HZB BESSY II Light Source

17TH BESSY@HZB USER MEETING

3 - 5 DECEMBER 2025

BESSY II & WISTA Event Center in Berlin-Adlershof

17TH BESSY@HZB USER MEETING
COUNTRY OF HONOUR 2025: NIGER

Contents

Welcome

Dear Users and Friends,

Welcome to the 17th BESSY@HZB User Meeting 2025.

At the beginning of the year, HZB had to focus all our resources and efforts as we were facing a major evaluation coming up in May 2025. This review - by international experts, who assessed both the scientific excellence and the potential for innovation - gave us the opportunity to present the research done at HZB as well as the User Facility BESSY II, and set the stage for the coming years, as it forms the basis for our funding from 2028 to 2034. HZB and BESSY II were not only considered highly successful, but also received top marks for science, infrastructure, and user service. One reviewer even said that she came as a guest but now quite liked the idea of staying and becoming a part of the HZB team - a place where happy people love what they do and want to make a difference in the world. We own this outstanding success also to you, our users, your support, and your great scientific work.

In September, we were delighted to welcome Ms. Saskia Vormfelde as the new Administrative Director. Ms. Vormfelde is a successful science manager and moved from Fraunhofer Institute for Solar Energy Systems in Freiburg. She succeeds Mr. Thomas Frederking, who retired after 32 years of service at HZB, including 13 years as Administrative Director. We would like to thank Mr. Frederking for his commitment over the past years and look forward to the future collaboration with Ms. Vormfelde. A cordial welcome!

BESSY II has now been in operation for more than 27 years and will remain in operation until at least 2035. To keep BESSY II at the forefront of scientific and technological development, the transition from a unique and highly productive analytical tool to a hub for materials research and innovation is on its way. With a clear focus on operando methods for energy research that enable, for example, to investigate batteries or catalysts "at work", the upgrade BESSY II+ will provide new possibilities for our users, our partners and our own research as well as bridge to the successor source BESSY III. To further shape BESSY III, this year’s User Meeting has dedicated discussions on your, the user’s, requirements and requests for a novel soft-to-tender X-ray facility in Berlin.

This year - after Kenia in 2023 and Romania in 2024 - we have the pleasure to announce Niger as the Country of Honour 2025. We have invited a mixed group of young and experienced scientists from Niger Universities to participate in the meeting and to start a scientific exchange.

To reflect HZB’s various cooperations with Africa this year’s User Meeting will be accompanied by a dedicated Energy Day, a one-off event on Friday, 5 December. Preceding presentations on energy storage and energy conversion, the Energy Day will be opened by the panel discussion “Energy and Synchrotron Science for Africa: Building Capacity through International Collaboration”.

The User Meeting once again honours the scientific achievements and high scientific impact of the experiments performed by you at the HZB facilities. Particular highlights of the meeting are the “outer space” Public Lecture given by Frédéric Safa and Marcos Bavdaž from the European Space Agency

(ESA) on ”ESA’s NewAthena X-Ray Space Observatory”, the bestowal of the Ernst-Eckhard-Koch Prize for an outstanding doctoral thesis and the Innovation Award on Synchrotron Radiation as well as the “Marketplace of Innovations” a follow-up of last year's very successful and much appreciated launch which allows a deeper insight into new projects and new instruments at BESSY II+ and planned instruments at BESSY III. Furthermore, it is a great honour to host the first ceremony of the newly established KFS Early Career Photon Science Award.

We would also like to take the opportunity to thank all vendors and companies who attend and support the User Meeting this year and sponsored the “green buffet” on Thursday evening.

We thank you all for joining and look very much forward to inspiring and fruitful discussions, to the exchange of exciting new ideas and future collaborations beyond it.

Enjoy the meeting!

Sincerely,

Prof. Dr. Bernd Rech	HZB User Coordination
Scientific Director	Organizing Team

Programme Day 1 / 03 December 2025 / Wednesday		
12:00 - 17:00	Vendor Exhibition (all-day alongside the meeting)	WISTA Center
12:00 - 13:00	Registration	WISTA Foyer
13:00 - 14:50	**Synchrotron Session (Chair: Holger Stillrich)**	**Bunsen-Hall**
13:00 - 13:10	Bernd Rech - Welcome to the BESSY@HZB User Meeting 2025	
13:10 - 13:25	Antje Vollmer - News from BESSY II and BESSY II+	
13:25 - 13:40	BESSY II Instrument Scientists - New Instruments in User Operation BerLUXS - BelChem - PRESTO - ENERGIZE - ROCK-IT	
13:40 - 13:55	Markus Ries - Operation and Development of BESSY II and MLS	
13:55 - 14:10	Andreas Jankowiak - BESSY III	
14:10 - 14:25	Yan Lu - Battery Village	
14:25 - 14:40	Cormac Mc Guinness (Trinity College Dublin, Ireland) The European Synchrotron and FEL User Organisation (ESUO)	
14:40 - 14:50	Discussion	
14:50 - 15:20	Coffee Break	WISTA Foyer
15:20 - 16:35	**Science Highlights Part I - Quantum Materials & Magnetism (Chair: Alevtina Smekhova)**	**Bunsen-Hall**
15:20 - 15:40	Aleix Barrera (Institut de Ciència de Materials de Barcelona, ICMAB-CSIC, Spain) On-Chip Planar Magnetic Flux Concentrators for Magnetic Sensors and Limited-Field Magnetic Imaging	
15:40 - 16:00	Olivier Boulle (Spintec, Grenoble, France) Electrical manipulation of skyrmions in synthetic antiferromagnet and magnetic tunnel junctions	
16:00 - 16:20	Tauqir Shinwari (Paul-Drude-Institut für Festkörperelektronik, Germany) Above-Room-Temperature Ferromagnetism in Large Scale Epitaxial Fe_3GaTe_2/ Graphene van der Waals Heterostructures	
16:20 - 16:35	Oliver Rader (Helmholtz-Zentrum Berlin, Germany) Outlook: BESSY III for Quantum Materials	
16:35 - 17:00	Coffee Break	WISTA Foyer
17:00 - 18:00	**Bestowal of Prizes (EEK Prize & Innovation Award)**	**Bunsen-Hall**
18:00 - 18:15	Technical Break	
18:15 - 19:00	**Public Lecture**	**Bunsen-Hall**
	Frédéric Safa and Marcos Bavdaž (European Space Agency, Directorate of Science, Netherlands) ESA's NewAthena X-Ray Space Observatory	
19:00 - 21:00	**SNACKS & BEER**	**WISTA Foyer**

Programme Day 2 / 04 December 2025 / Thursday		
09:00 - 14:00	Vendor Exhibition (all-day alongside the meeting)	WISTA Center
09:15 - 09:45	**Keynote Lecture (Chair: Catalina E. Jimenez)**	**Bunsen-Hall**
	Michelle Browne (Helmholtz-Zentrum Berlin, Germany) The Wonderful World of MXenes for Green H_2 Production	
09:45 - 11:00	**Science Highlights Part II - Energy Materials & Catalysis (Chair: Catalina E. Jimenez)**	**Bunsen-Hall**
09:45 - 10:05	Fabian Jeschull (Karlsruhe Institute of Technology (KIT), Germany) Why Half-Cell Samples Provide Limited Insight Into the Aging Mechanisms of Potassium Batteries	
10:05 - 10:25	Felix Lang (Universität Potsdam, Germany) “Moon Photovoltaics” utilizing Lunar Regolith and Halide Perovskites	
10:25 - 10:45	Pinar Sakoglu (Helmholtz-Zentrum Berlin, Germany) Unravelling the Role of Mn Promotion for the Chemical Structure and Surface Evolution of Co(0001) Model Catalysts for Fischer-Tropsch Synthesis	
10:45- 11:00	Renske van der Veen (Helmholtz-Zentrum Berlin, Germany) Outlook: BESSY III for Energy Materials and Catalysis	
11:00 - 11:30	Coffee Break	WISTA Foyer
11:30 - 12:20	**Science Highlights Part III - Life Science (Chair: Manfred Weiss)**	**Bunsen-Hall**
11:30 - 11:50	Bernhard Loll (Freie Universität Berlin, Germany) Computational and structure-based design of the diterpene cyclooctatenol synthase CotB2 as part of a biotechnological platform	
11:50 - 12:10	Andrea Thorn (Helmholtz-Zentrum Berlin, Germany) AI-based and Visual Diagnostics for Macromolecular X-Ray Diffraction: AUSPEX	
12:10 - 12:20	Outlook: BESSY III and AI options	
12:20 - 13:30	Lunch Break	Canteens on-site
13:30 - 14:30	**Young Scientists Session (Chair: Ioanna Mantouvalou)**	**Bunsen-Hall**
13:30 - 13:45	Shima Farhoosh (Freie Universität Berlin, Germany) Reaction Kinetics in Cobalt-based Electrocatalysts for Water Oxidation	
13:45 - 14:00	Leopold Lahn (Helmholtz-Zentrum Berlin, Germany) Effect of Ionic Liquids on Electrochemical Properties and the Electronic Structure of NiPt Alloys in Alkaline Media	
14:00 - 14:15	Deeksha Gupta (Helmholtz-Zentrum Berlin, Germany) Tuning ultrafast demagnetization with ultrashort spin polarized currents in multi-sublattice ferrimagnets	
14:15 - 14:30	Jakob Ruickoldt (Universität Potsdam, Germany) X-ray crystallography of the CODH/ACS complex	
14:30 - 14:50	**Presentations from the Country of Honour 2025**	**Bunsen-Hall**
	Abdou Latif Bonkaney and Abdoulkadri Ayouba Mahamane (Abdou-Moumouni University Niamey, Niger)	
14:50 - 15:20	**Bestowal of the KFS Early Career Photon Science Award 2025**	
15:20 - 15:25	**Acknowledgements**	
15:25 - 15:30	Technical Break - Change of Location to BESSY II	
15:30 - 17:00	**Market Place of Innovations**	**Lecture Hall**
17:00 - 19:00	**Poster Session**	**Experimental Hall**
from 19:00	**Green Buffet**	**Foyer**

Programme Energy Day / 05 December 2025 / Friday		
09:00 - 09:15	Registration	WISTA Foyer
09:15 - 09:30	**Bernd Rech (Helmholtz-Zentrum Berlin) - Opening and Welcome**	**Bunsen-Hall**
09:30 - 10:30	**Panel Discussion**	**Bunsen-Hall**
	"Energy and Synchrotron Science for Africa: Building Capacity through International Collaboration" Speakers: • Bernd Rech (Helmholtz-Zentrum Berlin) • Rabani Adamou (Abdou Moumouni University / AMU, Niger) • Lucy Ombaka (Hochschule RheinMain, Germany) • Nico Fischer (Catalysis Institute / UCT, South Africa) Moderator: Lucero Cobos-Becerra (Helmholtz-Zentrum Berlin)	
10:30 - 11:00	Coffee Break	WISTA Foyer
11:00 - 12:00	**Session I - Energy Conversion and Storage**	**Bunsen-Hall**
11:00 - 11:20	Rabani Adamou (Abdou Moumouni University / AMU, Niger) Photovoltaic cooling greenhouse adapted for year-round horticulture in the Sahel	
11:20 - 11:40	Duncan Kariuki (Octavia Carbon, Kenya) Harnessing Africa's Renewable Potential for CO_2 Removal: Octavia Carbon's Vision	
11:40 - 12:00	Nico Fischer (Catalysis Institute / UCT, South Africa) Advancing Synchrotron Science in Africa - A story of long flights, growing networks and new local opportunities	
12:00 - 13:00	Lunch Break	Canteens on-site
13:00 - 14:00	**Session II - Energy Conversion and Storage**	**Bunsen-Hall**
13:00 - 13:20	Philipp Adelhelm (Humboldt-Universität zu Berlin, Helmholtz-Zentrum Berlin) The Berlin Battery Lab (BBL): Uniting Berlin's Expertise in Battery Research	
13:20 - 13:40	Nancy Ochiba (Technical University of Kenya) and Lucy Ombaka (Hochschule RheinMain, Germany) Catalysis and the energy transition: A focus on Ni-Cu Catalysts for Renewable Hydrogen and eFuels	
13:40 - 14:00	Catalina Jimenez (Helmholtz-Zentrum Berlin) Synchrotron Insights for Industrial Innovation: CARE-O-SENE at BESSY II	
14:00 - 14:15	Technical Break - Change of Location to BESSY II	
14:15 - 15:00	**BESSY II visit**	**Experimental Hall**
From 15:00	**Get together with Cocktails and Snacks**	**BESSY Foyer**

ABSTRACTS

Science Highlights Part I - Quantum Materials & Magnetism

Wednesday, 3 December 2025 from 15:20 to 16:35

Bunsen-Hall at WISTA Event Center

On-Chip Planar Magnetic Flux Concentrators for Magnetic Sensors and Limited-Field Magnetic Imaging

A. Barrera[1], L. Marcano[2], R. Abrudan[3], E. Fourneau[4], N. Lejeune[4], A. Silhanek[4], I. Orue[5], M.L. Fdez-Gubieda[6], L. Chang[7], R. Harrison[8], N. Bort-Soldevila[9], J. Cunill-Subiranas[9], N. Del-Valle[9], C. Navau[9], N. Mestres[1], L. Balcells[1], A. Palau[1] and S. Valencia[3]

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5 SGIker, Universidad del País Vasco – UPV/EHU, 48940 Leioa, Spain
6 BCMaterials, Basque Center for Materials, Applications and Nanostructures, UPV/EHU, Spain
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8 Department of Earth Sciences, University of Cambridge, U.K.
9 Universitat Autonoma de Barcelona, UAB, Spain

Metamaterials with engineered structures have been extensively investigated for their capability to manipulate optical, acoustic, or thermal waves. In particular, magnetic metamaterials with precise geometry, shape, size and arrangement of their elemental blocks may be used to concentrate, focus, or guide magnetic fields. In this work, we show the potential of using soft-magnetic permalloy (Py) magnetic flux concentrator (MFC) to tailor the physical properties of other magnetic structures at the local scale[1]. On one hand, they have been implemented in Planar Hall effect sensor of a Cobalt Rod exhibiting gratly enhanced sensitivity which performance is governed by the design of the metasurface. On the other hand, we implemented this MFC in photoemission electron microscopy experiments employing X-ray magnetic circular dichroism as magnetic contrast mechanism. This particular magnetic imaging technique with nanometric resolution is often limited in the strength of magnetic field that can be applied during imaging due to interaction between the field and the imaging probe or because of geometrical constraints[2]. However, the placement of a MFC across the target structure allow to locally enhance the magnetic strength allowing to magnetic image materials with high saturation fields (up to ±150 mT)[3,4].

