy ultimately towards the scale of no more than a single molecule. We utilize the method of radio frequency (RF) scanning tunneling microscopy (STM) to induce dielectric loss in a single dipolar molecule (4.6 Debye) adsorbed on Ag(111) by an electric field oscillating at a frequency between 2 and 5 GHz. We detect the dielectric loss of the molecule indirectly via its effect of power dissipation. Varying the excitation frequency, we observe maximum spatial displacement of the molecule close to 3.4 GHz – the respective peak frequency acting as fingerprint of the dielectric absorption of the studied molecule.

761

On-Surface Synthesis of two-dimensional Metal-Organic Frameworks: Structural Assembly, Electronic Properties and Transmetallation

Olga Resel [1], Valentin Mischke [2], Alessandro Namar [3], Manuel Valvidares [4], Pierluigi Gargiani [4], Martin Sterrer [1], Mirko Cinchetti [2], Erik Vesselli [3], Giovanni Zamborlini [1,2]
[1] Institute of Physics, University of Graz, Austria, [2] Department of Physics, TU Dortmund, Germany, [3] Department of Physics, University of Trieste, Italy, [4] ALBA Synchotron Light Source, Barcelona, Spain

Metal-organic frameworks (MOFs) attract significant interest for their ability to host metal ions as active sites for molecular binding, catalysis and magnetic applications. They can be designed with tailored electronic properties, even at the 2D level.
Here, I will present a thorough characterization of a porphyrin-based 2D-MOF, obtained by cobalt coordination of self-assembled manganese tetrapyridylporphyrin on Au(100). We assessed structural and electronic properties of this on-surface 2D-MOF via low energy electron diffraction, x-ray photoelectron and x-ray absorption spectroscopy.In particular, the cobalt deposition leads to formation of a high-quality 2D-MOF atop Au(100), and, at the same time, promotes transmetallation at the porphyrin macrocycle (i.e. replacement of manganese with cobalt atoms), yielding a homometallic 2D-MOF with cobalt in two inequivalent sites.

Physics at Neutron and Synchrotron Sources

Tuesday, 19.08.2025, Room HS 30

Time	ID	PHYSICS AT NEUTRON AND SYNCHROTRON SOURCES *Chair: Herwig Michor, TU Wien*
14:00	**781**	**Ramsey GRS (Gravitational Resonance Spectroscopy) with the qBounce setup** *Florian Lachaume, TU Wien - Atominstitut, Austria* qBOUNCE studies gravitationally bound quantum states of UltraCold Neutrons (UCNs) using Gravitational Resonance Spectroscopy (GRS). This technique offers a way of looking at gravitation at short distances. The qBOUNCE setup uses the Ramsey spectroscopy method, with state transitions driven by mechanical oscillations, to search for possible interactions beyond the Standard Model. The experiment is located at the Institute Laue-Langevin (Grenoble, France) and benefits from the neutrons produced by the High Flux Reactor. These neutrons are slowed down to about 10 m/s. Several measurements with increasing transition frequencies have been made over the last 7 years. In 2024, the pair of transitions $\|1\rangle \rightarrow \|7\rangle$ & $\|2\rangle \rightarrow \|9\rangle$ was measured. These transitions are the ones with the highest frequencies measured so far.
14:15	**782**	**Nano- and Mesoporous Structure Formation Probed with In Situ/In Operando Small and Wide-Angle X-Ray Scattering Analysis during Electrodeposition** *Heinz Amenitsch [1], Philipp A. Wieser [1,2]* *[1] Institute of Inorganic Chemistry, Graz University of Technology, Graz, Austria,* *[2] Electronic Materials, Center for Functional Nanomaterials, Brookhaven National Laboratory, Upton, USA* Electrochemical formation of nanoporous materials via electrodeposition provides key materials for catalysis, energy storage, and sensing due to their high surface areas and tunable pore sizes. Understanding morphology development is crucial for material design. In situ techniques like Grazing Incidence Small and Wide Angle Scattering (GISWAXS) help reveal structure evolution at meso- and crystalline levels. Using a versatile electrochemical cell developed for GISWAXS studies we have investigated formation hexagonal Pt films using Brij®56 and mesoporous Pt-Ni films with Pluronic P123 based on the method of ref [3]. Additionally recent advances in electrodeposition of ordered materials and the SAXS beamline upgrade at ELETTRA 2.0 will also be discussed.
14:30	**783**	**Phase-Contrast Microtomography Applications in Life Sciences at the BEATS Beamline of the SESAME Synchrotron** *Fareeha Hameed [1], Elizabeth New [2], Maher Sughayer [3], Fatemeh Elmi [4], Hassan Hoda [5], Christoforos Odiatis [6], Charalambos Chrysostomou [7]* *[1] SESAME Synchrotron, Allan, Jordan, [2] The University of Sydney, Australia,* *[3] King Hussein Cancer Center, Amman, Jordan,* *[4] University of Mazandaran (UMZ), Babolsar, Iran,* *[5] Iranian Research Institute of Plant Protection (IRIPP), Tehran, Iran, [6] University of Cyprus, Nicosia, Cyprus, [7] ERATOSTHENES Centre of Excellence, Limassol, Cyprus* The ID10-BEATS beamline at the SESAME synchrotron in Jordan is the new X-ray microtomography beamline located centrally in the southwest region of Asia. The specifications and capabilities of this beamline are suitable for a wide range of applications in science, engineering, and industry. Recent imaging activities in the field of life sciences are being presented. Phase contrast imaging based on the principle of free space propagation is one of the strengths of this beamline. This technique is especially beneficial for low contrast materials like soft tissues. The studies presented include imaging studies of breast tissue, mice kidneys, and insects–agricultural pests. BEATS offers imaging in a broad range of applications, and, in this presentation, the focus is on biomedical applications research.

14:45	**784**	**Study on FeO Nanocubes combining X-ray Scattering Technique with Various Complementary Characterisation Techniques** *Rainer T. Lechner [1], Jerome Deumer [3], Christian Gollwitzer [3], Sarah-Luise Abram [2], Ute Resch-Genger [2]* *[1] Montanuniversität Leoben, Austria,* *[2] Bundesanstalt für Materialforschung und -prüfung BAM, Berlin, Germany,* *[3] Physikalisch-Technische Bundesanstalt - PTB, Berlin, Germany* Iron oxide nanocrystals (NCs) were synthesized within a reference material project at the BAM (Berlin) showing very narrow size distribution and a cubic shape with an edge length of 9 nm as derived by TEM. Here, we combine x-ray scattering (SAXS) and diffraction (XRD) to probe a larger NC ensemble as it is possible with TEM alone. These techniques not only allow retrieving the crystal structure and size by XRD, but also the mean 3D shape from SAXS. We compare two SAXS curves, one recorded at a synchrotron beamline and one recorded with a lab source. Both SAXS data were in excellent agreement, revealing cuboid shaped NCs, but with rounded corner and edges, which is known as superball shape.
15:00	**785**	**Where are the metals? Analysis of elemental distributions in moss leaflets using synchrotron X-ray experiments** *Matthias Weinberger [1], Luigi Schillaci [2], Ingeborg Lang [2], Christoph Rumancev [3], Axel Rosenhahn [3], Helga Lichtenegger [1]* *[1] BOKU University, Institute of Physics and Materials Science, Vienna, Austria,* *[2] University of Vienna, Department of Functional and Evolutionary Ecology, Vienna, Austria,* *[3] Ruhr-University Bochum Faculty of Chemistry and Biochemistry, Bochum, Germany* Bryophytes can be used to assess the pollution status of their environment due to their ability to absorb nutrients but also pollutants through their entire surface. In the talk or poster we will discuss our approach to quantifying micro-synchrotron X-ray fluorescence (μ-SRXRF) data measured at the PETRA III P06 beamline at DESY in Hamburg, Germany, and at the NanoMAX beamline at MAXIV in Lund, Sweden. We will focus on Fe, Mn and Cu and housekeeping elements such as Ca and K. We will also include first results from small-angle X-ray scattering (SAXS) experiments performed at NanoMax to study possible changes in cell wall ultrastructure due to heavy metal contamination.
15:15	**786**	**Conglomerate screening of 1,1'-binaphthalene by thin film preparation** *Roland Resel [1], Sanjay John [1], Christoph Huber [1], Anmol Andotra [1], Fabian Gasser [1], Tamas Javorfi [2], Giuliano Siligardi [2]* *[1] Institute of Solid State Physics, Graz University of Technology, Austria,* *[2] beamline B23, synchrotron radiation facility DIAMOND, Ditcot, United Kingdom* 1,1‘-binaphthalene is an axial chiral molecule which has the possibility to change the chirality from R-(-) conformation to S-(+). A racemic as well as a chiral crystal structure are known. We report on the thin film formation by solution processing starting from a racemic solution. Specific processing parameters are found which favours the formation of chiral phases, the type of chirality is determined by circular dichroism using Müller matrix approach. Both types of chiralities are found within single films, the characteristic extension of enantiopure domains are several tens of μm. The thin film processing parameters together with the thin film morphology suggests that the presence of a surface during the crystallisation process is responsible for the formation of a conglomerate.
15:30		***END; Coffee Break***
19:00		***Public Lecture***

ID	Physics at Neutron and Synchrotron Sources Poster
791	**Deep X-ray Lithography for material science: latest results** *Benedetta Marmiroli [1], Barbara Sartori [1], Alessio Turchet [2], Heinz Amenitsch [1]* *[1] Institute of Inorganic Chemistry, TU Graz Austria, [2] Elettra-Sincrotrone Trieste, Italy* The combination of top-down and bottom-up approaches to prepare functional materials has great potential for next generation microdevices. As top-down process we selected Deep X-ray lithography (DXRL) which is based on controlled irradiation of materials using high energy X-rays. In this communication we will present our latest research using DXRL. We will first describe our recent activity on X-ray irradiation of mesoporous materials. After investigating their mechanical properties, we are studying their use as active sample holders able to deliver fluids through the pores. We will then present the direct patterning of Metal Organic Frameworks (MOFs) to obtain a methanol vapor sensor, and of 3D oriented MOFs and MOF templated polymeric films to get micropatterns with anisotropic fluorescent properties.
792	**Elastic and inelastic neutron scattering studies of magnetism in the heavy fermion system $YbPt_5B_2$** *Herwig Michor [1], Leonid Salamakha [1], Oksana Sologub [1], Dimitry Khalyavin [2], Manh Duc Le [2], Devashibhai T. Adroja [2], Ernst Bauer [1]* *[1] Institute of Solid State Physics, TU Wien, Austria,* *[2] ISIS Neutron and Muon Source, STFC, Rutherford Appleton Laboratory, Chilton, U.K.* $YbPt_5B_2$ and $LuPt_5B_2$ were studied by elastic and inelastic neutron scattering experiments. The heavy fermion system $YbPt_5B_2$ orders antiferromagnetically below T_{N1} = 7.8 K and exhibits an incommensurate magnetic structure with a temperature dependent propagation vector, k1 = (0.194, 0, -0.045) at T = 6 K. Below T_{N2} = 4.7 K, a transition into a commensurate antiferromagnetic structure, k2 = (0, 0, 0), takes place. Rather large Yb moments, m(Yb) > 3 μB can be explained only by an appropriate wave function constituting the CEF ground state doublet as concluded from the present inelastic neutron data. The overall CEF splitting is of the order of 44 meV, while the first excited level is located near 25 meV above the ground state.
793	**The PERC Beamstop** *Johannes Schilberg, Hartmut Abele, Irina Pradler, Alberto Jose Saavedra Garcia, Erwin Jericha, the PERC Collaboration* *Atominstitut - TU Wien, Austria* The PERC (Proton and Electron Radiation Channel) facility, located at the neutron source FRM II of the Technical University of Munich (TUM), serves as a clean source of neutron decay products (protons and electrons). PERC aims to contribute to the determination of the Cabibbo-Kobayashi-Maskawa quark-mixing element (V_{ud}), measure the correlation coefficients of free neutron decay (*a*, *A*, *b*, *C*) and search for new physics at the TeV scale. In PERC, the decay products are separated from the neutron beam by a strong magnetic field. To ensure a low background for the detectors as well as to fulfil all radiation protection requirements, the PERC Beamstop has been designed. It consists of B_4C and Pb, which were chosen based on MCNP simulations.
794	**Upgrading qBounce: Toward New Frontiers in Quantum State Measurements** *Christoph Grüner [1], Daniel Aziz [1], Joachim Bosina [1], Tobias Jenke [2], Florian Lachaume [1], Hartmut Abele [1]* *[1] TU Wien/Atominstitut, Austria, [2] Institut Laue-Langevin, Grenoble, France* The qBounce collaboration operates a Ramsey-type neutron-based gravitational resonance spectroscopy setup at the Institut Laue-Langevin. Since its commissioning in 2018, the system's sensitivity has improved by a factor of 42 compared to previous implementations. This enhanced precision has enabled, among other achievements, tests of hypothetical modifications to the Newtonian gravitational potential at micrometer scales and the observation of previously unmeasured gravitational quantum state transitions. The setup is currently undergoing further upgrades to enable longer neutron interaction times, enhanced measurement sensitivity, and a broader range of applications, including fundamental tests of quantum mechanics. We report on the measurement campaign conducted in Spring 2025, present recent scientific findings and technical developments, and provide an outlook on the next phase of planned measurements.

795

Exploring Magnetic Field Effects on Quantum States of Ultracold Neutrons in the qBounce Experiment

Daniel Aziz [1], Christoph Grüner [1], Joachim Bosina [1], Hartmut Abele [1], Tobias Jenke [2]
[1] Atominstitut, Technische Universität Wien, Austria, [2] Institut Laue-Langevin, Grenoble, France

The qBounce experiment investigates the quantum states of ultracold neutrons in Earth's gravitational field, offering a unique platform to study gravity at microscopic scales with high precision. Neutrons confined above a horizontal mirror form discrete energy levels arising from the interplay between gravitational and quantum effects. Building upon this system, we have recently begun exploring how external magnetic fields may influence these quantum states. In our latest experimental run, a series of measurements were carried out to examine these interactions. This poster outlines the experimental approach, highlights preliminary observations, and provides a perspective on possible directions for future measurements and experimental techniques.

Quantum Information and Quantum Computing

This session has been organised in collaboration with the SFB BeyondC.

Thursday, 21.08.2025, Room HS 7

Time	ID	Quantum Information and Quantum Computing I: Quantum Thermodynamics *Chair: Joshua Morris, Universität Wien*
14:00	801	**Precision is not limited by the second law of thermodynamics** *Florian Meier [1], Yuri Minoguchi [1,2], Simon Sundelin [3], Tony J. G. Apollaro [4], Paul Erker [1,2], Simone Gasparinetti [4], Marcus Huber [1,2]* *[1] Atominstitut, Technitsche Universität Wien, Austria,* *[2] Institute for Quantum Optics and Quantum Information - IQOQI Vienna, Austrian Academy of Sciences, Wien, Austria,* *[3] Department of Microtechnology and Nanoscience, Chalmers University of Technology, Gothenburg, Sweden,* *[4] Department of Physics, University of Malta, Msida, Malta* Physical devices operating out-of-equilibrium are affected by thermal fluctuations, limiting their operational precision. This issue is particularly pronounced at quantum scales, where its mitigation requires additional entropy dissipation. Clocks, for example, need a thermodynamic flux towards equilibrium to measure time, resulting in a minimum entropy dissipation per clock tick. Although classical and quantum models often show a linear relationship between precision and dissipation, the ultimate bounds on this relationship remain unclear. We present an autonomous quantum model achieving clock precision scaling exponentially with entropy dissipation. This is enabled by coherent transport in a spin chain with tailored couplings. The result demonstrates that coherent quantum dynamics can surpass traditional thermodynamic precision limits, potentially guiding development of future high-precision, low-dissipation quantum devices.
14:15	802	**Quantum Master Equations in the Presence of Continuous Measurement and Feedback: Theory and Applications** *Pharnam Bakhshinezhad, TU Wien, Austria* We study quantum systems under continuous measurement and feedback using the recently developed Quantum Fokker-Planck Master Equation (QFPME). This framework enables analytical modeling of weakly monitored quantum dynamics with real-time feedback. We apply the QFPME to diverse scenarios: (i) quantum thermometry via Bayesian estimation in bosonic and fermionic environments; (ii) feedback-based ground-state cooling of a harmonic oscillator; (iii) generation of steady-state entanglement in quantum thermal machines; and (iv) information-to-work conversion in a monitored double quantum dot across the quantum-classical transition. These results showcase the QFPME as a powerful tool in quantum thermodynamics and feedback control.
	~~803~~	*cancelled*
	~~804~~	*cancelled*
14:30	805	**Information Thermodynamics of Agents** *Lukas J. Fiderer, Paul Barth, Isaac Smith, Hans Briegel, University of Innsbruck, Austria* We study the energetic limits of information processing in percept-action loops—agent–environment interactions where both agent and environment are modeled as channels with memory. Using tools from information theory and stochastic thermodynamics, we define the work capacity of an environment as the maximum rate at which an agent can extract work from it. This generalizes previous results from passive tape models to non-stationary settings with genuine feedback. We show that established principles such as maximizing predictive power and forgetting actions are no longer optimal.Instead, a trade-off emerges: work-efficient agents must balance prediction and forgetting. This highlights a fundamental departure from the thermodynamics of passive observation, suggesting that prediction and energy efficiency may be at odds in active learning systems.

14:45	**806**	**On the second law of thermodynamics in isolated quantum systems** *Tom Rivlin, Florian Meier, Tiago Debarba, Jake Xuereb, Marcus Huber, Maximilian P. E. Lock* *Atominstitut, TU Wien, Austria* The second law of thermodynamics makes entropy increase over time. But for isolated quantum systems, the most widely-used definition of entropy, the von Neumann entropy, is always constant. So in what sense does the entropy of an isolated quantum system actually satisfy the second law? In this talk I will present a perspective we propose in a recent paper based on the entropy of observables. We recover a version of the second law: relative to a given observable, the entropy of an isolated quantum system tends towards an equilibrium value (with post-equilibration fluctuations). Analytically-derived bounds on entropy equilibration will be presented, alongside numerical illustrations of these arguments using a one-dimensional quantum Ising chain.
15:00	**807**	**Stabilizer-based entanglement and secure key distillation** *Christopher Popp, University of Vienna, Austria* Uncontrolled interactions with the environment introduce errors that remain a significant challenge to the reliability of quantum technologies using entangled states. An essential method to overcome or mitigate these errors is entanglement distillation. A construction based on stabilizer codes offers an effective method for designing such protocols, which can also be leveraged for the distillation of secure key states. We establish a standard form for the output states of stabilizer-based protocols. This links the properties of input states, stabilizers, and encodings to the properties of the protocol, allowing to optimize required operations for the desired output. The performance of such protocols highlights the capability of stabilizer-based methods to address the effects of environmental noise, advancing the robustness of quantum technologies.
15:15		
15:30		***Coffee Break***
		QUANTUM INFORMATION AND QUANTUM COMPUTING II: **QUANTUM INFORMATION THEORY** *Chair: Christian Siegele, Institute of Science and Technology Austria*
16:00	**811**	**High-dimensional entanglement witnessed by correlations in arbitrary bases** *Nicky Kai Hong Li [1,2], Marcus Huber [1,2], Nicolai Friis [1,2]* *[1] Atominstitut, TU Wien, Austria, [2] IQOQI Vienna, Austria* Certifying entanglement is an important step in the development of many quantum technologies, especially for higher-dimensional systems, where entanglement promises increased capabilities for quantum communication and computation. A key feature distinguishing entanglement from classical correlations is the occurrence of correlations for complementary measurement bases. In particular, mutually unbiased bases (MUBs) are paradigmatic examples that are routinely employed for entanglement certification. However, implementing unbiased measurements exactly is experimentally infeasible. Here, we extend the entanglement-certification framework from correlations in MUBs to arbitrary bases. This practical simplification enables efficient characterisations of high-dimensional entanglement in many physical systems. Furthermore, we introduce a simple three-MUBs construction for all dimensions without using the Wootters–Fields construction, simplifying experimental requirements for implementing MUBs in high-dimensional settings.

16:15	**812**	**A Framework for the Security Analysis of Practical High-Dimensional QKD Setups** *Florian Kanitschar, Marcus Huber, Technische Universität Wien, Austria* High-dimensional quantum key distribution (HD-QKD) offers improved key rates and noise resilience, but security analyses often rely on impractical measurements or heavy computation. We present a physics-guided framework grounded in entanglement theory, enabling secure key rate certification using only native, experimentally accessible measurements. By combining entanglement-witness observables with matrix completion, we bound adversarial knowledge efficiently and reformulate the problem as a dual semidefinite program involving tractable eigenvalue computations. Our method improves noise tolerance, scales to high dimensions, and supports composable finite-size security. We further introduce a variable-length key rate model to address fluctuating channels. Demonstrated on time-bin entanglement, the framework is platform-independent and bridges the gap between theoretical analysis and practical HD-QKD implementations.
16:30	**813**	**Bypassing Losses in Quantum Optics: A Robust Measurement Design** *Mohammad Mehboudi [1], Fatemeh Rezaeinia [3], Saleh Rahimi-Keshari [2]* *[1] TU Wien, Austria, [2] IPM, Tehran, Iran, [3] University of Tehran, Iran* Photon loss represents a primary decoherence mechanism in quantum optics, posing a significant challenge for quantum information protocols relying on measurement incompatibility, such as quantum steering and communication. We study the impact of pure loss channels on continuous-variable incompatibility. We show any n measurements become compatible under transmissivity $\tau \leq 1/n$. However, we construct a feasible set of n+1 displaced on-off measurements that remains incompatible for $\tau \geq 1/n$. Fundamentally, we prove no loss ($\tau > 0$) universally destroys incompatibility; some measurements always remain incompatible. This confirms quantum steering is possible despite arbitrary amounts of pure loss, offering routes to mitigate loss in quantum communication.
16:45	**814**	**Estimating entanglement monotones of non-pure spin-squeezed states** *Julia Mathe [1], Ayaka Usui [2], Otfried Gühne [3], Giuseppe Vitagliano [1]* *[1] Vienna Center for Quantum Science and Technology, Atominstitut, TU Wien, Austria,* *[2] Departament de Física, Universitat Autònoma de Barcelona (UAB), Spain,* *[3] Naturwissenschaftlich-Technische Fakultät, Universität Siegen, Germany* We investigate how to estimate entanglement monotones of general mixed many-body quantum states via lower and upper bounds from entanglement witnesses and separable ansatz states. This enables analysis of spin systems on fully-connected graphs at nonzero temperature. We derive lower bounds to distance-like measures using spin-squeezing inequalities and apply our methods to equilibrium states of spin models with an external field. The lower bound becomes tight for zero temperature as well as for the temperature where entanglement disappears, both of which are thus precisely captured by the spin-squeezing inequalities. We further observe that entanglement arises at nonzero temperature close to a quantum phase transition, even when the ground state is separable. This "entanglement signature" may also be visible in experiments.
17:00	**815**	**The Impact of Architecture and Cost Function on Dissipative Quantum Neural Networks** *Tobias Christoph Sutter, Christopher Popp, Beatrix Hiesmayr, University of Vienna, Austria* A prominent approach to leveraging machine learning techniques on quantum devices is the so-called dissipative quantum neural network (DQNN) model. In our work, we develop an extended architecture for DQNNs where each building block can implement any quantum channel, thus introducing a clear notion of universality suitable for the quantum framework. We reformulate DQNNs using isometries instead of the conventionally used unitaries, thereby reducing the number of parameters in these models, and derive a versatile one-to-one parametrization of isometries to efficiently implement the proposed structure. Focusing on the impact of different cost functions on the optimization process, we numerically investigate the trainability of extended DQNNs, thus unveiling significant training differences among the cost functions considered.