References

[1] A. Barrera, et al. ACS Nano 19, 10461-10475 (2025)
[2] Nat Rev Methods Primers 5, 28 (2025)
[3] Pei, Z. et al. Communications Earth & Environment 6, 410 (2025)
[4] A. Barrera, A. Palau and S. Valencia, et. al. (under preparation)

Electrical manipulation of skyrmions in synthetic antiferromagnet and magnetic tunnel junctions

O. Boulle

Spintec, Grenoble, France

Skyrmions are topological spin textures which hold great promise as nanoscale bits of information in memory and logic devices [1]. The recent demonstration of room temperature skyrmions [2,3] as well as their current induced motion in sputtered ultrathin films have lifted important roadblocks toward the realization of skyrmion based devices. However, ferromagnetic skyrmions suffer from a low current induced velocity (about 100 m/s) [4] and the skyrmion Hall effect, i.e a deviation of their trajectory, due to their topological charge. Antiferromagnetic (AF) skyrmions allow these limitations to be lifted owing to their vanishing magnetization and net zero topological charge, promising fast dynamics without skyrmion Hall effect. In this presentation, I will first address the stabilization and current induced manipulation of skyrmion in compensated synthetic antiferromagnetic (SAF). I will show that skyrmions can be stabilized at room temperature in Pt/Co/Ru based compensated SAFs and nucleated using local current injection or ultrafast laser pulses [5], as demonstrated by STXM and XMCD-PEEM measurements in Maxymus and in UE49-PGMa Bessy beamlines. I will then show that SAF skyrmions can be moved by current at velocities over 900 m/s without skyrmion Hall effect due to the magnetic compensation [6]. I will conclude the talk with recent results on the electrical nucleation and detection of a skyrmion in magnetic tunnel junctions using *operando* STXM measurements at Maxymus, which is another important milestone for skyrmion based devices [7]. Our results open important paths toward the realization of logic and memory devices based on the fast manipulation of skyrmions

References

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[3] A. Fert, N. Reyren and V. Cros, Nat Rev Mater 2, 17031 (2017)
[4] R. Juge et al., Phys. Rev. Appl. 12, 044007 (2019)
[5] R. Juge et al., Nature Communication, 13, 4807 (2022)
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[7] J. Urrestarazu Larranaga, N. Sisodia, R. Guedas, Nano Letters, 24, 3557 (2024)

Above-Room-Temperature Ferromagnetism in Large Scale Epitaxial Fe_3GaTe_2/ Graphene van der Waals Heterostructures

Tauqir Shinwari[1], Kacho Imtiyaz Ali Khan[1], Hua Lv[1], Atekelte Abebe Kassa[1], Frans Munnik[2], Simon Josephy[3], Achim Trampert[1], Victor Ukleev[4], Chen Luo[4], Florin Radu[4], Jens Herfort[1], Michael Hanke[1] and Joao Marcelo Jordao Lopes[1]

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Fe_3GaTe_2 (FGaT), a two-dimensional (2D) layered ferromagnetic metal, exhibits a high Curie temperature (T_C) of ∼360 K along with strong perpendicular magnetic anisotropy (PMA), making it a promising material candidate for next-generation energy-efficient magnetic devices [1-2]. However, the vast majority of studies on FGaT to date have been limited to millimeter-sized bulk crystals and exfoliated flakes, which are unsuitable for practical applications and integration into device processing [3]. Also, its combination with other 2D materials to form van der Waals (vdW) heterostructures has only been achieved by flake stacking. Consequently, the controlled large-area growth of FGaT and related heterostructures remains largely unexplored. In this work, we demonstrate the high-quality, large-area growth of epitaxial FGaT thin films on single-crystalline graphene/SiC templates using molecular beam epitaxy (MBE). Structural characterization confirms the high crystalline quality of the continuous FGaT/graphene vdW heterostructures [1]. Temperature-dependent magnetization and anomalous Hall measurements reveal robust PMA with an enhanced T_C well above room temperature, reaching up to 400 K [1]. Furthermore, X-ray absorption and X-ray magnetic circular dichroism spectra provide insight into the spin and orbital magnetic moment contributions, further validating the high T_C and robust PMA [1]. These findings are highly significant for the future development of high-performance spintronic devices based on 2D heterostructures, with potential applications in next-generation data storage, logic processing, and quantum technologies [4-5].

References

[1] ACS Nano DOI: 10.1021/acsnano.5c07732 (Shinwari et al., accepted Sep, 2025)
[2] Nature Communications 15.1 (2024): 10765
[3] NPJ Spintronics 2.1, 6 (2024)
[4] Nano Letters 24.26, 7886-7894 (2024)
[5] Science Advances 10.11, eadk8669 (2024)

ABSTRACT

Public Lecture

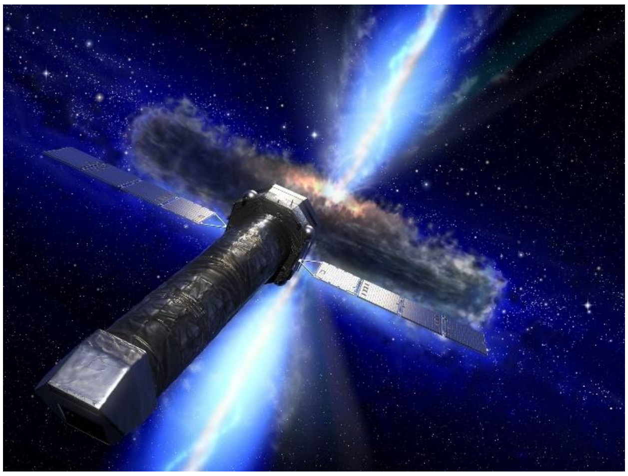
Wednesday, 03 December 2025 from 18:15 to 19:00

Bunsen-Hall at WISTA Event Center

ESA's NewAthena X-Ray Space Observatory

Frédéric Safa, Marcos Bavdaž

European Space Agency, Directorate of Science, Noordwijk, Netherlands



NewAthena is planned for launch in the late 2030s and will be the most powerful X-Ray telescope in space for observing the "hot and energetic universe" through the 0.2 to 10 keV X-Ray spectral window, to address a wide range of fundamental questions of modern astrophysics on e.g. black holes and galaxy evolution, neutron star physics, and large-scale structures in the Universe. NewAthena builds on the success of previous observatories, such as XMM-Newton (ESA), Chandra (NASA) and more recently XRISM (JAXA). The NewAthena telescope is using modular Silicon Pore Optics (SPO), a new technology developed by ESA with cosine (NL), and will provide unprecedented combination of high spatial resolution (HEW 5 to 9 arcsec), large collecting area (> 1m² @ 1 keV) and large field of view (40 x 40 arcmin^2). The two focal plane instruments, X-IFU (led by IRAP/CNES, Toulouse) and WFI (led by MPE, Garching), will provide high-resolution non-dispersive imaging spectroscopy using ultra-cooled Transition Edge Sensors (0.1K) and wide-field imaging capability using Active Pixel Sensors. Following an overview of the scientific objectives, the talk will present the recent project evolution and major progress achieved on SPO over the last decade allowing to start the spacecraft development in 2027.

For the alignment of the required about 600 mirror modules for the SPO, two dedicated beamlines (X-ray Parallel Beam Facility 3 and 4) will be installed in the PTB-laboratory at BESSY II in addition to XPBF 1 and 2, operated there already since 2005 and 2016, respectively. The talk will address the critical importance, for space science missions, of the system optimization and technology predevelopments for reaching the optimum balance between performance, affordability and implementation feasibility.

ABSTRACT

Keynote Lecture

Thursday, 04 December 2025 from 09:15 to 09:45

Bunsen-Hall at WISTA Event Center

The Wonderful World of MXenes for Green H_2 Production

Michelle P. Browne

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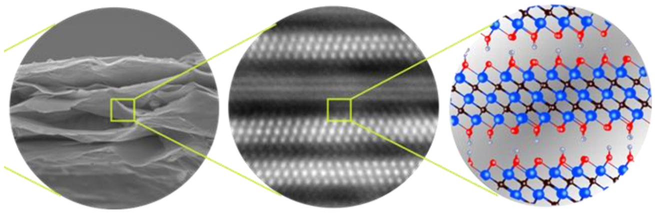

Figure 1. MXene Structure

In the Electrocatalysis Synthesis to Devices Group at Helmholtz-Zentrum Berlin, our research is focused on combining MXenes, Figure 1, and water splitting active materials to create the next generation Oxygen Evolution Reaction (OER) catalysts. Metal oxides, e.g. Ni oxides, are known to be the most active materials for the OER in alkaline media but lack high conductivity and exhibit only average OER overpotentials. On the other hand, MXenes are highly conductive but oxidise readily under several conditions due to its termination sites and don't contain OER active sites.[1, 2] To overcome these issues, we employ several strategies in our group to combine these two materials to make one material which is OER active and highly conductive. Furthermore, by blocking the MXene termination sites with metal-based materials, this may lead to less oxidation of the MXenes structure. This presentation will focus on the development of hybrid MXene materials for the OER through various fabrication methods to produce Green H_2.[3-6]

References

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[2] Current Opinion in Electrochemistry, 34, 101021 (2022)
[3] Electrochimica Acta, 490, 144269 (2024)
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[6] Advanced Functional Materials, 2503842 (2025)

ABSTRACTS

Science Highlights Part II - Energy Materials & Catalysis

Thursday, 04 December 2025 from 09:45 to 11:00

Bunsen-Hall at WISTA Event Center

Why Half-Cell Samples Provide Limited Insight Into the Aging Mechanisms of Potassium Batteries

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Half-cell experiments are an integral part of material evaluation in battery research. The performance of the working electrode is supposedly evaluated in the absence of influences by the metallic counter electrode. In practice, half-cell experiments are often strongly dependent on properties of the counter electrode, like its thickness, storage conditions or pretreatments.

While the reactivity of lithium metal counter electrodes often has little influence on short-term experiments, we found this issue strongly amplified in sodium or potassium half cells [1]. For instance, the build-up of electrolyte degradation products in electrolytes exposed to sodium or potassium metal proceeds rapidly. Electrode crosstalk leads to deposition of degradation products on the working electrode. Such crosstalk events impact the surface layer properties when analysed by surface sensitive techniques like photoelectron spectroscopy [2,3].

The focus of this presentation is placed on the difficulty of obtaining reliable results from half-cell experiments when investigation post-Li battery systems using potassium-ion cells as a representative system and how does the potassium electrode affect the results for the working electrode (independent of the electrode material one might look at).

In order to illustrate these differences photoelectron spectroscopy (PES) depth-profiling was performed in order to compare the surface layer characteristics of interphases generated in half- and full-cell experiments (specifically K/graphite and $K/K_2Fe[Fe(CN)_6]$ half cells, as well as graphite-$K_2Fe[Fe(CN)_6]$ full cells) [4]. Our results demonstrate that surface analysis studies on samples obtained from cycling against a potassium counter electrode compare only very poorly to samples from full-cells which raises the question to how reliable half-cell experiments in this reactive battery system really are?

References

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[4] Jeschull et al., Adv. Energy Mater., 2403811, 1–14 (2024)

"Moon Photovoltaics" utilizing Lunar Regolith and Halide Perovskites

Julian Mauricio Cuervo Ortiz[a], Juan Carlos Ginés Palomares[b], Sercan Ozen[a], Marlene Härtel[c], Sema Sarisozen[a], Alina Dittwald[d], Georgios Kourkafas[d], Andrés Felipe Castro-Méndez[a], Francisco Peña-Camargo[a], Biruk Alebachew Seid[a], Jürgen Bundesman[d], Andrea Denker[d,e], Heinz-Christoph Neitzert[f], Dieter Neher[a], Enrico Stoll[b], Stefan Linke[b], Felix Lang[a]

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The ROSI Freigeist group explores next-generation electronics utilizing soft perovskite semiconductors for innovative applications in space and healthcare. Our research focuses on developing high-efficiency perovskite solar cells and radiation detectors, with a key emphasis on assessing material tolerance under X-ray and particle radiation to ensure device stability in extreme environments.

In this presentation, I will discuss recent advancements in photovoltaic (PV) technologies for space applications, highlighting our latest preparations for orbital deployment. A particular focus will be on novel strategies to reduce launch weight, including the use of ultralight substrates and in-situ resource utilization (ISRU). Leveraging halide perovskite photovoltaics crafted on regolith-based Moonglass, ISRU is the most promising solution for powering future lunar settlements. After all, the approach drastically reduces material transport weight by 99%, achieving exceptional specific power ratios of 22-50 W/g, which is 20-100 times higher than traditional space PV solutions, all while maintaining superior radiation shielding, reliability, and mechanical stability.

References

Solar Cells Made of Moon Dust Could Power up a Lunar Base. Nature 2025, 640 (8058), 291–291. https://doi.org/10.1038/d41586-025-00971-x

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Unravelling the Role of Mn Promotion for the Chemical Structure and Surface Evolution of Co(0001) Model Catalysts for Fischer-Tropsch Synthesis

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Fischer–Tropsch Synthesis (FTS) enables promising pathways for the conversion of green syngas (H_2 + CO) into high-quality hydrocarbons such as diesel and jet fuel with Cobalt (Co) as the active metal due to its high activity and selectivity towards long-chain products. The incorporation of manganese (Mn) as a promoter enhances catalytic performance [1,2], yet its mechanistic role remains under debate [3,4,5]. Using Mn promoted Co(0001) single crystals as model catalysts, we investigate how Mn modifies the surface chemistry and structure under relevant FT environments.

The material synthesis capabilities of the Energy Materials In-situ Laboratory Berlin (EMIL) located at BESSY II, were exploited to deposit different amounts of Mn onto Co(0001) single crystals. The resulting samples were characterized in-system using X-ray (XPS) and ultraviolet (UPS) photoelectron spectroscopy monitoring the electronic and chemical structure changes induced by Mn. Density functional theory (DFT) calculations provided complementary insights shedding light on the mechanistic behind the observed property modifications. Scanning tunnelling microscopy (STM) further revealed distinct surface structural alterations upon Mn deposition. An in-situ study using ambient pressure XPS and X-ray absorption spectroscopy (XAS) measurements in FT relevant O_2, H_2, and syngas atmospheres at the CAT endstation of EMIL and at the HIPPIE endstation of MAX IV, combined with DFT calculations of solid/gas interfaces, ultimately allowed to correlate surface composition, structure, and catalytic conditions, uncovering Mn's promotional role during key FT reaction steps.