17:15	**816**	**Generalized Parity Measurements and Efficient Large Multi-component Cat State Preparation with Quantum Signal Processing** *Sina Zeytinoglu, TU Wien, Austria* General measurements with binary outcomes are crucial for quantum information processing applications. Here, we present a method for designing wide range of such measurements using the toolbox of Quantum Signal Processing, and apply it to design generalized parity measurements. Most strikingly, the proposed generalized parity measurements can be implemented in constant time, set by the interaction rate. We evaluate the effectiveness of our measurement protocol in preparing high-fidelity multi-component cat states in the setting of current superconducting cavity quantum electrodynamics experiments. Through detailed numerical simulations, we show that a 20-component cat state with 400 photons can be prepared with > 2 % success probability and $\approx$ 90 % fidelity, limited by the cavity decay and nonlinear qubit-cavity coupling rates.
17:30	**817**	**Quantum entanglement in Wigner functions** *Shuheng Liu [1,2], Jiajie Guo [2], Qiongyi He [2], Matteo Fadel [3]* *[1] Atominstitut, TU Wien, Austria, [2] School of Physics, Peking University, Beijing, China,* *[3] Department of Physics, ETH Zürich, Switzerland* While commonly used entanglement criteria for continuous variable systems are based on quadrature measurements, we study entanglement detection from measurements of the Wigner function. These are routinely performed in platforms such as trapped ions and circuit QED, where homodyne measurements are difficult to be implemented. We provide complementary criteria which we show to be tight for a variety of experimentally relevant Gaussian and non-Gaussian states. Our results show novel approaches to detect entanglement in continuous variable systems and shed light on interesting connections between known criteria and the Wigner function. Furthermore, we generalize our criteria to multipartite systems for the detection of genuine multipartite entanglement, and these criteria can be readily implemented in experiments.
17:45	**818**	**Exact Steering Bound for Two-Qubit Werner States** *Martin J. Renner, ICFO - The Institute of Photonic Sciences, Castelldefels, Spain* Many quantum technologies rely on nonlocality—correlations between distant particles that defy classical explanation. To harness this, it's essential to know which quantum states can or cannot display nonlocal behavior. A seminal 1989 result by Werner showed that some entangled states can be fully explained by local models, but only under the restricted class of projective measurements. We extend this result for two-qubit Werner states to the most general class of measurements, known as positive operator-valued measures (POVMs). Our model identifies exactly which of these states can demonstrate quantum steering—the effect Einstein famously called "spooky action at a distance." Surprisingly, we find that POVMs offer no advantage over simpler projective measurements, resolving a long-standing open question in quantum foundations.
18:00		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

Friday, 22.08.2025, Room HS 7

<table>
<tr><th>Time</th><th>ID</th><th>QUANTUM INFORMATION AND QUANTUM COMPUTING III:
QUANTUM FOUNDATIONS AND INFORMATION
Chair: Iris Agresti, Universität Wien</th></tr>
<tr><td>11:00</td><td>821</td><td>How to implement a causal measurement scheme for quantum fields?

Jan Mandrysch, Miguel Navascués,
Institute for Quantum Optics and Quantum Information, Vienna, Austria

While measurement processes in standard quantum mechanics are well understood, the extension of these ideas to quantum field theory (QFT) remains a key challenge. In particular, ensuring that measurements respect fundamental principles such as relativistic causality is crucial. A persistent issue concerning measurements in QFT is, though, that microcausality alone is insufficient to prevent superluminal signaling. In this talk, I will present a concrete scheme for measuring real linear scalar fields which allows to model projective and Gaussian measurements and more. The approach fully respects the principles of relativistic covariance, locality, and causality, offering a robust solution to the challenges of measurement in QFT.</td></tr>
<tr><td>11:15</td><td>822</td><td>On the Planckian time of thermalization

Paolo Abiuso [1], Pavel Sekatski [2], Alberto Rolandi [3], John Calsamiglia [4], Martí Perarnau-Llobet [4]
[1] IQOQI - Vienna, Austria, [2] University of Geneva, Switzerland,
[3] Technical University Vienna Austria, [4] Universitat Autònoma de Barcelona, Spain

We present the first mathematical proof that quantum mechanics entails a minimum time for any system to thermalize, namely, half of the Planckian dissipation time $\tau_{\mathrm{Pl}} = \frac{\hbar}{k_B T}$ in general.
Our bounds, rooted in Hamiltonian estimation, are valid for arbitrarily engineered baths/machines that only have to comply with the Schrödinger equation and are required to output a state close to its thermal ensemble for a nontrivial set of Hamiltonians.</td></tr>
<tr><td>11:30</td><td>823</td><td>Events and their Localisation are Relative to a Lab

Lin-Qing Chen, IQOQI-Vienna, Austria, & University of Vienna, Austria

The notions of events and their localisation are fundamentally different between quantum theory and general relativity, the reconciliation becomes more important and challenging in quantum gravity. We propose an operational approach, to define events and their localisation relative to a Lab, which includes a choice ofreference providing a generalised notion of “location” with certain operational properties.Applying this proposal to analyse the quantum switch (QS),we uncover its differences between classical and quantum spacetime realisations. Our analysis also clarifies a longstanding debate on the interpretation of QS experiments, demonstrating how different conclusions stem from distinct assumptions on the Labs. This provides a foundation for a more unified view of events, localisation, and causality across quantum and relativistic domains.</td></tr>
<tr><td></td><td><s>824</s></td><td>→ moved to 807</td></tr>
<tr><td>11:45</td><td>825</td><td>Optimising quantum tomography with classical post-processing

Andrea Caprotti, University of Vienna, Austria

In quantum information theory, the accurate estimation of observables is pivotal for quantum information processing, playing a crucial role in compute and communication protocols. We introduce a novel technique for estimating such objects, levereging an underutilised resource in the inversion map of classical shadows that greatly refines the estimation cost of target observables without incurring any additional overhead.
Specifically, considering the additional degrees of freedom in the homogeneous space of dual basis in overcomplete measurement schemes opens the possibility of extracting information more efficiently from limited resources.
Starting from the classical shadow measurement scheme, this opens to improvements in more general quantum estimation procedures.</td></tr>
<tr><td>12:00</td><td></td><td></td></tr>
</table>

12:30		***Poster Awards and Closing Ceremony***
12:45		***Lunch***
		QUANTUM INFORMATION AND QUANTUM COMPUTING IV: EXPERIMENT *Chair: Patrik Sund, Universität Wien*
14:00	**831**	**High finesse microcavities for quantum science and technology** *Philipp Koller [1,2,3], Jannek J. Hansen [1,2,3], David Walcher [1,2], Stefan Putz [1,2], Thomas Astner [1,2], Daniel Wirtitsch [1,2], Rhys Povey [1,2], Michael Trupke [1,2]* *[1] Institute for Quantum Optics and Quantum Information (IQOQI), Vienna, Austria,* *[2] Vienna Center for Quantum Science and Technology, Austria,* *[3] University of Vienna, Faculty of Physics & Vienna Doctoral School in Physics, Austria* Lithographically produced optical microcavities with open access, high finesse and small mode volume can drastically improve performance of quantum devices, by optical confinement and enhanced light matter interaction. The development of micromirrors on thin silicon membranes is a crucial step for MEMS tuneability and efficient fiber coupling, which is a prerequisite for scalable spin-based quantum memories. Small lightweight mirrors have further advantages in levitation experiments, when supported by a superconducting structure. This would greatly improve the position readout precision of magnetically levitated superconductors, making it a promising approach for the creation of non-classical states of macroscopic objects which are sufficiently massive for the observation of gravitational interactions.
14:15	**832**	**Experimental certification of high-dimensional entanglement with randomized measurements** *Giuseppe Vitagliano [1], Ohad Lib [2], Shuheng Liu [3], Ronen Shenkel [2], Qiongyi He [3], Marcus Huber [1], Yaron Bromberg [2]* *[1] TU Wien, Austria, [2] University of Jerusalem, Israel, [3] Peking University, China* High-dimensional entangled states offer higher information capacity and stronger resilience to noise compared with two-dimensional systems. However, the large number of modes and sensitivity to random rotations complicate experimental entanglement certification. Here, we experimentally certify three-dimensional entanglement in a five-dimensional two-photon state using 800 Haar-random measurements implemented via a 10-plane programmable light converter. We further demonstrate the robustness of this approach against random rotations, certifying high-dimensional entanglement despite arbitrary phase randomization of the optical modes. This method, which requires no common reference frame between parties, opens the door for high-dimensional entanglement distribution through long-range random links.
14:30	**833**	**Entropic costs of the quantum-to-classical transition in a microscopic clock** *Paul Erker [1], Vivek Wadhia [2], Florian Meier [1], Natalia Ares [2]* *1 Atominstitut, TU Wien, Austria, 2 University of Oxford, UK* We experimentally realize a quantum clock by using a charge sensor to count charges tunneling through a double quantum dot (DQD). Individual tunneling events are used as the clock's ticks. We quantify the clock's precision while measuring the power dissipated by the DQD. This allows us to probe the thermodynamic cost of creating ticks microscopically and recording them macroscopically. Our experiment is the first to explore the interplay between the entropy produced by a microscopic clockwork and its macroscopic measurement apparatus. Our results suggest that the entropy produced by the amplification and measurement of a clock's ticks, which has often been ignored in the literature, is the most important and fundamental thermodynamic cost of timekeeping at the quantum scale.

<table>
<tr><td>14:45</td><td>834</td><td>
Robust generation of multiphoton states from quantum dots

Vikas Remesh, Yusuf Karli, Iker Avila Arenas, Gregor Weihs, University of Innsbruck, Austria

High-purity multi-photon states are essential for photonic quantum computing. Among existing platforms, semiconductor quantum dots offer a promising route to scalable and deterministic multi-photon state generation. To fully realize their potential we require a suitable optical excitation method. Current approaches rely on active polarization-switching elements to spatio-temporally demultiplex the emitted single photons. Here, the achievable multi-photon rate is fundamentally limited by the switching speed of the EOM. Here, we introduce a fully passive demultiplexing technique that leverages a stimulated two-photon excitation process to achieve switching rates that are only limited by the quantum dot lifetime. Our approach significantly reduces the cost of demultiplexing, shifting it to the excitation stage, and effectively doubling the achievable multi-photon generation rate.
</td></tr>
<tr><td>15:00</td><td>835</td><td>
Quantum network node based on trapped ions coupled to a cavity

Sudhan Bhadade, Mehdi Rizvandi, Moming Jia, Roberts Berkis, Dmitry Bykov, Miao Cai,
Shivam Sawarn, Bo Wang, Liyang Zhang, Tracy Northup
Institute for Experimental Physics, University of Innsbruck, Austria

Quantum networks require nodes capable of generating high fidelity entanglement athigh rates. Trapped calcium ions coupled to a high-finesse optical cavity provide a promising platform for this. We are developing a new node designed to operate over metropolitan-scale distances of up to 50 km using polarization-state encoded single photons. In this talk, I will outline the advantages of trapped-ion based quantum networks, discuss the challenges of achieving faster entanglement generation, and present the strategies we are implementing. The focus will be on the key features of our next-generation node currently under construction.
</td></tr>
<tr><td>15:15</td><td>836</td><td>
Experimentally probing Landauer's principle in the quantum many-body regime

Stefan Aimet [1], Mohammadamin Tajik [2], Gabrielle Tournaire [1,3], Philipp Schüttelkopf [2],
João Sabino [2], Spyros Sotiriadis [4], Giacomo Guarnieri [5], Jörg Schmiedmayer [2], Jens Eisert [1]
[1] FU Berlin, Germany, [2] TU Wien, Austria, [3] University of British Columbia, Vancouver, Canada,
[4] University of Crete, Heraklion, Greece, [5] Università di Pavia, Italy

Landauer’s principle bridges information theory and thermodynamics by linking the entropy change of a system during a process to the average energy dissipated to its environment. Although typically discussed in the context of erasing a single bit of information, Landauer’s principle can be generalised to characterise irreversibility in out-of-equilibrium processes, such as those involving complex quantum many-body systems. Here we experimentally probe Landauer’s principle in the quantum many-body regime using a quantum field simulator of ultracold Bose gases. Our work demonstrates the ability of ultracold atom-based quantum field simulators to experimentally investigate quantum thermodynamics.
</td></tr>
<tr><td>15:30</td><td>837</td><td>
High-Dimensional Time-Bin Entanglement for Quantum Key Distribution

Dorian Schiffer [1,2], Robert Kindler [1], Florian Kanitschar [2,3], Alexandra Bergmayr-Mann [2],
Amin Babazadeh [1], Paul Erker [1,2], Marcus Huber [1,2], Anton Zeilinger [1]
[1] Institute for Quantum Optics and Quantum Information (IQOQI), Austrian Academy of Sciences, Vienna, Austria,
[2] Atominstitut, Technische Universität Wien, Austria,
[3] AIT Austrian Institute of Technology, Center for Digital Safety and Security, Vienna, Austria

Researchers have long looked to high-dimensional entanglement to enable quantum key distribution (QKD) in high loss and noise scenarios. Whether and when using the full entanglement dimensionality leads to a practical increase in key rates remains, however, the central open question. Here, we experimentally demonstrate that sought-after advantage by implementing a QKD protocol based on discretisations of temporally entangled photonic states.
Our protocol allows for a novel entangled-photon source, which achieves extreme brightness and high heralding ratios while maintaining low complexity. We locally distill key rates, with maxima appearing in higher dimensions. Varying the discretisations in post-processing, we scan a large parameter space, within which our results indicate ‚Goldilocks zones‘, where higher entanglement dimensionality translates into higher key rates.
</td></tr>
</table>

15:45	838	**Experimental data re-uploading with provable enhanced learning capabilities** *Martin Mauser [1], Solene Four [1], Lena Marie Predl [1], Francesco Ceccarelli [2], Roberto Osellame [2], Philipp Petersen [1], Borivoje Dakic [1,3], Iris Agresti [1], Philip Walther [1]* *[1] University of Vienna, Austria, [2] IFN-CNR, Milano, Italy, [3] IQOQI, Vienna, Austria* The last decades have seen the development of quantum machine learning, stemming from the intersection of quantum computing and machine learning. In this context, we present the implementation of a data re-uploading scheme on a photonic integrated processor, applied to several image classification tasks, where it grants high accuracies. We thoroughly investigate the capabilities of this apparently simple model, which relies on the evolution of one-qubit states, by providing an analytical proof that our implementation is a universal classifier and an effective learner, capable of generalizing to unknown data. Hence, our results shed new theoretical insight into this algorithm, its trainability, and generalizability properties.
16:00		***END***

ID	Quantum Information and Quantum Computing Poster
841	**Subjective nature of path information in quantum mechanics** *Xinhe Jiang [1,2], Armin Hochrainer [1,2], Jaroslav Kysela [1,2], Manuel Erhard [1,2], Xuemei Gu [1,3], Ya Yu [1,4], Anton Zeilinger [1,2]* *[1] Institute for Quantum Optics and Quantum Information, Austrian Academy of Sciences, Boltzmanngasse 3, AT-1090 Vienna,* *[2] Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Boltzmanngasse 5, AT-1090 Vienna ,* *[3] Max Plank Institute for the Science of Light, Staudtstraße 2, Erlangen DE-91058,* *[4] Shanghai Jiao Tong University, Dongchuan Road 800, Shanghai 200240, China* Common sense suggests that a particle must have a definite origin if its full path information is available. In quantum mechanics, the knowledge of path information is captured by the complementarity principle through the well-established duality relation $D^2 + V^2 \leq 1$, which describes the trade-off between path distinguishability D and interference visibility V. If visibility is zero, a high path distinguishability is obtained, which enables one with high predictive power to know where the particle comes from. Here we show that this perception of path information is problematic. We demonstrate that it is impossible to ascribe a definite physical origin to the photon pair even if the emission probability of one individual source is zero and full path information is available.
842	**The Cumulant Expansion Approach: the Good, the Bad and the Ugly** *Johannes Kerber, Helmut Ritsch, Laurin Ostermann* *Institute for Theoretical Physics, University of Innsbruck, Austria* The configuration space of compound quantum systems grows exponentially with the number of its subsystems. The full-quantum treatment, in general, is hardly possible analytically and can be determined numerically for small systems only. To obtain interesting physics, approximations might very well suffice, e.g. the Cumulant Expansion Method (CEM). Although the CEM is widely used, a general criterion for its applicability remains to be found. We discuss two problems in quantum electrodynamics (the dipole-dipole interacting chain of atoms) and quantum information (the factorization of bi-primes by annealing in an adiabatic quantum computer). On the one hand, we find smooth behavior, where the approximation becomes increasingly better with higher orders, while, on the other hand, we are puzzled by completely uncontrolled solutions.

843	**Random Numbers from Cosmic Microwave Background for Bell test** *Amin Babazadeh [1,2], Ricardo T. Genova-Santos [3,4], Alessandro Fasano [3,4], Jose Alberto Rubino Martin [3,4], Roger J. Hoyland [3,4], Rafael Rebolo Lopez [3], Anton Zeilinger [1,5]* *[1] Institute for Quantum Optics and Quantum Information, Austrian Academy of Sciences, Vienna, Austria,* *[2] Quantum Optics, Quantum Nanophysics and Quantum Information, University of Vienna, Austria,* *[3] Instituto de Astrofisica de Canarias (IAC), Tenerife, Spain,* *[4] Universidad de La Laguna, Dpto. Astrofisica, Tenerife, Spain,* *[5] Vienna Center for Quantum Science and Technology (VCQ), Faculty of Physics, Austria* We propose using Cosmic Microwave Background (CMB) radiation as a natural random number generator. Randomness is derived from CMB photons, emitted 378,000 years after the Big Bang. Links measurement choices to ancient, causally independent events nearly 13.8 billion years ago. This significantly strengthens Bell test experiments by extending causal separation and addressing the freedom-of-choice loophole, surpassing previous efforts by 7 billion years. With optimized detector bandwidths and strategic station placement, both locality and setting-independence loopholes can be closed for parameters significantly beyond current experiments. We also discuss technical challenges in isolating CMB signals from noise. Beyond foundational tests, this cosmological randomness offers a good source for quantum cryptography, randomness expansion, and secure communication.
844	**Uncertainty relations and entanglement with finite Fourier transformed variables.** *Dimpi Thakuria, TU Wien, Austria* We explore uncertainty relations for discrete phase-space observables in finite-dimension, focusing on canonical position/momentum observables linked by finite Fourier transforms. Our approach is complementary to the typical way of usingfinite-dimensional Heisenberg-Weylframework (especially, finite discrete-displacement operators) for studying such systems. Utilizing recent finite-dimensional phase-space formalisms, including analogs of Gaussian functions and Fourier matrix eigenstates, we analyze states saturating the Robertson-Schrödinger uncertainty relation. We extend our approach by embedding the problem in continuous-variable space, redefining displacement and squeezing operators beyond traditional Heisenberg-Weyl frameworks. We also examine uncertainty relations involving multiple observables, comparing minimum-uncertainty states, and discuss the continuous limit as dimension increases. We discuss applications that include entanglement detection in finite-dimensional systems, akin to covariance matrix criteria in continuous-variable systems.
845	**Approaching the mechanical ground state in an inductively coupled electromechanical system** *Bhargava Thyagarajan [1], Lukas Felix Deeg [1], Raamamurthy Sathyanarayanan [2], Christian Dejaco [2], Gerhard Kirchmair [1]* *[1] IQOQI, ÖAW, Innsbruck, Austria, [2] Institute for Experimental Physics, University of Innsbruck, Austria* A flux tunable microwave resonator coupled inductively to a magnetic cantilever has been shown to achieve optomechanical couplings > 10 kHz (Zoepfl, et al. PRL 2020), larger than state-of-the-art optomechanical devices. Backaction cooling of such a device to the mechanical ground state remains an outstanding challenge since it operates in the unresolved sideband regime. We circumvent this limitation by capacitively coupling the microwave mode to an auxiliary high-Q mode. Both the resulting hybridized modes inherit the optomechanical coupling and one of them should reside in the resolved sideband regime, allowing us to cool to the ground state. Alternatively, we use a flux transformer to mediate the optomechanical coupling. This mitigates the detrimental effect of the magnetized cantilever on the superconducting resonators.