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ABSTRACTS

Science Highlights Part III - Life Science

Thursday, 04 December 2025 from 11:30 to 12:20

Bunsen-Hall at WISTA Event Center

Computational and structure-based design of the diterpene cyclooctatenol synthase CotB2 as part of a biotechnological platform

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Terpene synthases (TPS) and their downstream functionalizing enzymes produce the largest family of known natural products with over 80,000 terpenes and terpenoids identified to date, and are found in mammals, insects, plants, and microorganisms.[1] Most diterpenoids exhibit a stereochemically complex macrocyclic core, which is generated by C–C bond forming of aliphatic oligo-prenyl precursors. This reaction is catalysed by TPSs, which are capable of chaperoning highly reactive carbocation intermediates through an enzyme-specific reaction. Due to the instability of carbocation intermediates, the proteins' structural dynamics and enzyme-substrate interactions a tightly guided during TPS catalysis. Directing the reaction pathway towards desired products is therefore an important but elusive challenge. Dolabellatriene is one of these desired products, displaying a broad biological activity and previously only accessible through extraction from marine organisms, it can serve as a biosynthetic structural precursor for other related diterpenoids. By this, it potentially paths the way for a sustainable biotechnological diterpenoid production in the future. We employed computational design strategies sought to stabilize specific carbocation intermediates to redirect the reaction pathway in the cyclooctatenol synthase CotB2 to produce dolabellatriene.[2-3] From this strategy we generated a library with 12 designs comprising up to 13 mutations each. We furthermore combined this approach with a full biotechnological, biochemical and structural characterization of these variants. Remarkably, 11 designs could be structurally and functionally characterized and five of which displayed the desired activity towards dolabellatriene. Our work demonstrates a deep synergy between computational protein design, transition-state calculations and an experimentally validation of these predictions. Which all together enables unprecedented control over reaction mechanisms in a complex enzyme.

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AI-based and Visual Diagnostics for Macromolecular X-Ray Diffraction: AUSPEX

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Traditionally, the initial quality of macromolecular single-crystal X-ray diffraction data was evaluated by looking at detector images as they were recorded. An expert user used to be able to recognize problems and after collection, the data would be integrated, scaled and merged with software that required considerable manual intervention and expertise. Data quality indicators were mostly designed so that they could be calculated rapidly with the limited computing power available, and were developed to provide information about the overall data consistency, completeness and resolution, often in the form of mean derivatives and R-values.

Today, data collection at BESSYII and other sources is many orders of magnitude faster, in particular due to the brightness of the X-rays obtained from modern sources. The high X-ray flux, coupled with fast-readout pixel detectors means that manual inspection of the raw data is no longer practical and that processing with its decision-making has been automated. Unfortunately, there is a severe mismatch between the robustness of our current diagnostics and our reliance on automatic processing. As many of the quality indicators in use by the automatic algorithms are not reliable enough for correct decision-making [1], and most users are no longer experts in processing, this has created a gap in the quality control of experiments.

New algorithms which play to the strengths of modern computing power, machine learning technology and robust statistical analyses need to be developed and implemented. In addition, much may be gained from taking the whole statistical distribution of the data into account, or even visualising the entirety of the data set instead of mean values. To address this need, we have started a software package for exploratory analyses of crystallographic data. AUSPEX [1] provides a visual and intuitive way of revealing problems in diffraction data that either require a specific processing approach. AUSPEX is available as part of CCP4 and as web service at auspex.de. The software was developed using open data; however, the lack of unprocessed raw images from beam lines is often a roadblock for new method development. Since 2021, we are utilizing convolutional neural networks [3, 4] when statistical indicators fail us and we have made first steps towards "explainable AI" for our developments.

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ABSTRACTS

Young Scientists Session

Thursday, 04 December 2025 from 13:30 to 14:30

Bunsen-Hall at WISTA Event Center

Reaction Kinetics in Cobalt-based Electrocatalysts for Water Oxidation

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Hydrogen production through water splitting, powered by renewable electricity or direct sunlight, is considered as a promising method to diminish reliance on fossil fuels. Cobalt-based oxy-hydroxide electrocatalysts (CoCat) are notable for high activity in neutral pH environments.[1-2] It is well-known that cobalt ions undergo two distinct redox reactions prior to initiating the oxygen evolution reaction (OER) and formation of an O-O bond.[3] Our research focussed on the kinetics of these redox transitions and the OER by utilizing operando spectroscopic methods. We have employed X-ray and UV-vis absorption spectroscopy, coupled with electrochemical experiments, to monitor oxidation state changes of cobalt ions during the reaction. Additionally, we used electrochemical impedance spectroscopy (EIS) to further characterize the electrochemical processes occurring at the catalyst-electrolyte interface and studying the kinetics and mechanism of the OER. Through a detailed analysis of X-ray and optical time traces, simultaneously recorded current density transients, as well as simulations of impedance data, we found that two redox transitions ($Co^{II}\leftrightarrow Co^{III}\leftrightarrow Co^{IV}$) of interacting cobalt sites occur rapidly within milliseconds (10-100 ms), while the OER itself proceeds significantly slower (around 1 second).[4] We also examined possible rate-limiting factors, including film thickness, electronic conductivity, mass transport and proton transport.[4] The results provide deeper insights into the electrocatalytic mechanism of transition-metal based OER materials.

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Effect of Ionic Liquids on Electrochemical Properties and the Electronic Structure of NiPt Alloys in Alkaline Media

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Ni based electrocatalysts are widely used in electrochemical energy devices operating at high pH due to their excellent electrocatalytic activity, high stability and relatively low cost. In alkaline media, the surface of Ni is covered by (oxy-)hydroxide species which serve as active sites for many electrosynthesis reactions and the oxygen evolution reaction (OER) in alkaline water electrolyzers (AWE) [1,2]. The performance of these materials can be enhanced by small additions of Pt that beneficially alter the electronic structure and improve conductivity [3]. Recently, hydrophobic ionic liquids (ILs) have emerged as promising surface modifiers to tackle the main challenges in electrocatalysis, which are controlling selectivity, activity and stability [4]. However, their influence on stability and redox behavior of NiPt alloys in alkaline media remains largely unexplored.

Here, we reveal the impact of the ionic liquid [C_2C_1Im] [OTf] on the oxidation and dissolution dynamics of different NiPt thin-film alloys in alkaline (0.05 M NaOH) electrolyte. Figure 1 outlines our experimental workflow, starting with the synthesis of the NiPt alloys via co-sputtering. We uncover the IL's impact on the dissolution behavior of these alloys by online inductively coupled plasma mass spectrometry (online ICP-MS) [5] under different electrochemical protocols. Using specially designed electrochemical cells we reveal the effect of the IL on the electronic structure of the NiPt alloys by ex-situ and in-situ X-ray absorption spectroscopy (XAS). Our in-situ and ex-situ spectroscopy data at Ni K-, Ni L- and O K-edge showcase a pronounced effect of the IL on the oxidation behavior of Ni in both electrolytes, which has significant impact on the electrochemical stability of these alloys. Overall, our results reveal a pathway towards modification of functional properties of Ni-based catalysts under harsh electrochemical conditions by using ILs.

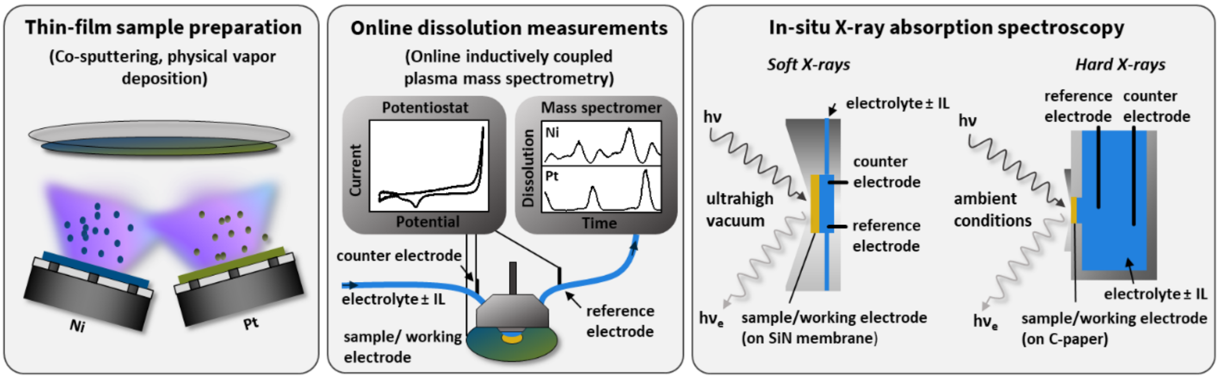

Figure 1: Revealing the effect of ionic liquids (ILs) on dissolution and oxidation dynamics of NiPt thin-film alloy electrocatalysts by using online dissolution and in-situ X-ray absorption spectroscopy methods.

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Tuning ultrafast demagnetization with ultrashort spin polarized currents in multi-sublattice ferrimagnets

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Femtosecond laser pulses can be used to induce ultrafast changes in the magnetization of magnetic materials [1]. Several microscopic mechanisms have been proposed to explain the observations, including the transport of ultrashort spin-polarized hot-electrons (SPHE) [2,3]. Such ultrafast spin currents attract growing interest because of the recent challenges in ultrafast spintronics. One of the key challenges in this emerging field is to characterize the actual role of the spin-polarization of such ultrafast current, especially in the specific case of technologically relevant ferrimagnetic alloys. Among different ferrimagnetic materials, the rare-earth transition-metal (RE-TM) alloy thin films, such as, FeGd are interesting for spintronic applications due to their antiferromagnetically coupled 3d and 4f sublattices and the possibility of manipulating the magnetization on ultrafast time scales in a controlled way. Additionally, these are also among systems that show single pulse all-optical switching at a subpicosecond time scale, an important property for applications using ultrafast spintronics [5].

In this work, we present the combined experimental and theoretical results evidencing the spin-dependent hot electron (SPHE) induced demagnetization on the ultrafast time scale on FeGd alloy in a specifically designed spin valve structure. The experimental results were obtained by time-resolved X-ray magnetic circular dichroism (TR-XMCD) at the transition-metal (TM) L_3 and rare-earth (RE) M_5 edges at the BESSY II Femtoslicing source of the Helmholtz-Zentrum Berlin [6]. This experimental method combines element and magnetic sensitivity with femtosecond time resolution, resolving the ultrafast magnetization dynamics in ferrimagnetic $Fe_{74}Gd_{26}$ alloys. In addition, relying on experimentally defined geometry and composition as well as interatomic exchange, theoretical modelling based on atomistic spin-dynamics simulations [7] reproduces the experimental ultrafast dynamics of this system. This fact allows identifying the microscopic process of spin angular momentum transfer at the shortest time scale. Our study shows that SPHE drives the demagnetization of the two sub-lattices of the $Fe_{74}Gd_{26}$ films. This behaviour is explained based on two physical mechanisms, i.e., spin transfer torque and thermal fluctuations induced by the SPHE. We provide a quantitative description of the heat transfer of the ultrashort SPHE pulse to the $Fe_{74}Gd_{26}$ films responsible for the observed magnetization dynamics [8].

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X-ray crystallography of the CODH/ACS complex

Jakob Ruickoldt[1,2], Dr. Jae-Hun Jeoung[2], Maik Alexander Rudolph[3], Dr. Frank Lennartz[2,4], Dr. Julian Kreibich[2], Prof. Dr. Reinhard Schomäcker[3], Prof. Dr. Holger Dobbek[2]

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The bifunctional CO-dehydrogenase/acetyl-CoA synthase (CODH/ACS) complex couples the reduction of CO_2 to the condensation of CO with a methyl moiety and CoA to acetyl-CoA. Catalysis occurs at two sites connected by a tunnel transporting the CO. In this study, we investigated how the bifunctional complex and its tunnel support catalysis using the CODH/ACS from '*Carboxydothermus hydrogenoforman'* as a model. We have studied the complex both by X-ray crystallography and kinetic analysis. Although CODH/ACS adapted to form a stable bifunctional complex with a secluded substrate tunnel, catalysis and CO transport is even more efficient when two monofunctional enzymes are coupled. Efficient CO channelling appears to be ensured by hydrophobic binding sites for CO, which act in a bucket-brigade fashion rather than as a simple tube. Tunnel remodeling showed that opening the tunnel increased activity but impaired directed transport of CO. Constricting the tunnel impaired activity and CO transport, suggesting that the tunnel evolved to sequester CO rather than to maximize turnover.

ABSTRACTS

Energy Day - Energy Conversion and Storage

Friday, 05 December 2025 from 11:00 to 14:00

Bunsen-Hall at WISTA Event Center

Photovoltaic cooling greenhouse adapted for year-round horticulture in the Sahel

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2 Director of the West-African Science and Service Centre in Climate Change and Adapted Land Uses (WASCAL) Graduate Program in Climate Change and Energy (GRP-CCE), including Green Hydrogen (H2).

Photovoltaic greenhouse is a technology that creates a synergy between renewable energy and agriculture. In the Sahel, conventional greenhouse generates a microclimate that heats up, becoming unbearable for crops growing. This work aims to develop an effective and affordable photovoltaic cooling greenhouse suitable for year-round horticulture under Sahelian harsh climatic conditions. The cooling greenhouse is made from semi-transparent ligno-cellulosic materials, covering the roof to improve adequate light harvesting, when reducing intense solar irradiance. A locally available cellulosic evaporative cooling pads, powered by photovoltaic poly-crystalline modules, were laterally used to cool and moisturize indoor ambient environment. The greenhouse's microclimate parameters such as temperature, relative humidity and solar irradiance were recorded with a weather station and thermo-hygrometer sensors installed inside and outside. The carbon dioxide (CO_2) contents and grown tomatoes physical parameters were also regularly measured. The whole greenhouse system thermodynamic behaviour was simulated through computational fluid dynamic (CFD) software (ANSYS). While the outside temperature was 34 – 42°C with an average relative humidity of 46%, the temperature within the greenhouse was around 29 - 32°C, with an average relative humidity of 72%, causing respectively a temperature drop of 5 - 10°C for an average relative humidity improvement of 26%. The thermal heat distribution and flow patterns analyzed under CFD showed a well-distributed heat around crop's coverage area in the greenhouse. Tomato crop cultivation inside and outside the greenhouse showed that plants inside could reach 190 cm height with leaves size of Length x Width (LxW) = 10x5cm against 70 cm high and LxW = 6x2.5 cm for outside. This situation can result from tomatoes photosynthesis improvement due to more than 2 times CO_2 contents compared to outside (425 ppm), adequate sun radiations harnessed through the colored semi-transparent cellulosic roof and conducive indoor ambient humidity. Tomato fruits inside greenhouse turned from green to deep red (best quality) at harvesting stage, whereas under ambient conditions tomatoes colors turned green, light yellow then light red due to extreme conditions. Photovoltaic cooling greenhouse, can become a cost-effective adaption and mitigation solution under sunny environment.