846	**Towards a Quantum Network Node: Trapped Calcium Ions Coupled to a High-Finesse Optical Cavity** *Mehdi Rizvandi, Sudhan Bhadade, Moming Jia, Roberts Berkis, Dmitry Bykov, Miao Cai, Shivam Sawarn, Bo Wang, Liyang Zhang, Tracy Northup* *University of Innsbruck, Austria* Trapped calcium ions optically coupled to cavities can serve as nodes in future quantum networks. They allow for the production of photons that are entangled with long-lived atomic qubits, making them ideal for quantum information transmission. We are working on a quantum node that can connect to another nodes over metropolitan distances of up to 50 kilometers using a polarization-state encoding of single photons. In this poster, I present our advances on constructing a novel system incorporating a linear Paul trap, a high-finesse optical cavity, and ablation loading of trapped ions. I will also present future envisioned improvements such as a Raman transition scheme for high-purity photon states and mechanisms to enhance stability and control of the ion-cavity system.
847	**Adding and removing systems in quantum reference frames** *Bruna Sahdo, Esteban Castro Ruiz, IQOQI Vienna, Wien, Austria* We analyse the problem of adding and ignoring systems from the perspective of a quantum reference frame. We use examples with translation invariance to illustrate that an apparent modification of the rules of Quantum Theory for adding can indicate the ‘quantumness’ of an observer's frame. This is true when the symmetry invariance is demanded at the level of operators. However, we also show that there is a unitary way to go to a classicalized perspective of a frame, where the rules apply again, after internalizing the initial describer. This generates discussion about how this formalism can recover other QRF formulations, as well as an analogy between QRFs that are manifestly quantum and reference frames that are non-inertial in classical mechanics.
848	**A new view on Quantum Computers** *Christoph Grüner [1], Daniel Aziz [1], Joachim Bosina [1], Tobias Jenke [2], Hartmut Abele [1]* *[1] Atominstitut, TU Wien, Austria, [2] Institut Laue-Langevin, Grenoble, France* We describe a concept for a quantum computer based on an abundant number of energy eigenstates. These states form Q-bits or, ad libitum, higher dimensional Q-Nits with $N > 2$, allowing gate operations according to the quantum computing requirements of DiVincenzo. This system with higher dimensional Q-Nits offers potential advantages over traditional qubit-based quantum computing. It provides a larger state space for storing and processing information, which can reduce circuit complexity, simplify experimental setups, and enhance algorithm efficiency.
849	**Detecting genuine multipartite entanglement in multi-qubit devices with restricted measurements** *Nicky Kai Hong Li [1,2], Xi Dai [3,4], Manuel H. Muñoz-Arias [5], Kevin Reuer [3,4], Marcus Huber [1,2], Nicolai Friis [1,2]* *[1] Atominstitut, TU Wien, Austria, [2] IQOQI Vienna, Austria,* *[3] Department of Physics, ETH Zurich, Switzerland, [4] Quantum Center, ETH Zurich, Switzerland,* *[5] Institut Quantique and Département de Physique, Université de Sherbrooke, Canada* Detecting genuine multipartite entanglement (GME) can serve as a benchmark of coherence and control in quantum systems. However, many GME tests require joint measurements on all or most of the involved quantum systems, posing experimental challenges for platforms with restricted qubit connectivity, such as typical setups for time-bin encoded qubits. Here we construct a family of versatile GME criteria that require measurements of only a small subset—$O(n^2)$ out of 2^n—of (at most) m-body stabilizers of n-qubit target graph states, with m bounded from above by twice the graph's maximum degree. We present analytical results for white-noise-added graph states and numerical simulations for graph states produced in microwave photonic qubits that demonstrate the effectiveness of our GME criteria under realistic conditions.

850

Security Analysis and Implementation of Finite-Size Multi-User CV-QKD with Discrete Modulation

Florian Kanitschar [1,2], Adnan Hajomer [3], Michael Hentschel [1], Tobias Gehring [3], Christoph Pacher [1]
[1] AIT Austrian Institute of Technology, Wien, Austria, [2] Technische Universität Wien, Austria,
[3] Technical University of Denmark (DTU), Lyngby, Denmark

We present the first security analysis and experimental implementation of multi-user continuous-variable QKD with discrete modulation. Our protocol enables a central node to establish secret keys with multiple users over a passive optical network using standard telecom components. We analyze realistic trust scenarios and provide asymptotic and composable finite-size security proofs, employing efficient analytical and numerical methods that scale independently of the number of users. Demonstrated with a three-user 10 km fiber setup, our implementation achieves 0.866 Mbit/s under experimentally feasible conditions. The results confirm that scalable, fiber-based quantum networks with discrete-modulated CV-QKD are practical, bridging theory and deployment in real-world networked quantum communication.

851

Robust quantum memory in a trapped-ion quantum network node with an optical cavity

James Bate, Johannes Helgert, Marco Canteri, Viktor Krutyanskiy, Ben Lanyon
Universität Innsbruck, Institut für Experimentalphysik.

A key threshold for quantum networks is to store remotely entangled states for longer than the time required to generate them. Achieving that with trapped-ion network nodes requires quantum memories robust to photon generation attempts on co-trapped ions. In this work, a quantum memory is implemented in $^{40}Ca^{+}$ ions using dynamical decoupling that survive 8000 photon generation attempts on a co-trapped ion, lasting 1.7 s. The demonstrated storage time approaches the anticipated generation time of remote ion-ion entanglement over 100 km of ~ 10 s, achievable by modestly optimizing and duplicating our current experimental platform.

852

Josephson Gravimeter - Gravity Sensing by Quantum Tunneling in Superconducting Circuit

Martin Zemlicka, Gerard Higgins, Marios Christodoulou, Alejandro Perez
Institute for Quantum Optics and Quantum Information - Vienna, Austria

Recent studies suggest gravity might influence quantum tunneling in superconducting Josephson junctions (JJs). The idea is that gravity changes the potential across the junction, affecting how electrons (Cooper pairs) tunnel. This can create an electromagnetic signal – the AC Josephson effect. If the JJ is aligned with gravity, the signal's frequency could increase due to higher gravitational potential energy. We propose using this to detect gravity with high precision. With the right circuitry and a proper setup calibration, such signals can be measurable. This opens a new way to study gravity at the atomic scale and may find uses in nanotechology, material science, geophysics, and navigation systems.

Correlated Quantum Materials and Solid State Quantum Systems

This session has been organised in collaboration with the SFB Q-M&S

Thursday, 21.08.2025, Room HS 27

Time	ID	Correlated Quantum Materials and Solid State Quantum Systems *Chair: Aline Ramires, TU Wien*
16:00	871	**Correlated Quantum Materials and Solid State Quantum Systems** *Silke Bühler-Paschen, Institute of Solid State Physics, TU Wien, Austria* The SFB "Correlated Quantum Materials and Solid-State Quantum Systems" (Q-M&S, https://www.q-ms.org) is a collaborative research initiative funded by the Austrian Science Fund and the German Research Foundation. It brings together 10 principal investigators across four institutions in Austria and Germany. The project aims to bridge the fields of correlated quantum materials and solid-state quantum systems to drive progress in both areas. Concepts and methods from quantum information and computation are employed to gain deeper insights into correlated quantum materials. Conversely, the project also explores how such materials can be harnessed for quantum technologies. In this talk, I will provide an overview of the current status of the research.
16:15	872	**Enhanced entanglement in the pseudogap** *Frederic Bippus [1], Juraj Krsnik [1,4], Motoharu Kitatani [2], Anna Kauch [1], Gergö Roosz [3], Luka Akšamović [1], Neven Barišić [1,5], Karsten Held [1]* *[1] TU Wien, Austria, [2] University of Hyogo, Japan,* *[3] HUN-REN Wigner Research Centre for Physics, Budapest, Hungary,* *[4] Institute of Physics, Zagreb, Croatia, [5] University of Zagreb, Croatia* We show enhanced entanglement in the pseudogap regime of the Hubbard model using the dynamical vertex approximation (DGA). The pseudogap, a partially gapped electronic state, is observed near the superconducting transition in cuprates and nickelates. Leveraging DGA, we compute the quantum variance-a lower bound to the quantum Fisher information from the spin susceptibility directly on the imaginary Matsubara axis, circumventing the need for ill-controlled analytical continuation. The results show qualitative agreement with experimental data. Additionally, Ornstein-Zernike fits provide analytical insights. This work is supported by the SFB Q-M&S (FWF project ID F86).
16:30	873	**Quantum Fisher information in quantum critical $Ce_3Pd_{20}Si_6$** *Federico Mazza [1], Sounak Biswas [2], Xinlin Yan [1], Andrey Prokofiev [1], Paul Steffens [3], Qimiao Si [4], Fakher Assad [2], Silke Paschen [1]* *[1] TU Wien, Austria, [2] Universität Würzburg, Germany,* *[3] Institute Laue Langevin, Grenoble, France, [4] Rice University, Huston, USA* Strange metal behavior is observed across many materials platforms; its understanding represents a key open problem in correlated quantum matter. The heavy fermion compound $Ce_3Pd_{20}Si_6$ is an ideal testbed not only to probe quantum criticality that goes beyond the Landau-Gizburg-Wilson paradigm through the evaluation of the fractional quantum critical exponent but also to investigate new theoretical predictions regarding multipartite entanglement. We present the results of our recent inelastic neutron scattering investigation at a strange metal quantum critical point in Ce3Pd20Si6, including the dynamical scaling, the quantum Fisher information density as a function of temperature and a comparison with quantum Monte Carlo simulations on a pertinent model.

16:45 | **874**

High-entropy magnetism of murunskite

Priyanka Reddy [1], Davor Tolj [2], Ivica Živković [3], Luka Akšamović [1], Jian Rui Soh [3], Kamila Komedera [4], Naveen Kumar [5], Mario Novak [6], Clemens Ritter [7], Wojciech Tabiś [4], Trpimir Ivšić [8], Thomas La Grange [3], Ivo Batistić [6], Laszlo Forro [9], Henrik Rønnow [3], Denis Sunko [6], Neven Barisic [1]
[1] Technical University of Vienna, Austria, [2] Johns Hopkins University, Baltimore, USA,
[3] École Polytechnique Fédérale de Lausanne, Switzerland,
[4] AGH University of Krakow, Faculty of Physics and Applied Computer Science, Krakow, Poland,
[5] Institute of Nuclear Physics, Krakow, Poland,
[6] Department of Physics, Faculty of Science, University of Zagreb, Croatia,
[7] Institut Laue-Langevin, France, [8] Ruđer Bošković Institute, Croatia,
[9] University of Notre Dame, USA

Murunskite ($K_2FeCu_3S_4$) bridges cuprate and iron-pnictide high-temperature superconductors (HTS), showing an antiferromagnetic-like transition below 97 K. Its structure features randomly distributed magnetic Fe and non-magnetic Cu in 2D planes, forming a high-entropy magnetic alloy. Neutron, Mössbauer, and XPS studies on single crystals reveal nearly commensurate antiferromagnetic order. In the paramagnetic state, Mössbauer spectra show two Fe sites (Fe^{3+}/Fe^{2+}), merging into a third upon cooling – signaling an orbital transition. This evolution reflects a shift from disordered to ordered magnetic/orbital states in reciprocal space, despite real-space randomness. These results challenge conventional views linking crystal structure and magnetic moment localization in insulating magnets.

17:00 | **875**

Disentangling Coherent Phonons from Propagation Effects in the Terahertz Kerr Response of Bulk $LaAlO_3$

Chao Shen [1], Maximilian Frenzel [2], Sebastian Maehrlein [2,3,4], Zhanybek Alpichshev [1]
[1] Institute of Science and Technology Austria (ISTA), Klosterneuburg, Austria,
[2] Fritz Haber Institute of the Max Planck Society, Department of Physical Chemistry, Berlin, Germany,
[3] Helmholtz-Zentrum Dresden-Rossendorf, Institute of Radiation Physics, Dresden, Germany,
[4] Dresden University of Technology, Institute of Applied Physics, Germany

Analyzing multi-dimensional nonlinear Terahertz response is a powerful method to study nonlinear dynamics of complex systems. However, the interpretation of the obtained data, in particular, distinguishing genuine coherent oscillations from the measurement artifacts in THz Kerr response remains challenging. Here, combining two-dimensional Terahertz Kerr effect (2D-TKE) spectroscopy experiments and modeling, we unravel complex THz-induced temporal oscillations in twinned $LaAlO_3$ crystals at low temperatures. Our findings highlight the importance of propagation effects in nonlinear THz experiments and provide a refined framework for interpreting THz polarization dynamics in birefringent crystals.

17:15 | **876**

Magnetotropic Susceptibility in α-$RuCl_3$: Insights into Bond-Dependent Exchange Interactions and Frustrated Magnetism

Hamza Nasir [1], Muhammad Nauman [1], Young-June Kim [2], Kimberly Modic [1]
[1] Institute of Science and Technology Austria, AT-3400 Klosterneuburg,
[2] University of Toronto, Canada

We measured the magnetotropic susceptibility ($k = \partial^2F/\partial\theta^2$) in small monoclinic crystals with fine in-plane angular precision of the crystal axes with respect to the external magnetic field. We observed asymmetries in k at temperatures above and below T_N (~14 K) when rotating the c-axis across the magnetic field towards different in-plane directions. These asymmetries, which are highly dependent upon the in-plane rotation direction, are an indication of the prominent bond-dependent exchange interaction, including Kitaev-like interactions – the magnitude and sign of which could be determined using future numerical approaches. For some planes of rotation, periodic transitions are observed as a function of the out-of-plane field angle from ~ 10 to 14 T, likely due to the multiple monoclinic domains.

17:30	**877**	**Low-noise quantum dots in ultra-thin cap Ge/SiGe heterostructures for applications in hybrid semiconducting-superconducting devices.** *Maksim Borovkov [1], Yona Schell [1], Dina Sokolova [1], Kevin Roux [1], Paul Falthansl-Scheinecker [1], Giorgio Fabris [1], Stefano Calcaterra [2], Daniel Chrastina [2], Giovanni Isella [2], Georgios Katsaros [1]* *[1] Institute of Science and Technology Austria, Klosterneuburg, Austria,* *[2] L-NESS, Physics Department, Politecnico di Milano, Como, Italy* Hybrid semiconducting-superconducting devices—such as Andreev spin qubits, Cooper pair splitters, and Kitaev chains—are a rapidly developing area in solid-state quantum systems. Most prior research has focused on III-V material platforms, where superconducting proximity effects are well established. Recently, germanium-based systems have gained attention for their potential to host both coherent spin qubits and induced superconductivity. When inducing superconducting order through an ultra-thin (4 nm) SiGe tunnel barrier cap, the challenge of creating a low-noise electrostatic environment for quantum dots arises. In this work, we address this issue and demonstrate the ability to form quantum dots with charge noise levels in the range of 0.5 – 7 μeV/√Hz, comparable to established platforms supporting spin qubits with long coherence times.
17:45		*Discussion*
18:00		***END***
		Transfer to Dinner
19:00		***Conference Dinner***

ID	Correlated Quantum Materials and Solid State Quantum Systems Poster
881	**Signatures of Weyl-Kondo physics in $Ce_3Bi_4Pd_3$** *Monika Luznik [1], Diana Maria Kirschbaum [1], Mathieu Taupin [1], Xinlin Yan [1], Andrey Prokofiev [1], Léo Mangeolle [2,3], Gwenvredig Le Roy [1], Silke Paschen [1]* *[1] Institute of Solid State Physics, TU Wien, Austria,* *[2] Technical University of Munich, School of Natural Sciences, Physics Department, Garching, Germany,* *[3] Munich Center for Quantum Science and Technology (MCQST), Germany* Weyl-Kondo semimetals represent a novel category of materials, wherein the interplay of strong correlations and metallic topology leads to the integration of Weyl nodes into the Kondo resonance, thereby substantially amplifying Berry curvature effects. A hallmark of this state, as exemplified by the prototypical Weyl-Kondo semimetal $Ce_3Bi_4Pd_3$, is a giant spontaneous nonlinear Hall effect. A comparison with noninteracting Weyl semimetals of similar charge carrier concentration reveals that the nonlinear Hall effect is amplified by orders of magnitude through strong correlations. These findings, along with recently discovered new signatures of Weyl-Kondo physics, serve as effective tools for both identifying and utilizing this novel and promising materials class.
882	**Emergent topological phase from quantum criticality in $CeRu_4Sn_6$** *Diana Kirschbaum [1], Lei Chen [2], Diego A. Zocco [1], Haoyu Hu [2], Federico Mazza [1], Julio Larrea Jiménez [1,3], André M. Strydom [4], Devashibhai Adroja [5], Xinlin Yan [1], Andrey Prokofiev [1], Qimiao Si [2], Silke Paschen [1]* *[1] Institute of Solid State Physics, TU Wien, Austria,* *[2] Department of Physics and Astronomy, Center for Quantum Materials, Rice University, Houston, USA,* *[3] Lab. for Quantum Matter under Extreme Conditions, Institute of Physics, University of São Paulo, Brazil,* *[4] Physics Dep., Highly Correlated Matter Research Group, University of Johannesburg, South Africa,* *[5] ISIS Neutron and Muon Source, Science and Technology Facilities Council, Rutherford Appleton Laboratory, Didcot, United Kingdom* Heavy fermion systems exhibit various fascinating phenomena, ranging from strange metal behavior and unconventional superconductivity to correlation-driven topology. A prime example for the latter is the Weyl-Kondo semimetal observed in $Ce_3Bi_4Pd_3$. Here, we use the quantum-critical heavy fermion semimetal $CeRu_4Sn_6$ to investigate whether such a topological phase can still form when the Fermi liquid description no longer holds, such as at a quantum critical point of beyond-order parameter type. Our experiments reveal a topological semimetal phase that emerges from the system's quantum critical state, exhibiting a dome-like shape as a function of pressure and magnetic field. These findings are explained by extending the concept of Weyl crossings to non-quasiparticle spectral functions overlapping in energy at specific points in momentum space.

~~883~~	*cancelled*
884	**Tuning the Weyl-Kondo semimetal $Ce_3Bi_4Pd_3$ via stoichiometry** *Nikolas Reumann, Diana Kirschbaum, Diego Zocco, Monika Lužnik, Sami Dzsaber, Mathieu Taupin, Gaku Eguchi, Xinlin Yan, Andrey Prokofiev, Silke Bühler-Paschen* *TU Wien, Austria* The Weyl-Kondo semimetal $Ce_3Bi_4Pd_3$ represents a recent example of how strong electronic correlations combined with nontrivial topology can give rise to novel quantum phases. In particular, the interplay between the Berry curvature singularities at Weyl nodes and the Kondo effect, which can stabilize these nodes at the Fermi level and strongly enhance the density of states of the Weyl bands, enhances the material's topological responses, as exemplified by the giant nonlinear Hall effect. In this work, we synthesized and thoroughly characterized a series of $Ce_3Bi_4Pd_3$ single crystals with slight stoichiometric variations. We will present and discuss the observed trends in lattice parameters and electrical transport properties, with an emphasis on the nonlinear Hall effect.
885	**Investigation of the quantum critical compound $Ce_3Pd_{20}Si_6$ through thermal conductivity** *Gwenvredig Le Roy, Duy Ha Nguyen, Xinlin Yan, Andrey Prokofiev, Silke Paschen* *Institute of Solid State Physics, Technische Universität Wien, Austria* Quantum criticality, a key phenomenon in strongly correlated electron systems, has been extensively studied in heavy fermion materials, where quantum critical points (QCPs) can be readily accessed through tuning. Of particular interest are Kondo destruction QCPs. The heavy fermion compound $Ce_3Pd_{20}Si_6$ exhibits two consecutive Kondo destruction QCPs, which can be explored through magnetic field tuning. Recent quantum Fisher information measurements with inelastic neutron scattering on this material haverevealed a high multipartite entanglement at one of these QCPs. Here we present low-temperature thermal conductivity measurements across the magnetic field-tuned phase diagram. We address the contributions of both the antiferroquadrupolar and the antiferromagnetic transition. Our objective is to determine whether the Wiedemann-Franz law is violated near the Kondo destruction QCPs.
886	**Scrutinizing quantum effects on the classical modeling of $BaCo_2(AsO_4)_2$ with the magnetotropic susceptibility** *Shiva Safari, Institute of Science and Technology Austria (ISTA), Klosterneuburg, Austria* $BaCo_2(AsO_4)_2$ (BCAO) is a promising platform for studying exotic quantum magnetism, with strong frustration from third-neighbor exchange interactions on a cobalt honeycomb lattice. Neutron scattering reveals an incommensurate ground state and exchange parameters consistent with the classical XXZ-J1-J3 model. However, density matrix renormalization group (DMRG) calculations using these parameters predict a ferromagnetic (FM) ground state, indicating significant quantum effects. To refine the model, we map the intermediate and high-field phase diagram by measuring the magnetotropic susceptibility as a function of the out-of-plane magnetic field at T = 1.6 K. With updated parameters, infinite-DMRG simulations reproduce the incommensurate ground state observed experimentally, located near the boundary of the FM phase predicted by DMRG, thereby bridging experimental observations with theoretical developments in BCAO.

887

MBE growth of heavy-fermion thin films

Lukas Fischer [1], Stefania Isceri [2], Laura Kronlachner [3], Maximilian Podsednik [3], Duy Ha Nguyen [1], Monika Waas [1], Xinlin Yan [1], Andreas Limbeck [3], Andrey Prokofiev [1], Aaron Maxwell Andrews [2], Silke Paschen [1]

[1] Institute of Solid State Physics, Technische Universität Wien, Austria,
[2] Institute of Solid State Electronics, Technische Universität Wien, Austria,
[3] Institute of Chemical Technologies and Analytics, Vienna, Austria

Heavy-fermion materials offer a platform to study quantum criticality, topological effects, and unconventional transport. Their exploration in reduced dimensions and integration into quantum devices requires the synthesis of high-quality thin films. This work focuses on the molecular beam epitaxy (MBE) growth of two compounds: $YbRh_2Si_2$ and $Ce_3Bi_4Pd_3$. $YbRh_2Si_2$ hosts a Kondo destruction quantum critical point (KD QCP) where strange metal behaviour is observed and quantum entanglement predicted to become long-range. This could be detectable with thin films. We show how the substrate temperature controls growth modes, allowing to further improve transport properties. $Ce_3Bi_4Pd_3$ is a Weyl-Kondo semimetal exhibiting a giant spontaneous Hall effect. We report its first thin-film synthesis, to enable studies on gate-tunable Hall response.

888

Microwave conductivity of a strange metal heavy fermion compound

Thanh Duc Phan, TU Wien, Austria

$YbRh_2S_2$ is a paradigmatic heavy fermion compound, with a quantum critical point that goes beyond the Landau order parameter framework and exhibits various new signatures of strange metallicity. Here we present first results on broadband microwave (MW) spectroscopy in Corbino geometry down to mK temperatures, on $YbRh_2S_2$ thin films grown by molecular beam epitaxy on Ge substrates. This method grants access to the full complex MW conductivity and allows exploring the magnetic field-temperature space that spans Fermi liquid and non-Fermi liquid regimes, which remained elusive in prior THz conductivity measurements.