Keywords: Photovoltaic, cooling greenhouse, evaporative pads, cellulosic materials, horticulture, Computational Fluid Dynamic (CFD).

Harnessing Kenya's Renewable Energy Potential to solve Climate Change

Duncan Kariuki

Octavia Carbon, Kenya

Three truths about Africa: Africa has the lowest per capita emissions of any region in the world; Africa (and especially Sub-Saharan Africa) is the poorest region in the world; but Africa also has vast untapped clean energy resources. For example, in my country of Kenya, we have a geothermal electricity generation potential of 10,000 MWe using conventional geothermal. However, we have only realized 944 MWe, primarily due to low levels of industrialization. While every other region of the world has developed and created prosperity for their people in a way that is coupled with increased GHG emissions, this growth strategy is untenable for Africa given the climate crisis that we have on our hands.

At Octavia, we have set out to create a new model for economic development, leveraging my country, Kenya's, energy endowments to solve the climate crisis through our proprietary Direct Air Capture (DAC) technology. DAC is an engineered method of removing CO_2 from the atmosphere for permanent sequestration deep underground. At the heart of our technology is a material that is highly selective to CO_2 ("the sorbent"). It works by selectively filtering CO_2 from ambient air and releasing the CO_2 at elevated temperatures of 80 – 100°C. This second phase of the process accounts for >80% of the process's energy consumption. With this in mind, we have developed technology that leverages Kenya's abundant heat to supply >80% of our process's energy consumption.

Geothermal heat is the world's largest and cleanest form of primary energy. It is abundant, low-cost, and crucially, has low emissions. ~40% of Kenya's electricity is produced from geothermal sources. With >940MW of geothermal electricity capacity installed, Kenya is the 6th largest geothermal producer in the world and is growing rapidly. While geothermal electricity is a crucial source of clean electricity, >80% of the energy is wasted through heat rejection to the atmosphere. This heat has little value to the electricity generation process, but has great value to industrial processes that require low-temperature heat. This creates an opportunity for us to leverage the waste heat from geothermal to supply the bulk of the energy required to remove CO_2 from the atmosphere.

Combining geothermal and CO_2 capture lowers the effective cost of removing CO_2 from the atmosphere by driving down the energy cost from >$300/t$CO_2$ to <$90/t$CO_2$, while utilizing energy that would have otherwise been rejected into the atmosphere. Additionally, this creates a new engine of economic growth for my country, Kenya, as it creates value for the world, but in a way that is decoupled from increasing GHG emissions.

Advancing Synchrotron Science in Africa - A story of long flights, growing networks and new local opportunities

Nico Fischer

Catalysis Institute, University of Cape Town, Cape Town, South Africa

Africa remains the only continent, apart from Antarctica, without its own synchrotron facility. Although South Africa is a Scientific Associate country at the ESRF, African researchers must still travel long distances to access international synchrotron light sources, after securing highly competitive experimental time. This limited access constrains the development of local expertise and hinders the continent's capacity for world-class scientific research.

Among the diverse techniques available at synchrotron facilities, X-ray absorption spectroscopy (XAS) has become a cornerstone for the detailed characterization of materials, both crystalline and amorphous, and in solid or liquid states. This element-specific technique provides critical insights into oxidation states, geometric structure, and local coordination environments, attracting researchers across multiple disciplines. While XAS was traditionally limited to synchrotron facilities, recent advances in X-ray source and detector technologies have made high-quality laboratory-based XAS increasingly viable.

In this presentation, I will highlight key research examples from the Catalysis Institute at the University of Cape Town that would not have been possible without access to XAS beamlines. I will also discuss efforts to cultivate local expertise in XAS despite limited exposure, and the crucial role of international partnerships in achieving this.

Looking ahead, exciting developments are underway. Funded by the South African National Research Foundation and supported by the Helmholtz Zentrum Berlin (HZB), Africa's first laboratory-based XAS beamline will be commissioned in Cape Town in January 2026. Integrated into the BESSY application structures and operated as a Joint Laboratory between the Catalysis Institute and HZB, this facility represents a financially sustainable and transformative step for the African research community. It will expand access to advanced characterization tools, accelerate local capacity building, and enhance both the quality and competitiveness of African research at international synchrotron facilities.

The Berlin Battery Lab (BBL): Uniting Berlin's Expertise in Battery Research

Philipp Adelhelm[1,2,3]

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3 Center for the Science of Materials Berlin (CMSB), Humboldt-University Berlin, Berlin, Germany

Berlin is an important national research hub in Germany with several institutions actively engaged in battery research. The newly established Berlin Battery Lab (BBL) brings together these activities under one collaborative framework. Founding members include the Berlin institutions Helmholtz-Zentrum Berlin (HZB), Humboldt-Universität zu Berlin (HU Berlin), and the Bundesanstalt für Materialforschung und -prüfung (BAM).

The BBL aims to strengthen and integrate the complementary expertise of these institutions, focusing on the alternative cell technologies sodium-ion and metal–sulfur batteries, materials synthesis, and operando characterization. Beyond fostering scientific excellence, the BBL also serves as a platform and lighthouse initiative to promote collaboration with additional partners from academia and industry.

This presentation introduces the Berlin Battery Lab and highlights current research results emerging from ongoing collaborations among the partner institutions.

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Catalysis and the energy transition: A focus on Ni–Cu Catalysts for Renewable Hydrogen and eFuels

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The actualization of an energy transition heavily relies on the availability of cost competitive and reliable renewable energy storage modes. Hard to abate sectors such as maritime and aviation, inevitably require the use of renewable fuels such as hydrogen and electro-fuels (eFuels).[1,2] Although the technological readiness level of H_2 and eFuels meets market standards, their market uptake and ramp-up is sluggish due to high costs in comparison to fossil-based fuels. These high costs are attributed to many factors including high capital expenditure (CAPEX) owing to the usage of expensive catalysts such as Pt in electrolyzers. At present, research on the reduction of electrolyzer cost focuses on the usage of non-precious group metals as catalysts.[3] In this regard we present the synthesis and application of affordable Cu, Ni and Cu-Ni catalysts for photo and electrocatalytic production of renewable hydrogen as well as for the electrocatalytic reduction of CO_2 to potential eFuels. The catalysts were synthesized using different surfactants either *via* solvothermal, microwave-assisted solvothermal or electrodeposition. [4,5] The resulting catalysts were then characterized using various electro- and physicochemical characterization techniques such as X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). In photocatalysis, nitrogen-rich surfactants enhanced the activity of Cu catalysts towards hydrogen evolution (19.03 mmol g^{-1} h^{-1}) compared to oxygen-rich surfactants. A similar trend was observed in electrocatalytic reactions where Cu catalysts synthesized using a nitrogen-rich surfactant showed the highest FE (96%) towards hydrogen evolution. In contrast, catalysts synthesized using oxygen-rich surfactants were more active towards the reduction of CO_2 to hydrocarbons. Bimetallic Cu–Ni electrocatalyst exhibited a higher Faradaic efficiency of 3.9% CH_4 and 12.5% C_2H_4, compared to monometallic Cu (FE 8.2% for C_2H_4) under comparable conditions. Future work targets O*perando* spectroscopic analysis (XAS) to elucidate the catalysts' structure activity correlation and reaction mechanisms, thus guiding further catalyst performance optimization. Evaluation of catalysts performance on modular anion exchange membrane electrolyzers is also targeted.

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[5] Ombaka, L., *et.al.*, (2022). Photocatalytic H_2 production and degradation of aqueous 2-chlorophenol over B/N-graphene-coated Cu^0/TiO_2: A DFT, experimental and mechanistic investigation. *Journal of Environmental Management*. 311. 114822

Synchrotron Insights for Industrial Innovation: CARE-O-SENE at BESSY II

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The CARE-O-SENE project aims to advance the development of Co-based catalysts for the industrial production of sustainable aviation fuels (SAF) via Fischer-Tropsch-Synthesis (FTS) from renewable feedstocks, such as green syngas ($CO+H_2$) [1,2]. This initiative brings together seven major German and South African partners from industry and academia in a collaborative effort that combines complementary expertise, shared methodologies, and best practices to accelerate the translation of research into industrial innovation.

Recent dedicated infrastructure developments at several BESSY II beamlines now enable comprehensive multi-scale imaging, scattering, and spectroscopy investigations for automated in-system, in-situ, and operando characterization of both model and commercial Co-based FT catalysts. Here, we present results from such catalysts studied using X-ray diffraction (XRD), ambient-pressure soft and hard X-ray photoelectron and absorption spectroscopies (AP-XPS, HAXPES, XAS), and correlative synchrotron- and focused ion beam (FIB) tomography. Machine learning–assisted data analysis enables detailed three-dimensional characterization across micro- to nanoscale dimensions. These studies provide key insights into the structural, chemical, and electronic properties that govern catalytic activity and selectivity, contributing to the rational design of next-generation Co-based catalysts for sustainable fuel production.

In the frame of CARE-O-SENE, Sasol recently achieved kerosene yields over 80% that will accelerate the commercialisation of sustainable aviation fuels[1].

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ABSTRACTS

Poster Session

Thursday, 04 December 2025 from 17:00 to 19:00

BESSY II Experimental Hall

38 CCDC127 - a mitochondrial protein with “so far” unknown function

Tobias Bock-Bierbaum (Helmholtz-Zentrum Berlin)

Mitochondria are the powerhouse of our cells and involved in several vital processes. Here, we present the characterization of CCDC127, a mitochondrial protein with unknown function. By applying x-ray crystallography combined with AI-driven protein structure prediction and biochemical investigation, we propose a potential role in stabilization of membrane architectures.

39 Crystallographic fragment screening towards new NS2-NS3 Zika protease inhibitors

Laila Benz (Helmholtz-Zentrum Berlin)

Fragment-based drug discovery (FBDD) in academia often struggles with fragment progression due to limited synthesis resources. The European Fragment Screening Library-96 (EFSL-96), a subset of the European Fragment Screening Library, was validated against Zika virus protease (ZIKVpro). 11 active site binders and two follow-up binders were identified, demonstrating efficient, resource-saving FBDD.

40 Dancing of a bridging ligand at the diiron site for oxygen activation

Jae-Hun Jeoung (Humboldt-Universität zu Berlin)

Non-heme diiron enzymes typically use a conserved 2-His-4-carboxylate motif to coordinate a dinuclear Fe site with two carboxylates bridging the Fe ions. We demonstrate that altering these bridges modulates sulerythrin’s O_2 reactivity, establishing it as a versatile scaffold for engineering diiron centers and stabilizing diverse (hydro)peroxo intermediates.

42 Engineering enzymes for sustainable biodegradation of plastics

Parinita Singh (Helmholtz-Zentrum Berlin)

Production of synthetic plastic leads to vast amounts of waste, increasing at an alarming rate. Plastic-degrading hydrolase enzymes hold great promise as sustainable biocatalysts for recycling and upcycling persistent polymer waste. Structural characterization of the reported and engineered enzymes in their substrate-bound state is crucial for further optimization and industrial-scale applications.

45 Learnings from Crystallographic Fragment Screenings for Fragment-Based Drug Design Towards New Antituberculotics

Fabrice Becker (Universität Münster)

Crystallographic fragment screenings were performed on a mycobacterial thioredoxin reductase at BESSYII and analysed using the automated software pipelines for hit identification. The screening of the F2X Entry, a halogen-enriched and a highly sociable and diverse library, as well as respective follow ups, led to multiple hits which are processed further in terms of fragment-based drug design.

46 Metalloradical-driven enzymatic CO_2 reduction by a dynamic Ni-Fe cluster

Yudhajeet Basak (Humboldt-Universität zu Berlin / Goethe-Universität Frankfurt)

Carbon monoxide dehydrogenases (CODHs) selectively catalyse the reversible reduction of CO_2 to CO and water. The catalytic centre of CODHs contains a unique $[NiFe_4(OH)(\mu 3\text{-}S)_4]$ cluster whose role in activating and converting CO_2 is poorly understood. Here we reveal the structures of all catalytically relevant oxidation states with and without substrates and products bound.

46 a MX Facilities - Update

Uwe Müller (Helmholtz-Zentrum Berlin)

This poster will provide an update about the current state of the MX-facilities at HZB. It describes, user opportunities, technical aspects as well as future development plans.

48 New Gold(I) Complexes as Potential Precursors for Gas-Assisted Methods

Tadeusz M. Muzioł (Nicolaus Copernicus University, Poland)

We report the synthesis and characterization of new gold(I) $[Au_4(\mu\text{-}(NH)_2CC_2F_5)_4]_n$ coordination polymer and $[Au_2Cl_2(NH_2(NH{=})CC_2F_5)_2]$ complex. These compounds were investigated for potential application as precursors in chemical vapor deposition (CVD) and focused electron/ion beam-induced deposition (FEBID/FIBID), which are additive methods to produce nanomaterials.

50 PHYCOLOR - Better Colorants for Food and Beverages

Tatjana Barthel (Helmholtz-Zentrum Berlin)

Food colorants are usually small molecules, but even approved ones can have harmful side effects such as carcinogenicity. A promising alternative is colourful proteins from algae or cyanobacteria, which are already valuable food sources. Using our protein structure knowledge, we aim to enhance their stability for application in the food industry.

51 PUreValue - optimizing enzymes for the biodegradation of polyurathanes

Frank Lennartz (Helmholtz-Zentrum Berlin)

Here we present PUreValue, a Helmholtz-funded project that has the aim to develop and optimize enzymes for the degradation of polyurethanes (PU) and to generate peptide fusion proteins for the detection of PU and PU additives. We showcase our strategies and first results towards the characterization and optimization of the urethanase UMG-SP2 as an enzyme for degradation of PU.

52 THE HZB-MX BIOLAB

Camilla Genter Dieguez (Helmholtz-Zentrum Berlin)

The HZB-MX BioLab (safety level S1) offers comprehensive support for protein sample preparation, covering the entire gene-to-crystal workflow. Services include cell cultivation, expression, purification, characterization, and crystallization. We also prepare samples for biological investigations, like X-ray imaging and microscopy, for internal and external users.

53 Upscaling and engineering of PET hydrolases in the Horizon Europe project UPCYCLE

Gert Weber (Helmholtz-Zentrum Berlin)

UPCYCLE is a 4-year Horizon Europe Innovation Action project with 19 partners including HZB that aims to demonstrate novel circular value chains that transform currently non-recyclable mixed plastic waste into biodegradable polymers. The role of HZB is to upscale PET hydrolase production and enhance the enzymes with AI-based protein design or structure-based and as HT-screening-driven enzyme engineering.

115 Polarization dependent soft X-ray photoemission for purely organic quantum materials

Arkaprava Das (Eberhard Karls Universität Tübingen)

We present our results with tuneable polarized photoemission of purely organic quantum radicals and the opportunity for all users that our project, funded by the BMFTR offers. It allows us to implement a new experimental infrastructure at the CoESCA end station of the UE52 PGM beamline, making it available to the entire synchrotron user community.

116 Evidencing the oxygen-centered radical character of $[Os(O)_4]^+$ through X-ray absorption spectroscopy supported by theory

João Pedro Massaria de Arcanto (Helmholtz-Zentrum Berlin)

The electronic structure of $[Os,O_x]^+$ (x=0-4) was studied using XAS at the IonTrap endstation. While most of these oxides are known, there is no direct spectroscopic evidence that $[Os(O)_4]^+$ is an oxygen-centered radical. Here, upon reaction with CH_4, we probe that it forms $[Os(O)_3(OH)]^+$ and the radical signature in the XAS spectrum disappears. Computational results are consistent with the experiments.

117 Oxygen-Evolving Complex Model Systems with high oxidation and spin states.

Simon Raphael Kruse (Helmholtz-Zentrum Berlin)

XAS and XMCD in the gas phase on oxygen-evolving model systems ($Ca_wMn_xO_yH_z$, w=0-1, x=1-4, y=1-4, z=0-4) directly reveal the high oxidation- and spin-states of the Mn metal centres. This work deepens the understanding of the water-splitting and O_2 formation process in Photosystem II as part of the photosynthesis, which is otherwise difficult to access due to short time scales of the S4 state.

118 Magnon Momentum Microscopy for nonlinear magnonics

Steffen Wittrock (Helmholtz-Zentrum Berlin)

Future magnonic devices for beyond-CMOS computing require access to nanoscale and nonlinear magnon dynamics, yet their detection remains challenging. We present magnon momentum microscopy (MMM), an X-ray-based technique that bridges this gap, resolving short-wavelength magnons with unprecedented sensitivity across the full 2D dispersion plane.

119 Dynamic control of X-ray core-exciton resonances by Coulomb screening in photoexcited semiconductors

Thomas Rossi (Helmholtz-Zentrum Berlin)

Excitonics focuses on manipulating excitons through light-matter interactions. Advancing the field into X-ray excitonics requires precise energy and time control of core-exciton resonances. In this work, we illustrate this control through experiments and ab initio calculations. Applied to ZnO, we unveil how photoexcited carriers control core-exciton binding energies.

120 Temperature control and sample damage mitigation in static and transient soft X-ray experiments using flexible sample cells

Richard Gnewkow (Technische Universität Berlin)

In solid samples, laser excitation leads to lattice heating, which can damage samples and distort time-resolved X-ray spectra, especially at the high repetition rates typical of large-scale facilities. We present two in-vacuum sample cells to mitigate lattice heating by one order of magnitude, reduce sample damage and assess the contribution of lattice heating to transient X-ray signals.

122 Composition-tuned electronic and magnetic properties in mixed chalcogenido ferrates

Mohammadreza Ghazanfari (Technische Hochschule Wildau)

Synchrotron XANES/EXAFS reveal composition-dependent Fe-S/Se bond variations and coordination geometries in mixed sulfido-selenido ferrates, correlating with tuneable magnetic properties and interactions. Together with ionic conductivity and optical band gap analyses, these results show how chalcogen substitution tailors the multifunctional behaviour of this class of ferrates.

123 Temperature-dependent phase transitions of high-efficiency hybrid halide perovskites

Ana Palacios Saura (Helmholtz-Zentrum Berlin)

Hybrid halide perovskite (HHPs)-based photovoltaic devices with the highest power conversion efficiency are based on triple-cation double-anion compositions $(Cs,FA,MA)Pb(I,Br)_3$. We investigated the temperature-dependent phase transitions of these HHPs from 300 to 30 K using in-situ powder X-ray diffraction at the KMC-2 beamline at BESSY II, which is crucial for potential space applications.

124 The crystallographic evolution by in-situ annealing under synchrotron radiation for (Ni, Co, and Pd)/WO_3 piezoelectric thin films

Jesus Toledo-Díaz (Universidad Autónoma de Ciudad Juárez, Mexico)

Tungsten trioxide shows strong piezoelectricity (97 ± 6 pm V^{-1} for Pt/WO_3), exceeding other ceramics due to mixed orthorhombic-tetragonal phases and non-centrosymmetric groups. No systematic studies exist. We propose in-situ grazing-incidence XRD at KMC-2 using high-flux 2D detection to resolve mixed phases in Pd-, Ni-, and Co-doped WO_3 thin films.

125 XAFS at XANES@KMC-2 for investigating fast-charging, high-voltage layered cathodes for sodium-ion batteries

Götz Schuck (Helmholtz-Zentrum Berlin)

Examples of investigations on layered oxide electrodes for sodium-ion batteries will be presented that advance the understanding of the composition–structure–property relationships of oxide cathode materials. The redox characteristics of the cathode under study were examined using X-ray absorption fine-structure (XAFS) spectroscopy at the BESSY II XANES@KMC-2 end station.

126 Investigation of elemental diffusion within dentine using nanometer-resolved synchrotron techniques

Oleksandra Marushchenko (Helmholtz-Zentrum Berlin)

This poster presents ongoing investigations of elemental diffusion from restorative materials into dentine using complementary synchrotron methods. By combining transmission X-ray microscopy and holo-tomography with elemental imaging offered by nano-X-ray fluorescence spectroscopy, both the structure and the composition of the biomaterial can be visualized.

127 Towards quantitative elemental depth profiling of NMC batteries using confocal micro X-ray fluorescence spectroscopy

Yannick Wagener (Technische Universität Berlin)

In Li-ion batteries using NMC cathodes, transition metal (TM) dissolution during cycling may cause capacity fading. To understand this process, non-destructive depth-resolved methods such as confocal micro XRF spectroscopy can be utilized. Elemental depth profiling facilitates not only the localization of TM traces, but yields the local elemental density when fundamental parameter quantification is applied.

128 A fluctuation-free pathway for a topological magnetic phase transition

Riccardo Battistelli (Universität Augsburg)

Topological magnetic textures are robust spin configurations stabilized by competing interactions. Their formation is usually attributed to fluctuation-driven, first-order nucleation processes requiring activation over an energy barrier. Here, we demonstrate the existence of an alternative fluctuation-free nucleation pathway that produces a lattice of topological magnetic textures.

129 Lab X-ray sources - A powerful tool to complement synchrotron-based research

Manuela Klaus (Helmholtz-Zentrum Berlin)

Decentralized X-ray measurement stations such as high flux metaljet sources are becoming increasingly important in materials research due to their high performance, enhanced availability, ideality for preliminary studies prior to synchrotron measurements, long-term operando investigations and time-resolved in-situ measurements. Examples of the wide range of possible applications are shown.

130 Operando Studies of Batteries Using Advanced Laboratory X-ray Diffraction

Tatiana Mishurova (Helmholtz-Zentrum Berlin)

The high-energy laboratory facilities at the X-ray CoreLab (HZB) enable operando experiments with exceptional set-up flexibility and without the strict time limitations typical of synchrotron beamlines. The case studies using laboratory XRD systems reveal phase transformations in solid-state potassium- and sodium-ion coin cell batteries during multiple charge-discharge cycles.

131 Rapid In-Situ Perovskite Slot-Die Coating Analysis with Lab-Based X-Ray Scattering

Erik Wutke (Helmholtz-Zentrum Berlin)

Multimodal in-situ perovskite slot-die coating has been conducted at the LIMAX-160 laboratory at HZB. The poster will detail the newly developed data analysis workflow enabling data upload to NOMAD and modification of the experimental plan during the beamtime. Results are showing the correlation of the different measurement modes PL, UV-vis and x-ray scattering from in-situ perovskite slot-die coating.

135 CO pulse enabled time resolved in-situ investigation of the chemical structure of Co(0001) FTS model catalysts under reaction conditions

Pinar Sakoglu (Helmholtz-Zentrum Berlin)

Fischer-Tropsch Synthesis (FTS) enables the production of high-quality hydrocarbons such as diesel and jet fuel. Cobalt (Co) serves as the active metal due to its high activity and selectivity, which are further enhanced by manganese (Mn) promotion. On Mn promoted Co(0001) CH_x formation and CO dissociation is improved compared to unpromoted Co(0001), as reflected in C 1s and O 1s NAP-XPS spectra.

136 SEPIA: A Scalable System for Integrated Sample Metadata Management

Mojeeb Rahman Sedeqi (Helmholtz-Zentrum Berlin)

ChatGPT said: SEPIA is a scalable system for managing sample metadata and assigning persistent identifiers. It links samples with datasets, people, and investigations through a REST API and web interface. Piloted at HZB, SEPIA streamlines sample management, enhances collaboration, and ensures research data are traceable and accessible.

137 Services Offered by the HZB FDM (Research Data Management) Team

Katherine Rial (Helmholtz-Zentrum Berlin)

The FDM team offers a wide variety of services to BESSY II users. From lab tools & notebooks, e.g. NOMAD, to our data repository, ICAT, we have a solution at each step of the data lifecycle. Where needed, we develop our own software components, e.g. NeXusCreator, SEPIA. We also provide data publication guidance. We fully support all our tools. Talk to us about your needs, our development is driven by you!

138 Updates from HMC Hub Matter

Oonagh Brendike-Mannix (Helmholtz Metadata Collaboration Hub Matter)

The Helmholtz Metadata Collaboration (HMC) is transforming the Helmholtz Association's distributed research data ecosystem into a FAIR data space. Here we present the latest developments from Hub Matter including training courses, the Dashboard for Open and FAIR data in Helmholtz, the SEPIA (sample database for enhancing metadata) project, use cases, the EM Glossary and the Helmholtz Knowledge Graph.

139 Characterization of Polymer Electrolyte Membrane Fuel Cell Catalyst Coated Membranes

Kyle Dessa (University of Toronto, Canada)

Polymer electrolyte membrane (PEM) fuel cells are a promising energy conversion technology to reduce reliance on fossil fuels. A barrier to widespread adoption of these devices is the costly and fragile catalyst coated membrane (CCM). This MASc thesis plan involves both in-situ and ex-situ investigations to determine the dominating environmental conditions affecting the structure and degradation of the CCM.

140 Elucidating the effects of thermal boundaries on polymer electrolyte membrane fuel cell performance via the distribution of relaxation of times

Beste Derebasi (University of Toronto, Canada)

In this study, we performed electrochemical experiments to reveal the effects of thermal boundaries in the through plane on the electrochemical performance of the fuel cell. To further quantify the losses of each electrochemical process, we employed the distribution of relaxation times analysis using impedance spectrum measurements. Our study provides an in depth understanding of operando cell performance.

141 Accessing hidden text on papyri - an example for cultural heritage research at SESAME

Heinz-Eberhard Mahnke (Freie Universität Berlin)

143 The European Synchrotron and Free Electron Laser Users Organisation (ESUO)

Cormac McGuinness (European Synchrotron and Free Electron Laser User Organisation (ESUO) & Trinity College Dublin, Ireland)

ESUO represents and advocates for 32 national user communities of Europe, to benefit all the >35,000 users of European SR and FEL facilities. ESUO's vision is to support a thriving (European) synchrotron & FEL user community with equal opportunities of access and participation for all scientists based solely on the scientific merit of their ideas; eliminating geographic and financial barriers.

144 The NEPHEWS Project - Funding Trans-National Access for Excellent Curiosity Driven Research

Cormac McGuinness (European Synchrotron and Free Electron Laser User Organisation (ESUO) & Trinity College Dublin, Ireland)

NEutrons and PHotons Elevating Worldwide Science is an Horizon Europe co-funded Trans-National Access project for excellent curiosity driven research at European synchrotron, FEL and neutron research infrastructures, vital for users in Widening & non-facility countries. Twinning actions, virtual training and policy initiatives are included. NEPHEWS is a collaboration of LEAPS, LENS, ESUO and ENSA.

145 Control of magnetic cocoons in aperiodic multilayers using He^+ ion irradiation

Krishnanjana Puzhekadavil Joy (Helmholtz-Zentrum Berlin)

Magnetic cocoons are 3D spin textures that can be stabilized in [Pt/Co/Al]n aperiodic multilayers. Here, we employed He^+ ions to achieve a local alteration of the magnetic properties of the material. The magnetic imaging of these irradiated aperiodic multilayers was carried out by STXM (MAXYMUS). By tuning the ion energy and dose, three-dimensional control of the spin textures was achieved in the material.

147 X-ray microspectroscopy for the analysis of atmospheric aerosols

Michael Chilinski (Max-Planck-Institut für Chemie)

Atmospheric aerosols collected from multiple field campaigns: Amazonian biogenic sources (plants, fungi), an aircraft mission over the Pacific, and sea spray from s/y Eugen Seibold - were analyzed using STXM-NEXAFS, a unique technique for studying the composition, morphology, and mixing state of aerosols. Authentic ambient conditions were mimicked using the improved environmental cell MIMiX.

148 Fischer-Tropsch Catalysts Explored Across Scales at the BESSY II Synchrotron within the CARE-O-SENE Project

Lucia Maria Toscani (Helmholtz-Zentrum Berlin)

The CARE-O-SENE project aims at advancing the development of Co-based catalysts for sustainable aviation fuel production via Fischer-Tropsch-Synthesis (FTS). This contribution showcases the multi-scale imaging and spectroscopy capabilities of the BESSY II synchrotron light source for in-system, ex- or in-situ, and operando characterization of thin-film and powder FT catalysts.