Biophysics and Soft Matter

Friday, 22.08.2025, Room HS 30

Time	ID	BIOPHYSICS AND SOFT MATTER I: BIOPHYSICS *Chair: Christof Fattinger*
11:00	**901**	**A generic mechanism for force-modulated adsorption of E. coli** *Erik Reimhult [2], Anders Lundgren [1], Peter D. J. van Oostrum [2], Jagoba Iturri [3], Michael Malkoch [1], José Luis Toca-Herrera [3],* *[1] Department of Chemistry and Molecular Biology, University of Gothenburg* *[2] Institute of Colloid and Biointerface Science, BOKU University* *[3] Institute of Biophysics, BOKU University* Many bacteria interact with surfaces via long (μm) and thin (nm) tethers called fimbriae or pili. A particularly intriguing function of pili is how they aid, e.g., E. coli, in attaching more strongly to surfaces in flow than in the absence of flow and performing stick-slip and roll motions along the surface. This has been attributed to molecular so-called catch-bonds between host cell-surface sugars and lectins at the pilis' tips. We used nanopatterned substrates, in situ microscopy, in-line holography, and atomic force microscopy to demonstrate that a molecular mechanism is unnecessary to explain the adsorption and motion of fimbriated E. coli. The loss of translational motion in high shear is caused by a shear force-induced push of the bacteria toward the interface. Pushing the bacteria closer to the surface increases the binding valency, as shorter fimbriae can bind to the surface. In contrast to catch-bond force-controlled binding mechanisms, force modulation of the binding valency is generic, applying to any surface and likely to other microorganisms.
11:30	**902**	**Understanding Fracture in Physically Crosslinked Hydrogels** *Kerstin G. Blank [1,2], Alberto Sanz de León [2], Geonho Song [1,2], Isabell Tunn [2], Tanja D. Singewald [1]* *[1] Johannes Kepler University Linz, Austria,* *[2] Max Planck Institute of Colloids and Interfaces, Potsdam, Germany* Hydrogels for cell culture are typically designed with controlled linear viscoelasticity. As cells exert tensile and compressive forces, non-linear mechanical properties are, however, equally important. We use a bottom-up approach to synthesize physically crosslinked hydrogels from molecularly defined building blocks. A library of coiled coil crosslinks with tunable molecular properties enables a systematic exploration of their influence on hydrogel stress relaxation and fracture. Rheological measurements reveal that stress relaxation is determined by the equilibrium thermodynamic and kinetic properties of the crosslinks. In contrast, fracture is governed by their dynamic mechanical stabilities, as quantified with single-molecule force spectroscopy. Crosslinks with identical thermodynamic but different molecular mechanical stabilities yield hydrogels with similar linear viscoelastic properties but controlled and distinct yield stresses.
11:45	**903**	**Effect of 2D confinement and substrate properties on bacterial self-organization at surfaces** *Vincent Hickl, Antonia Neels, René Rossi, Katharina Maniura, Bruno Silva* *Empa, St. Gallen, Switzerland* Surface-attached bacterial colonies exhibit collective behaviors that play an important role in the spread of microbial infections. Many open questions remain about how the bacteria's self-organization adapts to the variety of different environments they encounter in natural settings. Here, the effects of dimensional confinement and material properties on the collective behaviors of pathogenic bacteria are described. Biofilm-forming bacteria are grown confined to a single monolayer between different substrates. Using single-cell segmentation and tracking, the orientational ordering in the colony, cell morphologies, and swimming behaviors are shown to be altered by 2D confinement. These results demonstrate the remarkable breadth of collective behaviors exhibited by bacteria in different environments, which must be considered to better understand bacterial colonization of surfaces.

12:00 | **904**

Synthesis and flow behaviour of polymer-grafted nanopores

Giacomo Chizzola, Mudassar Virk, Peter D. J. van Oostrum, Erik Reimhult
Institute of Colloid and Biointerface Sciences, BOKU University, Vienna, Austria

Nanopores in solid substrates have received great interest for many years, often inspired by their similarity to important biological systems. So far, diffusion through solid-state nanopores grafted with polymer brushes has been investigated; however, transport by diffusion is severely restricted, especially as the pore dimensions approach the size of the diffusing molecules. In many applications and biological systems, flow and transient flow might play an important role, as transport through a nanopore is only efficient if the flow is convective.
In polymer-grafted nanopores, the flow profile might strongly deviate from the Poiseuille flow profile. The polymer can also deform under flow and affect it transiently. We set out to achieve controlled and reproducible growth of polymers grafted from the inner surface of nanopores and characterize the dynamic flow circuit behavior for future applications, such as gated protein and other biomolecular transport.

12:15 | **905**

Electro-Acoustic Spinning for the Characterization of Individual Cells

Tayebeh Saghaei, Erik Reimhult, Peter D. J. van Oostrum
Institute of Colloid and Biointerface Science, BOKU University, Vienna, Austria

We have developed electro-acoustic spinning (EAS), a label-free method capable of concurrently assessing individual cells' electrical and mechanical characteristics. Deformable suspended objects rotate when subjected to a combined electric and acoustic field. The frequency-dependent rotation spectrum depends on the mechanical and electrical properties of the object and its surroundings. Therefore, EAS enables the characterization of a broad range of “soft” colloids based on their electrical and mechanical properties. In the same experimental setup, we found that the rotation speed and direction depend sensitively on the type of object, the presence of ionic surfactants, pH, and ionic strength. The rotational behavior is consistent throughout the microscope’s field of view, allowing for parallelized, high-throughput characterization. We demonstrated EAS's capability to distinguish cells with subtle differences in electrical and mechanical properties, including variations in age or passage number.

12:30 | ***Poster Awards and Closing Ceremony***

12:45 | ***Lunch***

Biophysics and Soft Matter II:
Light and Biophysics

Chair: Rainer Leitgeb, Med. Universität Wien

14:00 | **911**

New contrasts for holographic microscopy for novel applications in biotechnology and environmental monitoring

Peter D. J. van Oostrum, Erik Reimhult
Institute of Colloid and Biointerface Science, BOKU University, Vienna, Austria

In holographic microscopy, monochromatic light is shone through a medium in which particles or microorganisms scatter some of it. The scattered light interferes with a coherent reference beam, forming holograms. In in-line holography, the ballistic part of the illumination serves as the reference beam, which guarantees perfect alignment. Holograms can be analysed either by fitting a scattering model or by back-propagation.
We propose a simple criterion based on the phase of the scattered field that allows suppressing many artefacts and effectively enhances the resolution by a factor of two. In addition, we propose a family of interference contrasts that boost the signal-to-noise ratio further. These improvements allow for the swift locating and characterizing of thousands of individual particles, including microorganisms such as bacteria, in large volumes of liquid. We will show examples of its application to a host of real-world microscopy monitoring challenges.

14:15	**912**	**Investigation of dynamic tissue properties using optical coherence tomography** *Bernhard Baumann [1], Lucas May [2], Conrad Merkle [2], Sybren Worm [2], Gerhard Garhöfer [2], Ireneusz Grulkowski [3]* *[1] Medical University of Innsbruck, Austria, [2] Medical University of Vienna, Austria, [3] Nicolaus Copernicus University, Torun, Poland* The biomechanical characteristics of biological tissues often strongly depend on their microstructural composition. Pathological changes can alter these tissue properties, thus the measurement of biomechanical parameters may provide access to diagnostic information. Optical methods enable non-invasive probing of tissues as well as high-resolution imaging. Here we present optical coherence tomography (OCT) for the measurement of nano-scale tissue deformations in parallel with high-speed volumetric imaging of tissue morphology in the eye. Different methodological approaches for OCT elastography will be discussed and substantiated with in-vitro and in-vivo applications to showcase the diagnostic potential of this technology.
14:30	**913**	**Light scattering angular dependency in brain tissues determined by wide-field polarimetric and time-of-flight measurements.** *André Stefanov, Vladislav Stefanov, Bhanu Singh, University of Bern, Switzerland* We present wide-field measurements of the backscattered light from brain tissue samples. The light is analyzed either in a polarimetric setup or in a time-of-flight one using a time-resolved single-photon camera. We relate the anisotropic scattering to the microscopic properties of the tissues, in particular, we can distinguish the disordered gray matter from the oriented fiber-like white matter. From the polarimetric measurements, we can determine a local average orientation in the white matter. From time-of-flight measurements, we obtain the angle-resolved scattering coefficients of white and gray matter in the brain.
14:45	**914**	**How do Graphium butterflies manipulate colors by using protein?** *Limin Wang, Kiyesola Rantioluwa Kolawole, Primoz Pirih, Bodo Wilts* *Department of Chemistry and Physics of Materials, University of Salzburg, Austria* Colors play an essential role in the survival of organisms in many aspects, e.g., for sending signals and facilitating communication, or camouflaging. Animals use a plethora of manipulation ways to create different hues using structural and/or pigmentary colors. Here, we investigated Graphium butterflies. A special focus is on G. weiskei which features three different colors on their wings that are (uniquely) induced by pigmentary colors. By characterizing UV-vis spectra and Raman spectra on the butterfly wings and extractions of the pigment, we realize that this butterfly can use the same bile pigment to form three distinct hues (blue, green and purple) by manipulating their pigment and protein binding systems, and show that this is a wider trait across the genus.
15:00	**915**	**Formation of biophotonic gyroid nanostructures in the butterfly Parides sesostris** *Anna-Lee Jessop [1,2]* *[1] University of Salzburg, Austria, [2] Murdoch University, Perth, Australia* Nature provides many remarkable examples of complex functional materials. Such examples include the biophotonic gyroid nanostructures found in butterflies. These biological nanostructures exhibit uniquely desirable optical properties but form at a length scale that we are currently unable to easily replicate. In this study we aimed to elucidate the formation mechanisms of gyroid nanostructures in the butterfly Parides sesostris. We used in vivo hyperspectral microscopy on living pupae to observe changes in reflectance that occur due to gyroid nanostructure development and combined this with post-mortem electron microscopy. We show that the structure forms as an entanglement of fibres woven into a gyroid that is templated by cellular membranes and that this produces a red-shifted optical signal that increases over time.