149 From UHV to Operando: Probing the Metal-Support Interaction of Pt-MnO

Manuela Arztmann (Helmholtz-Zentrum Berlin)

The electronic structure evolution of ultra-thin Pt films during controlled growth on MnO was monitored by lab-based XPS/UPS at EMIL. These model catalysts were further studied during catalysis at ambient pressures using operando XANES measurements at the mySpot beamline. The combined results provide insights into how metal-support interaction shapes the electronic structure of Pt.

150 Harvesting Energy by Thermoelectric MoS_2 and $MoSe_2$ Materials

Manuel Ramos Murillo (Universidad Autónoma de Ciudad Juárez, Mexico)

We investigated $MoSe_2/MoS_2$ thin films prepared via RF-sputtering. Atom probe tomography revealed MoS_2 and MoS_3 ions, no grain boundaries, and intermixing at the $MoSe_2/MoS_2$ interface (S: 45%, Se: 0.4%). DFT showed an indirect band gap (Eg = 0.805 eV) near Γ-K. Linseis measurements yielded a Seebeck coefficient of 1.185 mV K^{-1} (290–320 K) and ZT ≈ 1.0.

151 Domain-resolved electronic structure of AgTe-intercalated graphene on SiC(0001)

Vibha Reddy (Max-Planck-Institut für Festkörperforschung)

Intercalation at the graphene-SiC interface allows tuning the properties of both graphene and the intercalant. Nominal AgTe intercalation produces multiple coexisting phases. Synchrotron-based ARPES reveals domain-specific graphene doping and interlayer band dispersions, demonstrating tuneable interface engineering via transition metal-chalcogen intercalation, a first of its kind in this graphene-SiC system.

152 Emergence of Moiré Dirac Fermions at the Interface of Topological and 2D Magnetic Insulators

Aymeric Saunot (Donostia International Physics Center, Spain)

We investigate moiré heterostructures formed by 2D magnetic insulators ($FeBr_2$, $FeCl_2$) epitaxially grown on the topological insulator Bi_2Se_3. The lattice mismatch, tuneable via film stoichiometry, induces a moiré superlattice measured by STM. ARPES reveals Dirac cone replications and signatures of moiré-induced interactions at their intersections (M point).

153 Green and stable X-ray detectors based on novel hybrid materials

Olena Maslyanchuk (Helmholtz-Zentrum Berlin)

We developed green X-ray detectors from mechanochemically synthesized bismuth-based compounds. Compressed pellets show exceptional sensitivity to white spectra from various X-ray tubes and the BESSY II synchrotron source, very low detection limits, superior performance to a-Se and CdZnTe, and excellent long-term stability.

154 Highly Sensitive X-ray Detectors with Polymer-Perovskite-Embedded Flexible Teflon Membranes

Sema Sarisözen Akkan (Universität Potsdam)

Polymer-perovskite composites embedded in flexible Teflon (PTFE) membranes present a new platform for X-ray detectors, where the poly(methyl acrylate) (PMA) additive enables ultra-high sensitivity and mechanical durability via a dual-passivation mechanism. The energy-dependent response (7-15 keV) of these high performance devices was successfully characterized at the KMC-3 XPP beamline at BESSY II.

156 SOL³PES - a newly upgraded experimental setup for liquid phase soft X-ray photoemission spectroscopy at BESSY II

Robert Seidel (Helmholtz-Zentrum Berlin)

We present the experimental setup SOL³PES equipped with a high-transmission hemispherical electron analyzer for soft X-ray photo- and Auger-Meitner-electron spectroscopy from liquid phase that has been built for operation at BESSY II. Its name is derived from solid, solution, and solar, and refers to the aim of studying solid-liquid interfaces, optionally irradiated by photons in the solar spectrum.

156 b Volcano-like effect at the nanoscale: efficient oxygen exchange at the Si/SnO_2 interface

Vladimir Sivakov (Leibniz-Institut für Photonische Technologien)

Theoretical calculations, wide-ranging surface and bulk sensitive techniques partly synchrotron-based X-ray photoelectron and X-ray absorption spectroscopy have been applied to study the formation mechanisms of tin-based thin layers.

157 Study of metal-organic interface In/$CuPcF_x$: metal self-assembly/ordering in 2D/3D ultra-small indium nano-objects on the surface and in the bulk of the organic matrix

Olga Molodtsova (Deutsches Elektronen-Synchrotron DESY)

The results of a study of the morphology and electronic properties of a nanocomposite material consisting of a thin $CuPcF_4$ film and multiphase/multidimensional indium nanoparticles self-organized on the surface and in the bulk of an organic matrix during synthesis in ultrahigh vacuum are presented.

158 Electronic properties of multiferroic vdW $CuCrP_2S_6$ and its interface with graphene

Yefei Guo (Henan University of Technology, P.R. China)

Using X-ray spectroscopy methods, we address electronic properties of multiferroic vdW $CuCrP_2S_6$ and its interface with graphene.

159 Correlation effects in $CrYTe_3$ (Y: Si, Ge) from X-ray spectroscopy studies

Elena Voloshina (Ruđer Bošković Institute, Croatia)

Using NEXAFS and resonant photoelectron spectroscopy we address correlation effects in the layered vdW $CrYTe_3$ (Y: Si, Ge) crystals.

160 Chemical graphene functionalization based on the chemistry of diazonium compounds

Victor Aristov (Deutsches Elektronen-Synchrotron DESY)

A covalent functionalization is a promising approach to expanding the scope of graphene, which has attracted the attention of scientists due to its unique properties. Covalent attachment to graphene of photoactive dyes leads to the transformation of electronic structure in resulting nanocomposite.

161 The role of IRIS Beamline in conservation science

Ljiljana Puskar (Helmholtz-Zentrum Berlin)

Infrared IRIS beamline offers non-destructive chemical analysis of small, complex samples in artworks, archaeological artifacts and historical documents. Mapping both organic and inorganic components with high spatial resolution (micro to 20 nm scale) identifies material composition, aging and preservation states aiding in authentication, restoration and the scientific understanding of historical materials.

162 Broadband infrared spectroscopy at IRIS Beamline: from mid-IR to THz with spatial resolution down to the nanoscale

Alexander Veber (Helmholtz-Zentrum Berlin)

The infrared macro-, micro-, nano-spectroscopy end-stations available at the IRIS beamline enable chemical characterization of materials from bulk down to sub-30 nm spatial resolution in the terahertz and far- to mid-IR spectral ranges. Here, we describe the experimental stations and their capabilities for investigating matter across multiple length scales and hierarchical levels.

163 Linking sSNOM and Specular Reflection FTIR Measurements in Bovine Enamel

Franco Lizzi (Zahnklinik - Charité Universitätsmedizin)

This work compares bovine enamel spectra obtained by sSNOM and specular reflection FTIR at BESSY's IRIS beamline to identify common spectral features. Enamel, largely composed of inorganic phosphate, serves as a simple reference tissue. Dominant phosphate ν_1 and ν_3 bands provide a robust basis for testing both methods and extending them to dentine.

164 Nanoscale Infrared Spectroscopy at IRIS Infrared Beamline for Biological Applications

Maria Eleonora Temperini (Helmholtz-Zentrum Berlin)

Nano-FTIR spectroscopy at the IRIS beamline enables IR-imaging and spectroscopy with spatial resolution down to 10 nm in the far- and mid- IR regions. The nanoscale resolution combined with broadband synchrotron radiation source directly probes biological molecules and complex samples such as protein fibrils implicated in neurodegenerative disorders, providing structural and chemical information.

164 a Nonlinear Vibrational and Infrared Nanospectroscopic Investigation of PAS-Domain Protein at Model Protein Interfaces

Montserrat Roman Quintero (School of Analytical Sciences Adlershof)

The PAS domain mediates signal sensing and regulation. Using the photoactive yellow protein (PYP) as a model, we studied its interaction with poly-L-lysine (PLL) via CD, AFM, VSFG, MD, and nano-FTIR. PYP adopts a defined, dipole-driven orientation at PLL surfaces, tuned by pH and temperature, revealing how local environments shape PAS signalling.

164 b Vibrational and Surface Selective Probes for Investigating Antimicrobial Aurein 1.2 Membrane Disruption

Vincent Hempel (Humboldt-Universität zu Berlin)

Antimicrobial peptide Aurein 1.2 disrupts bacterial membranes and is a promising candidate for new antibiotics, but its mechanism is unclear. Using Langmuir monolayers, AFM, FTIR, and VSFG spectroscopy, we seek to gain molecular understanding of its interaction with model lipid bilayers.

164 c From soft X-rays to mid-infrared: Molecular structure and nanoscale imaging of intact cells using U41-TXM and IRIS beamlines

Cecilia Spedalieri (Humboldt-Universität zu Berlin)

Understanding metabolic processes in living cells requires information on both molecular and ultrastructure. Taking advantage of complementary nanoimaging techniques that use synchrotron light, we study the chemical composition and distribution of biomolecules in cells in native conditions combining scattering-type near-field optical microscopy in the infrared with soft-X-ray nanotomography.

164 d Benchmark EUV/VUV optical constants of fused silica and quartz

Najmeh Abbasirad (Physikalisch-Technische Bundesanstalt)

Fused silica and α-quartz are widely used, yet their EUV/VUV (13–140 nm) optical constants are not well established. We measured thermally grown SiO_2 and Y-cut α-quartz by angle-resolved reflectometry at BESSY and PTB. A transfer-matrix model with MCMC retrieved n and k (ordinary/extraordinary), resolving the absorption edge and distinct quartz resonances.

165 Determination of the optical constants of TiO_2 by VUV and EUV reflectometry

Mattia Mulazzi (Physikalisch-Technische Bundesanstalt)

In this contribution, we show how to determine the optical constants of TiO_2 from the reflectivity measurements in the VUV and EUV and fitting a physics-agnostic model to them. The results show a significant improvement over the literature values underscoring deviations in some regions of the spectrum, especially close to the absorption resonances.

166 Optical Constants Determination for Soft X-ray/EUV Optics: Refined Optical Data for Iridium

Qais Saadeh (Physikalisch-Technische Bundesanstalt)

We present the determination of iridium (Ir) optical constants in the Extreme Ultraviolet (EUV) range, wavelength: 5.0 nm - 35.0 nm. The optical constants were determined using the Fresnel formalism from the angle resolved reflectance of a 42 nm thick magnetron sputtered Ir coating, measured with synchrotron radiation-based reflectometry. Our results reveal significant deviations from existing optical data.

168 Resolving multimodality in EUV reflectometry of ultra-thin films through joint s/p-polarized data analysis

Samira Naghdi (Physikalisch-Technische Bundesanstalt)

Ultra-thin film characterization with single-polarization EUV reflectometry faces parameter ambiguity. Using high-quality s- and p-polarized data from the BESSY II synchrotron, we show that joint analysis uniquely determines optical and geometrical parameters of a 5 nm ruthenium film, reducing uncertainty and enabling robust film characterization.

168 a Cyclotriphosphazene electrolyte additives tailoring inorganic-rich solid electrolyte interphase in Lithium-Ion Batteries

Mahima Ann Paul (Helmholtz-Zentrum Berlin)

Fully inorganic substituted cyclotriphosphazenes are evaluated as Solid Electrolyte Interphase (SEI) forming electrolyte additives in Lithium-ion batteries. Electrochemical analysis and (Hard) X-ray Photoelectron Spectroscopy results suggest that the inorganic-rich, multicomponent SEI improves capacity retention in Li-ion half-cells with liquid carbonate electrolyte.

168 b HAXPES investigation into conversion of $CsPbBr_3$ to $CsPbCl_3$ via ALD half-reactions

Khaleed Abdul (Helmholtz-Zentrum Berlin)

$CsPbCl_3$ perovskite is a promising, stable material for violet-emitting distributed feedback lasers. Solution-based synthesis is limited by solvent incompatibility of chloride precursors. Instead, $CsPbBr_3$ is converted to $CsPbCl_3$ via exposure to $TiCl_4$ in ALD half-cycles. HAXPES (HiKE) tracks the mechanism of the conversion, providing insight into the non-degrading complete halide conversion process.

169 Lithium-Rich Copper Sulfides as Cathode Active Materials in All-Solid-State Lithium-Ion Batteries

Goutham Narasipura Srinivas (Humboldt-Universität zu Berlin)

CuS-based solid-state batteries enable stable, high-capacity performance. This study compares discharged (LiCuS, Li_3CuS_2) and charged (CuS, Cu_2S) cathodes synthesized and characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM), while operando hard X-ray photoelectron spectroscopy (HAXPES) probes buried interfaces and their real-time chemical changes.

170 Role of ionic liquid additives on modifying solid electrolyte interphase composition in lithium-ion batteries

Ashwin Thirumalai Shekhar (Helmholtz-Zentrum Berlin/Umicore)

The solid electrolyte interphase (SEI) is crucial to stable cycling of lithium-ion batteries. Here, we use ionic liquid additives to introduce possible favourable species (LiF, Li_3N, polymers) in the SEI. Through (hard) X-ray photoelectron spectroscopy and electrochemical cycling of coin cells, we correlate SEI composition and cycling performance with and without additives.

171 Mechanochemical COFs for PFAS adsorption

Maroof Arshadul Hoque (Bundesanstalt für Materialforschung und -prüfung)

PFAS are widely used chemicals with strong thermal, water, and oil resistance, but they contaminate drinking water and pose health risks. This work explores covalent organic frameworks (COFs), porous materials made via green mechanochemistry, to adsorb PFAS from water. Adsorption testing is ongoing, and results are a work in progress, but COFs show promise for PFAS removal.

172 Perovskite nucleation captured with sub-second resolution - a multimodal case study

Lennart Reb (Helmholtz-Zentrum Berlin)

Perovskite photovoltaics offer scalable, solution-based processing, but the assembly and crystallization dynamics require in-situ studies to better understand film formation. This poster presents a case study using the multimodal slot-die coater combining optical spectroscopy and X-ray scattering (GISAXS/GIWAXS) to correlate film thinning, bandgap evolution, and structural growth dynamics.

172 a Real-time Insights into Heusler Alloy Formation: Multimodal X-ray study

Ana Guilherme Buzanich (Bundesanstalt für Materialforschung und -prüfung)

We present a unified X-ray Emission Spectroscopy (XES) and X-ray Diffraction (XRD) approach for real-time in situ characterization of materials, demonstrated on Co_2FeSi Heusler alloys under different heat treatments. This combined method reveals subtle changes in atomic ordering and electronic structure such as site occupancy, hybridization, and spin state.