15:15	**916**	**Mutanofactin affects interactions of mucin-coated surfaces and Streptococcus mutans** *Konstantin Nikolaus Beitl [1], Leon Gabor Sacha Thies [2], Lukas Lüthy [3], Moritz Hansen [3], Joshua McManus [3], Muhammad Afzal [2], Lukas Schrangl [4], Susanne Bloch [2], Guruprakash Subbiahdoss [1], Erick M. Carreira [3], Christina Schäffer [2], Erik Reimhult [1]* *[1] Institute of Colloid and Biointerface Science, BOKU University, 1190 Vienna, Austria* *[2] Institute of Biochemistry, BOKU University, 1190 Vienna, Austria* *[3] Department of Chemistry and Applied Biosciences, Laboratory of Organic Chemistry, ETH Zürich, 8093 Zürich, Switzerland* *[4] Institute of Biophysics, BOKU University, 1190 Vienna, Austria* Mucin is a glycoprotein and a major component of the salivary pellicle, forming protective layers against the adhesion of bacteria in the human oral cavity. Nevertheless, pathogens like Streptococcus mutans (S. mutans) adhere to this highly hydrated surface and initiate the formation of dysbiotic biofilms. Mutanofactins (Muf) were recently identified as small-molecule secondary metabolites of S. mutans that promote the formation of such biofilms, supposedly through increasing cell surface hydrophobicity (CSH). However, we rule out any direct effects on CSH. Instead, quartz crystal microbalance with dissipation monitoring (QCM-D) and atomic force microscopy (AFM) measurements reveal that Muf-697 irreversibly changes the conformation of adsorbed mucin to promote S. mutans adhesion. This unique property of Muf-697 might be key to the early stages of biofilm formation in the human oral microbiome.
15:30		***END***

ID	Biophysics and Soft Matter Poster
931	**Optical Performance of Cylindrical and Tapered Fly Rhabdomeres Using a Cascaded Waveguide Approach** *Mahdi Khodadadi Karahroudi, Primoz Pirih, Bodo Wilts* *Department of Chemistry and Physics of Materials, Paris Lodron University of Salzburg, Austria* Insect vision often relies on waveguides to enable vision. This study investigates light propagation in fly rhabdomeres, their lightguides, using a cascaded waveguide modeling approach. By dividing the rhabdomere into axial segments, we simulate the evolution of guided modes along the photoreceptor length. We compare rhabdomeres with cylindrical and tapered geometries to evaluate differences in mode excitation, power confinement, and light propagation behavior. The approach enables tracking of modal amplitude and phase across structural transitions, providing insight into how geometry influences optical performance. Tapering significantly alters the modal structure and can enhance or suppress specific modes. This flexible, biologically relevant framework aids in analyzing light flow in compound eyes and contributes to understanding structure-function relationships in insect vision.
932	**Atomic Force Microscopy (AFM) Analysis of Cellular Mechanics Following Measles Vaccine Virus Infection** *Alexander Einschütz López [1], Johanna Bacher [2], Alois Jungabuer [2], José L. Toca-Herrera [1]* *[1] Institute of Biophysics, Department of Natural Sciences and Sustainable Resources, BOKU Wien, Austria,* *[2] Institute of Bioprocess Science and Engineering, Department of Biotechnology and Food Science, BOKU Wien, Austria* The measles virus (MeV) disrupts cellular functions by compromising cytoskeletal integrity. To examine its biomechanical effects, we studied Vero cells using atomic force microscopy (AFM) for force–distance and stress relaxation measurements. Our analysis showed a significant reduction in cell stiffness and prolonged stress relaxation times following MeV infection, indicating disruption of the actin and microtubule networks. These findings enhance our understanding of the biomechanical alterations induced by MeV and highlight potential targets for therapeutic intervention to mitigate virus-driven cellular damage.

933 Understanding Biological Material Mechanics Through Energy Dissipation

Jose Luis Toca-Herrera [2], Andreas Weber [1]
[1] London Centre for Nanotechnology, University College London, England,
[2] Institute of Biophysics, BOKU University, Vienna, Austria

Biological materials are made of complex networks of proteins, lipids, carbohydrates, and other biomolecules. As a result, they display rich and complex viscoelastic behavior. Recent work has aimed to describe these properties at the nano- and microscale using linear and nonlinear models. However, selecting the appropriate model and its level of complexity remains challenging.
Here, we use atomic force microscopy (AFM)-based force spectroscopy across a wide range of frequencies and indenter geometries to study energy dissipation (hysteresis) during compression–relaxation cycles. We examine cells, bacteria, and hydrogels. Hysteresis shows a power-law dependence on frequency. We propose this simple and accessible framework as a powerful tool to characterize viscoelastic behavior in biological materials and discuss its implications for understanding cell mechanics.

934 Rheo-microscopy of Soft Materials

Eva Hudec [1,2], Nikolaos Kalafatakis [1], Roberto Cerbino [1]
[1] Computational and Soft Matter Physics, Faculty of Physics, University of Vienna, Austria,
[2] Department of Physics, Faculty of Science, University of Zagreb, Croatia

We investigate how microscopic dynamics underpin the bulk rheological behavior of soft materials by integrating microscopy with rheological measurements. By adapting a commercial rheometer for in situ imaging, we visualize structural rearrangements during deformation and recovery. Using echo protocols and recovery rheology, we probe viscoelastic behavior in both commercial and custom samples. Particle tracking and differential dynamic microscopy (DDM) enable us to correlate macroscopic mechanical responses with microscopic motion across different timescales and length scales. This work moves us closer to the rheologist's dream: directly observing the structures responsible for flow and deformation.

935 Non-Universality of Jamming in Cellular Monolayers

Jasmin Di Franco [1,2], Fabian Krautgasser [1], Camillo Mazzella [3], Fabio Giavazzi [4], Giorgio Scita [3,5], Roberto Cerbino [1]
[1] Computational and Soft Matter Physics, Faculty of Physics, University of Vienna, Austria,
[2] Vienna Doctoral School in Physics, University of Vienna, Austria,
[3] IFOM, The FIRC Institute for Molecular Oncology, Milan, Italy,
[4] Department of Medical Biotechnology and Translational Medicine, Milan, Italy,
[5] Department of Oncology and Haemato-Oncology, University of Milan, Italy

Phase transitions in cellular collectives, such as jamming, play key roles in biological processes like morphogenesis and wound healing. While traditionally linked to increasing cell density, recent evidence suggests that adhesion forces also influence collective arrest. Our study examines jamming across epithelial and fibroblast cell lines using Particle Image Velocimetry (PIV) and Differential Dynamic Microscopy (DDM). We find significant variability in dynamical behaviors, with some monolayers slowing gradually while others transition from ballistic to diffusive motion. Crucially, motility transitions often correlate with spatial ordering, reflected in the static structure factor. These differences emerge both between and within cell types, challenging the idea of universal jamming. Our findings highlight the need for cell-type-specific frameworks to describe collective arrest in living tissues.

936 Rheomicroscopy of hydrogels across the yielding transitions

Sakshi Khandelwal [1,2], Mohandas Mohandas [1,2], Nikos Kalafatakis [1,2], Roberto Cerbino [1]
[1] Computational and Soft Matter Physics, Faculty of Physics, University of Vienna, Austria,
[2] Vienna Doctoral School in Physics, University of Vienna, Austria

Hydrogels are soft, water-rich polymer networks with widespread applications in biomedicine, soft robotics, and materials engineering. Understanding their mechanical behavior – particularly yielding, the strain amplitude at which their response transitions from solid-like to fluid-like – is essential for improving their reliability and performance. Here, we present preliminary rheomicroscopy results on a model hydrogel system, obtained using both a commercial and a custom-built rheometer. Our approach, combining classical rheological measurements with simultaneous quantitative microscopy, elucidates how the material responds to applied stress and highlights the onset of mechanical failure. These observations provide insight into the gel's stress-bearing capacity and lay the groundwork for future strategies to enhance its mechanical resilience and functional adaptability in application-oriented contexts.

937	**Cell response to curvature gradients** *Parvathy Anoop, Heidi Pertl-Obermeyer, Andreas Roschger, John Dunlop, University of Salzburg, Austria* Cells actively sense and respond to their surroundings. These responses can be triggered by biochemical signals as well as physical cues. Physical signals include substrate stiffness, compressive forces, or shear stress. Recent research has highlighted the significance of another key physical factor: substrate curvature. Previous studies in the group reveal that pre-osteoblast MC3T3-E1 cells grown on capillary bridges show a twisted plywood like structure. Micropatterning techniques have been widely used to constrain cell adhesion areas on 2D surfaces. While micropatterning is optimised for 2D surfaces, methods for controlled curvature study on 3D structures remain to be explored. This poster explores techniques to combine 2D patterning techniques on 3D printed surfaces to study cell alignment, movement and growth.
~~938~~	*cancelled*
939	**Cavitation on metallic implants induced by alternating magnetic fields disrupts bacterial biofilms but damages osteoblast-like cells** *Konstantin Nikolaus Beitl, Guruprakash Subbiahdoss, Erik Reimhult* *Institute of Colloid and Biointerface Science, BOKU University, 1190 Vienna, Austria.* Implant-associated infections present a significant clinical burden. Traditional treatments range from prolonged antibiotic therapy to surgical removal of the implant. Novel physics-based therapeutic strategies like the application of alternating magnetic fields (AMF) promise to eradicate implant-associated infections non-invasively via localized inductive heating on metallic implants. We investigated the effects of AMF on Staphylococcus aureus biofilms and layers of SaOS-2 osteosarcoma cells on titanium surfaces. Our results suggest that the mechanism of AMF-induced biofilm disruption extends beyond thermal effects and likely involves mechanical forces from cavitation. Fast microbubble formation and cavitation generate intense shear forces through phenomena such as microjet impingement and microstreaming. These lead to irreversible structural damage and induce apoptosis in SaOS-2 cells, even for short AMF exposures. Our findings underline the importance of considering mechanical stress caused by cavitation to balance biofilm eradication with tissue safety when treating bacterial infections of metallic implants with AMF.

Young Minds

Friday, 22.08.2025, Room HS 41

Time	ID	YOUNG MINDS *Chair: David Steiner, Universität Wien*
14:00	991	**Navigating the bias-variance tradeoff in materials science** *Markus Wallerberger, TU Wien* In this introductory talk, I aim to give a broad overview over machine learning (ML) and related techniques as they have been applied to problems in materials science. The fundamental tradeoff between uncertainty and bias inherent to learning shall serve as our guide. It explains why large-scale general purpose models, while valuable, have had limited impact in physics, and why on the other hand simple ML models taylored to specific problems have led to breakthroughs to molecular dynamics and quantum field theories. Time permitting, we will turn to physical interpretations and phase transitions in the the tradeoff itself.
14:30	992	**High-Dimensional Temporal Entanglement for Quantum Key Distribution** *Dorian Schiffer, TU Wien*
14:45	993	**Biodegradation of Poly(Ethylene Terephtalate) via selected petase enzymes** *Laura Wolfthaler, JKU Linz*
15:00	994	**Experimental Realization of Inverse-Design Magnonics** *Fabian Majcen, Universität Wien*
15:15		***END***

Further Meetings and Events

Time	Room	Meeting
Monday, 18.08., 08:30	**HS 30**	SPS Board Meeting (Non-Public)
Monday, 18.08., 18:00	**HS 30**	SPS General Assembly
Monday, 18.08., 08:30	**HS 31**	ÖPG Board Meeting (Non-Public)
Monday, 18.08., 18:00	**HS 31**	ÖPG General Assembly
Tuesday, 19.08., 14:00	**HS 29**	ENS Fachausschusssitzung
Tuesday, 19.08., 15:30	**HS 29**	NESY Fachausschusstreffen
Wednesday, 20.08., 20:00		Young Minds Get-Together *Further information on p. 9.*
Thursday, 21.08., 12:00	**HS 27**	SFB BeyondC Business Meeting
Friday, 22.08., 16:30		Lab Tours *Further information on p. 9.*

Autorenverzeichnis - List of Authors

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

T

U

V

W

X

Y

Z

Notizen - Notes