172 b Two Pimelic Acid Cocrystals - A Mechanochemical and Thermal Study

Anastasia May (Bundesanstalt für Materialforschung und -prüfung)

In our study, we investigated the mechanochemical cocrystallization of pimelic acid (PA) with pyrazinamide and nicotinamide using in-situ powder X-ray diffraction (PXRD). Cocrystallization kinetics were affected by milling temperature and pre-milling of PA due to PA polymorphism and thermal effects. Our results highlight the value of in-situ PXRD for the investigation of mechanochemical reaction mechanisms.

172 c Understanding Perovskite Crystallisation - Comparative in-situ X-ray scattering studies on intermediate phases

Anton Dzhong (Helmholtz-Zentrum Berlin)

Metal halide perovskites show great promise for next-gen solar cells due to excellent optoelectronic properties and solution processability. Using in-situ GIWAXS during slot-die coating at BESSY II, we mapped crystallization pathways across different solvents and perovskite compositions, revealing solvent-dependent intermediate formation that dictates phase formation and ink optimization.

173 Microstructural characterisation of aerospace ceramics via Synchrotron X-ray Computed Tomography

Paula Campos de Oliveira (Bundesanstalt für Materialforschung und -prüfung)

This study investigates the microstructural evolution of refractory ceramics applied in aerospace using Synchrotron X-ray Computed Tomography (SXCT). We analyse how processing and temperature affect factors such as agglomeration, microcracking, particle orientation, and pore interconnectivity. These findings offer insights for optimising the design of more sustainable aircraft engines.

174 Multi-Energy HDR Synchrotron X-ray Computed Tomography

Mustapha Eddah (Bundesanstalt für Materialforschung und -prüfung)

LTCC are ceramic/metal devices used for a wide array of applications. The radiographic and tomographic reconstruction of such devices is challenging due to the complex microstructure and presence of both strongly and weakly absorbing parts. This project aims to develop novel Synchrotron X-Ray imaging techniques to quantify structure and defect formation during sintering.

175 Optimized polycapillary optics for high-resolution full-field XRF

Jonathan Kranz (Technische Universität Berlin)

A Polycapillary Conic Collimator (PolyCCC) has been used in a Full-field XRF setup with a color x-ray camera at the BAMline. The novel optic facilitates elemental imaging with a lateral resolution of ~5 µm with high speed and a magnification of 12 and higher. We present characterization results and first application images.

176 Simulation of functional aging towards failure prediction of dental restorations - Investigating the Crown-Cement-Tooth-Complex (CCTC)

Akshar Soni (Bundesanstalt für Materialforschung und -prüfung)

SimuCrown investigates the ageing behaviour of dental restorations using functional simulation and microstructural analysis. The crown-cement-tooth complexes (CCTCs) underwent chewing simulation followed by XCT evaluation (Charité), SXRR imaging (BAM), and FEM simulation (TU Berlin) to evaluate material degradation, interfacial integrity, and performance during simulated functional ageing.

176 a Solution-drive processing of calcium sulfate

Tomasz Stawski (Bundesanstalt für Materialforschung und -prüfung)

In high-salinity brines (>4 M NaCl) above 80°C, gypsum rapidly and reversibly converts to bassanite. This direct transformation is driven by a solubility inversion, where gypsum becomes more soluble than bassanite, causing a dissolution-reprecipitation process. The reverse reaction upon cooling is kinetically slow, allowing the more stable bassanite to be easily harvested for industrial applications.

176 b Controllable Synthesis of Porous $LiFePO_4$/C Microspheres via a One-Step Co-Precipitation Process for High-Performance Lithium-Ion Batteries

Mouad Dahbi Mohammed (Mohammed VI Polytechnic University, Marocco)

A scalable one-step method is presented for synthesizing porous carbon-coated $LiFePO_4$ microspheres. The process enables control of particle size and porosity, enhancing conductivity and battery performance. This approach supports low-cost, efficient lithium-ion cathodes for sustainable energy storage.

177 Synchrotron X-Ray Tomography Examples at BAMline

Henning Markötter (Bundesanstalt für Materialforschung und -prüfung)

The BAMline at BESSY II is used by researchers, particularly in materials science. As a non-destructive characterization method, synchrotron X-ray imaging, especially tomography with hard X-rays, plays an important role in structural 3D characterization. Examples of imaging possibilities are shown, such as operando battery-, in-situ cryogenic CT-, and in-situ tensile experiments.

178 Understanding Mechanochemical Reactions with In Situ XAS

Jacob Wilson (Bundesanstalt für Materialforschung und -prüfung)

Mechanochemistry offers a green and sustainable route for material synthesis, yet its industrial implementation is hindered by limited fundamental understanding, especially of (sub)nanostructural mechanisms. Developing local structural in situ techniques is essential. X-ray absorption spectroscopy (XAS) now enables real-time tracking of local structures in mechanochemical reactions.

179 X-ray Absorption Spectroscopy to Uncover the Structure of Metal and Nitrogen Doped Carbon Electrocatalysts

Simon Dietzmann (Bundesanstalt für Materialforschung und -prüfung)

High-performance electrocatalysts are essential for efficient energy conversion. Metal and nitrogen enriched carbons (M–N–Cs) are promising candidates due to their intrinsic conductivity and tuneable properties through targeted modification. To understand and optimize the catalytically active sites at the pseudo-molecular level, detailed structural characterization is crucial.

180 In-situ analysis of nucleation pro-cesses – case study: calcium sulfate

Tom William Ryll (Bundesanstalt für Materialforschung und -prüfung)

In this project we investigate nucleation pathways by utilizing synchrotron-XRD and running a case-study on calcium sulfate phases. To accomplish this, we developed a modular automation setup for reactions in solution to run synthesis and control reaction conditions. So far, we successfully characterized the recycling process of gypsum and are now investigating the formation of anhydrite.

181 Photoelectronic and Neutron Insights into N-Doped MoS_2 for Efficient HER Catalysis

Aliki Gerakianaki (Institute Laue-Langevin, France)

Recent photoelectronic and neutron spectroscopy reveal that N-doped MoS_2 powders exhibit higher hydrogen diffusivity than pristine MoS_2. This improvement suggests that N-doping effectively promotes catalytic activity towards the HER, a key process in water electrolysis for green hydrogen production. We present our latest findings and discuss them in comparison to standard Pt catalysts.

182 Plasma-assisted surface modifications of polymeric separator films used for lithium-ion batteries

Christian Fischer (Mohammed VI Polytechnic University, Marocco)

An important component of rechargeable Lithium-based batteries is the separator, a commercially available porous polyolefin film positioned between anode and cathode. To address hydrophobic surface properties hindering effective electrolyte exchange RF-PECVD plasma treatments are used. Here, separators are modified with O_2- and C_2H_2-plasma to tailor surface characteristics.

183 XPS and NEXAFS spectroscopy for the development of Li free battery electrodes based on 2D carbon based materials

Muhammad Hamza (GREMI - Université d'Orléans, France)

Carbon based 2D and 3D materials were synthesized by means of low-temperature- low power plasma, and subsequently treated in situ with H_2, N_2, and O_2 plasmas at various temperatures. XPS and NEXAFS studies at HE-SGM beamline presented herein focus on the role of gas mixture, substrate type and temperature on the presence of dopants, functionalities, and sp2 content (supported by MD simulations).

184 High precision benchmarking of potential energy curve calculations with sensitivity to internuclear distances

Adrian Peter Krone (Universität Kassel)

Fluorescence spectra of H_2 molecules singly-excited by narrow-bandwidth photons at 1 meV intervals between 12 and 15 eV displaying the H_2 Condon diffraction bands are measured providing a high precision benchmarking tool for potential energy curve calculations.

189 Capillary-based Soft X-ray Ptychography for Ultimate 4D Spectro-Microscopy with Versatile Sample Environment

Boris Sorokin (Universität Augsburg)

In this project we aim to create the first coherent, digital soft X-ray ptychography endstation with a highly versatile sample environment. To this end, we will employ capillary optics that extend the working distance compared to conventional zoneplates from sub-millimeter to several centimeters. The endstation is currently being built and will be located at the PETRA-III P04 beamline.

190 X-ray Atto Chirality

Markus Ilchen (Deutsches Elektronen-Synchrotron DESY)

The initial milestones of chirality science at FELs, the status of advanced metrology schemes for variably polarized, high-power (X)FEL pulses at the attosecond frontier, latest results from our atto-campaigns at the European XFEL, and the advent of related scientific prospects that are about to emerge at a variety of facilities worldwide will be discussed with a scope on localized charges in chiral matter.

192 Comparative study of charge transition level in hexagonal and tetragonal $BaTiO_3$ by X-ray photoelectron spectroscopy

Savita Chaoudhary (Technische Universität Darmstadt)

CTLs play an important role in determining the functional characteristics of materials, and their position can be affected by the crystal structure. This work investigates how the charge transition level (CTL) is correlated to crystal structure, specifically, comparing the tetragonal and hexagonal phases of $BaTiO_3$.

193 BelChem-PGM Goes Pump-Probe: New Capabilities to Study Photoinduced Charge-Transfer Dynamics

Friedrich Roth (TU Bergakademie Freiberg)

At BelChem-PGM, we are installing a new ultrafast photoemission platform: a new endstation integrated with a newly installed, synchronized optical laser for picosecond tr-(AP)XPS from <100 ps to ms. We will present an overview of the concept and its initial capabilities, including the first successful commissioning beamtime during the second single-bunch operation week of 2025 at BESSY II.

194 Thin films and bulk material of an Fe^{2+} complex: Spin-crossover studies using X-ray absorption spectroscopy

Fasil Yousaf (Freie Universität Berlin)

The spin-crossover properties of the molecule $[Fe(HB(3\text{-}Mepz)_3)_2]$ are measured by X-ray absorption spectroscopy as a thin film on HOPG and in bulk. Both exhibit a partial high-spin to low-spin transition by variation of temperature as well as a light-induced spin state trapping (LIESST) by green light. In addition, the thin-film sample shows novel reverse LIESST characteristics.

195 Vector-field control and emergent basal-plane anisotropy of magnetic spirals in noncentrosymmetric $Fe_{1.9}Ni_{0.9}Pd_{0.2}P$

Victor Ukleev (Helmholtz-Zentrum Berlin)

$Fe_{1.9}Ni_{0.9}Pd_{0.2}P$ (FNPP) is a tetragonal S4-symmetric magnet hosting diverse topological spin textures. Using resonant small-angle x-ray scattering in vector magnetic fields, we show that at room temperature, magnetic spirals align with any in-plane field as small as 10 mT, while below 50 K their orientation becomes pinned.

196 Investigation of CrSBr single crystal using X-ray Linear Dichroism and Resonant Inelastic X-ray Scattering

Chen Luo (Helmholtz-Zentrum Berlin)

We introduce a novel method to probe antiferromagnetic ordering and determine the critical temperature of van der Waals antiferromagnetic semiconductor CrSBr single crystals using temperature-dependent X-ray magnetic linear dichroism, which agrees well with resonant inelastic X-ray scattering results. This approach offers a reliable tool for a wide range of antiferromagnetic materials.

199 Nanoscale characterization of PEM fuel cell catalyst degradation for improved electrochemical performance

Spencer Lytle (University of Toronto, Canada)

Polymer electrolyte membrane (PEM) fuel cells offer a promising solution to the decarbonization of heavy-duty vehicles. However, their catalyst layers are prone to sever degradation that hinders their commercialization. Thus, the TXM beamline at Bessy-II is used to quantify the 3D distribution of catalyst nanoparticles in pristine and degraded catalyst layers to elucidate catalyst degradation.

200 Spatially Resolved NEXAFS Spectromicroscopy of Na Deintercalation Pathways and Fe Redox Behavior in Na-Ion Cathodes at U41-TXM

Neama Imam (Brandenburgische Technische Universität Cottbus-Senftenberg)

TXM imaging at the Na-K and Fe-L edges reveals nanoscale heterogeneity and particle-size effects. The corresponding spatially resolved NEXAFS spectra provide insights into the site-resolved Na deintercalation and the charge-compensating redox processes from Fe^{2+} to Fe^{3+} in sodium iron sulfate cathodes.

200 a Kondo scaling of f-electron states and the Kondo singlet breakdown in heavy fermions

Bodry Tegomo Chiogo (Helmholtz-Zentrum Berlin)

Resonant inelastic X-ray scattering measurements have been performed at PEAXIS as a function of temperature on $CeSi_2$. An unprecedentedly significant temperature dependence of the f0 final state is observed, reflecting the breakdown of the Kondo singlet as the first excited magnetic states are thermally excited. These results highlight RIXS as a powerful spectroscopic method for determining the Kondo gap.

200 b PEAXIS in 2025: A Year in Review

Deniz Wong (Helmholtz-Zentrum Berlin)

PEAXIS is a RIXS end station at BESSY-II dedicated to a variety of users in the field of quantum and energy materials. In 2025, our users used PEAXIS to elucidate the electronic structures of model quantum materials, to explain activities in catalytic systems and to probe distinct chemical states of oxygen that contribute to the redox reaction inherent to next generation cathodes in batteries.

CR 2 All-Optical Helicity-Dependent Switching (AO-HDS) in Fe_4GeTe_2 Probed by XPEEM

Shubhada Prashant Patil (Helmholtz-Zentrum Berlin)

We present X-ray photoemission electron microscopy (XPEEM) studies on exfoliated Fe_4GeTe_2 flakes revealing robust all-optical helicity-dependent switching (AO-HDS) of magnetic domains induced by femtosecond laser pulses. The experiments demonstrate light-induced control of magnetic domains and reveal the influence of laser parameters and external magnetic fields on the switching behaviour.

CR 3 Sample-Integrated Magnetic Flux Concentrators: Surpassing Intrinsic Field Limits in Magnetic Imaging

Sergio Valencia (Helmholtz-Zentrum Berlin)

Sample-integrated magnetic flux concentrators (MFCs) can locally increase the effective magnetic field during imaging by at least a factor five. Micrometer-sized MFCs fabricated directly on the samples are tested in photoemission electron microscopy experiments employing X-ray magnetic circular dichroism as magnetic contrast mechanism. Effective fields as large as 150 mT are achieved during imaging.

CR 4 X-PEEM studies of 2D heterostructures: time-resolved PEY oscillations and evolution of magnetic domains

Alevtina Smekhova (Helmholtz-Zentrum Berlin)

We present the results of time-resolved X-PEEM experiments performed over the atomically thin heterostructure based on the van der Waals Fe_xGeTe_2 ferromagnet covered with the h-BN layer. PEY oscillations observed for regions of the adjacent h-BN and Graphene layers and magnetic domains found in the Fe_xGeTe_2 at 40K demonstrate their time evolution on the ns scale after the fs laser excitation.

CR a Status of the Microfocus Beamline for Tender X-rays

Matthias Müller (Physikalisch-Technische Bundesanstalt)

PTB's microfocus beamline provides monochromatized dipole radiation ranging from 1 keV to 10 keV, with a focused beam spot typically measuring 20 µm x 20 µm. The beamline integrates two monochromator modules: a DCM equipped with two Si(111) crystals and a PGM employing a multilayer-coated blazed grating and a plane mirror. We will present recent results from the commissioning beamtimes.

CR b Time-resolved interface characterisation in Na-ion and lithium-sulphur batteries using quantitative X-ray absorption spectroscopy in the soft X-ray range

Katja Frenzel (Physikalisch-Technische Bundesanstalt)

Next-generation batteries present sustainable alternatives to Li-ion batteries for grid stabilization. Achieving enhanced efficiency and longevity demands in-depth analysis of interface formation processes. Reference-free X-ray fluorescence combined with X-ray absorption spectroscopy enables quantitative operando insights, as shown in studies of Na-Ion SEI formation and LiS cathode CEI degradation.

CR c Understanding interphase formation and subsequent evolution upon cycling in Lithium-ion batteries combining ex-situ and operando x-ray spectrometry

Lena K. Mathies (Physikalisch-Technische Bundesanstalt)

Performance and degradation of Lithium-ion batteries is strongly influenced by surface reactions and interphase formation at the electrodes. While initial buildup is crucial for lithium transport, modification upon cycling lead to capacity fading and reduced lifespan. Quantitative x-ray spectrometry (XRF and XAS) was used for ex-situ and operando studies of degradation mechanisms of NMC batteries.

CR d X-ray spectrometry study of Organo-Sulfur Material

Hongfei Yang (Physikalisch-Technische Bundesanstalt)

Li-S batteries offer high theoretical energy density but suffer fade from shuttle and slow kinetics. Copolymerization of sulfur has been proposed to enhance the stability of organosulfur cathode. In this study, in-situ/operando XAS, XES are employed to probe sulfur speciation, estimate strand lengths, track structural evolution, and reveal the sulfur strand length correlation with battery performance.

CR e The curse of optical contrast in material parameter determination

Victor Soltwisch (Physikalisch-Technische Bundesanstalt)

An overview of the challenges in the determination of optical constants and which paths need to be taken to increase sensitivities in the future.

PTB 1 A systematic beam damage study on solid state electrolytes for LiS batteries

Adrian Jonas (Physikalisch-Technische Bundesanstalt)

Lithium-sulfur (LiS) batteries offer high energy density (2500 Wh/kg) and eco-friendly materials. Solid electrolytes (SE) can boost safety and performance. Using traceable, quantitative XRF and NEXAFS, the FestPoLiS project studies transport, degradation, and X-ray-induced changes in SEs to optimize LiS battery chemistry.

PTB 2 Beamlines XPBF3 and XPBF4

Dieter Skroblin (Physikalisch-Technische Bundesanstalt)

The X-ray parallel beam facility 3 (XPBF3) and X-ray parallel beam facility 4 (XPBF4) are two new beamlines to be installed in the PTB laboratory at the synchrotron radiation facility BESSY II. They will provide the metrology instrumentation to align silicon pore optics into mirror modules that will be used to produce the optic for the new advanced high energy astrophysics telescope (NewAthena).

PTB 3 Determining Size-Distributions of Highly Polydisperse Nanoparticles Using SAXS

Nicholas Engel (Physikalisch-Technische Bundesanstalt)

SAXS was measured on the superparamagnetic iron oxide nanoparticles (NPs) FeraSpin R and its size fractions, which are MRI contrast agents. These NPs are polydisperse by design. Since the SAXS scattering curves of these samples are featureless, it is challenging to retrieve their size-distributions from form-factor fitting. Therefore, we employed a Monte Carlo fitting approach using McSAS.

PTB 4 Exploring the soft X-ray energy range for next generation nanostructure metrology

Hans Kirschner (Physikalisch-Technische Bundesanstalt)

Shrinking semiconductor features demand innovative, non-destructive metrology for complex 3D structures. Soft X-rays enable high-resolution analysis of nanostructured surfaces and buried layers. We study their sensitivity, optical constants, and compare results with hard X-ray tools, also exploring hybrid scatterometry-fluorescence methods for advanced materials.

PTB 5 From the EU metrology projects AEROMET I & II to the HE project MI-TRAP - Reliable chemical aerosol analysis by X-ray spectrometry without calibration samples

André Wählisch (Physikalisch-Technische Bundesanstalt)

Reliable analysis of airborne particulate matter (PM) is crucial for health and climate studies, yet limited reference materials hinder conventional methods. PTB advances reference-free X-ray spectrometry, enabling size and element-resolved aerosol quantification. Building on AEROMET I & II, the ongoing MI-TRAP project develops traceable monitoring to close gaps in transport emission assessments.

PTB 6 Investigation of electronic structures using a calibrated wavelength-dispersive spectrometer for advanced x-ray analysis

Moritz Winkler (Physikalisch-Technische Bundesanstalt)

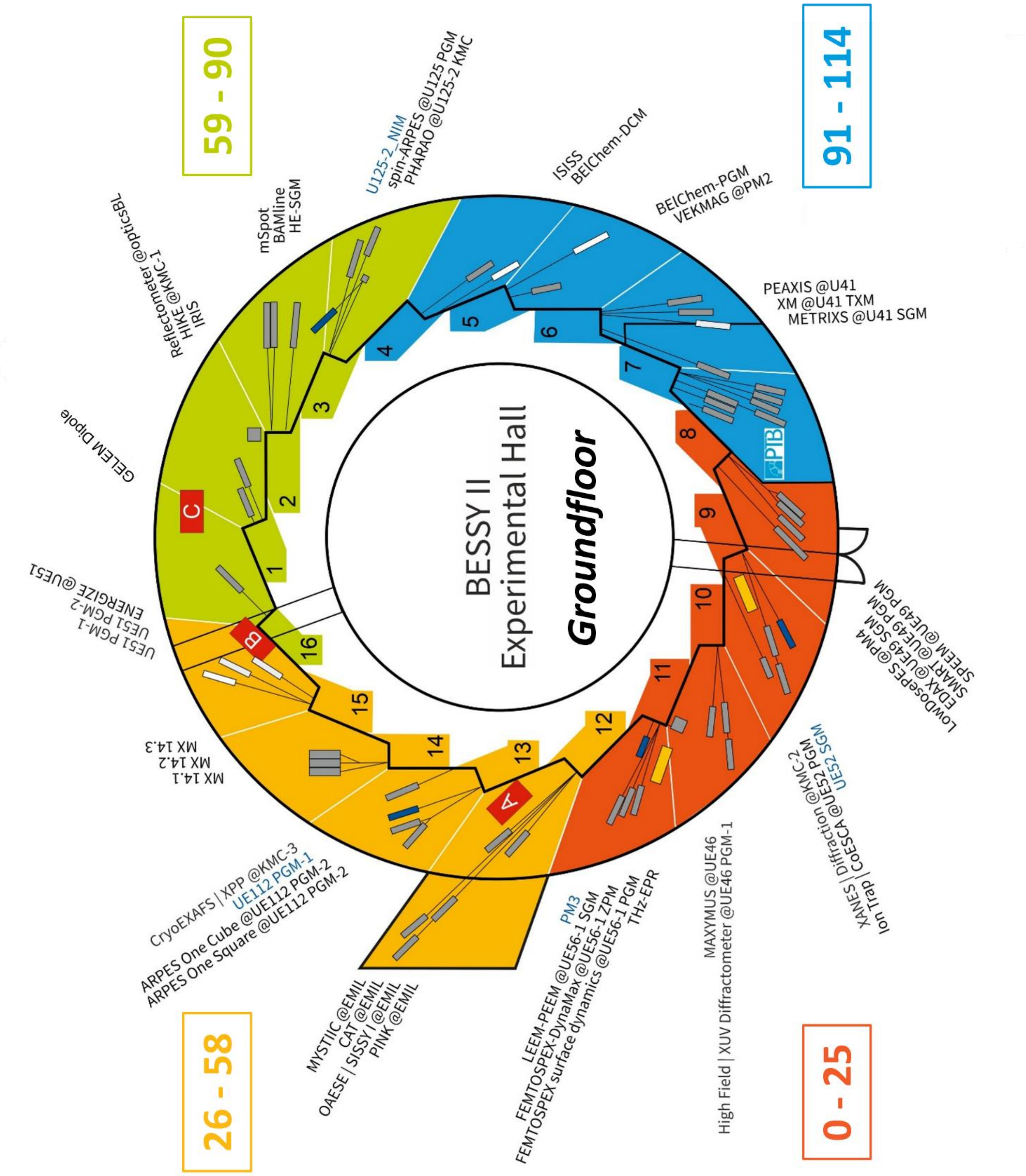
In collaboration with the NIST the PTB has developed a calibrated wavelength-dispersive spectrometer capable of Resonant Inelastic X-ray Scattering in the photon energy range from 80 eV to 1100 eV. The WDS finds its main applications in battery material research, the validation and development of theoretical calculation tools, and the accurate determination of x-ray fundamental Parameters.

PTB 7 Small-Angle X-Ray Scattering of Magnetosomes inside a Magnetic Field

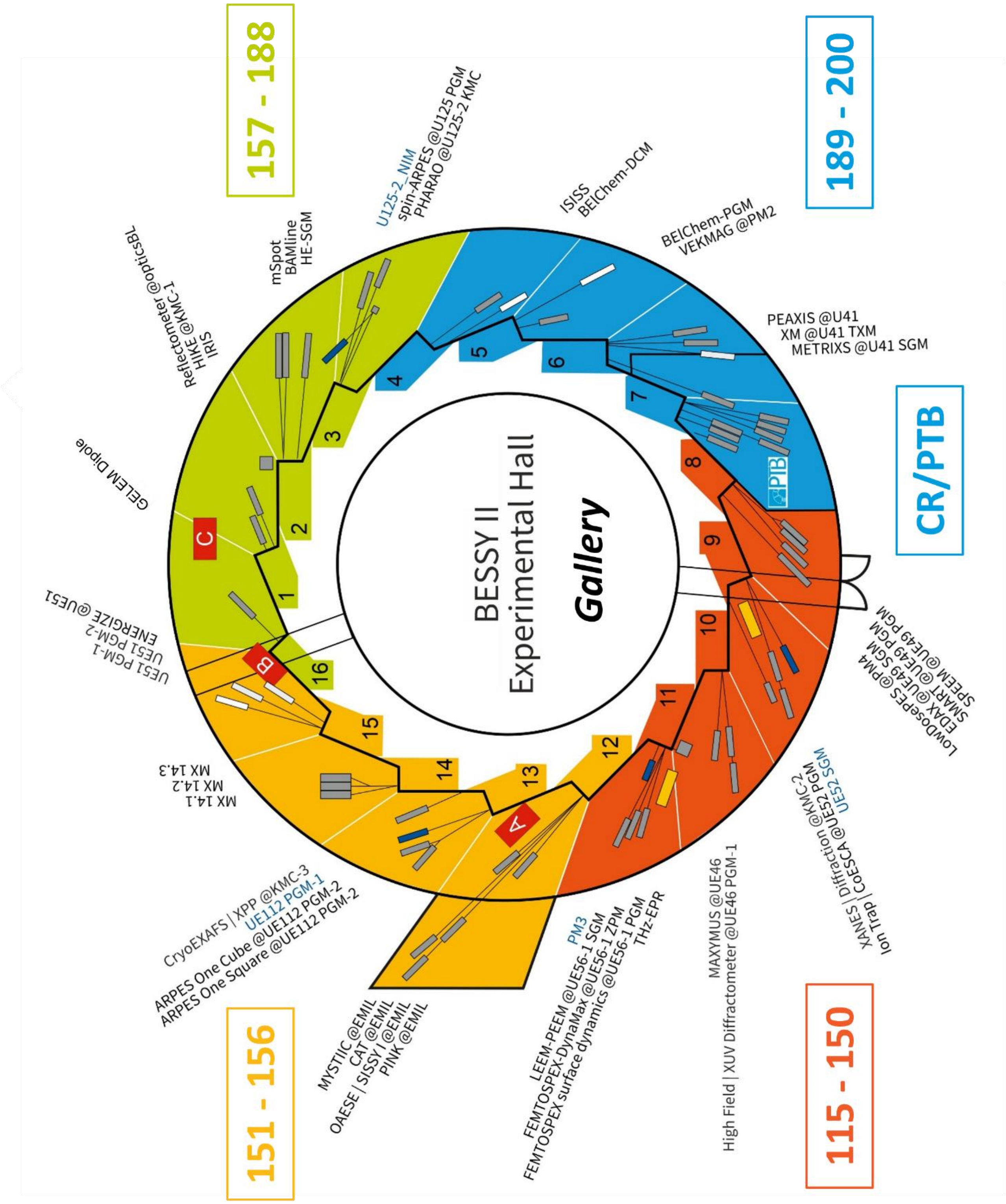
Christian Gollwitzer (Physikalisch-Technische Bundesanstalt)

Magnetosomes align in a magnetic field due to magnetic anisotropy, leading to strong directionality in the small-angle X-ray scattering patterns. We present SAXS data collected with a magnetic field applied, showing field-induced chain formation and hexagonal ordering, and Monte-Carlo based models to compute the corresponding oriented form and structure factors.

Floor Plan Poster Session - Groundfloor



Floor Plan Poster Session - Gallery / First Floor



Friends of Helmholtz-Zentrum Berlin e.V.

The purpose of the Association of Friends of Helmholtz-Zentrum Berlin e.V. includes the support of the development of science and research, especially by the support of scientific activities at BESSY II. The association is a link between HZB and the general public and it shall develop the cooperation between HZB, its friends and sponsors and other national and international institutions. In particular, it is dedicated to support young scientists.

Main activities of the association include the annual bestowals of science awards. In memory of the former scientific director of BESSY, who died in September 1988, the association awards annually the Ernst-Eckhard-Koch-Prize. This prize is given for outstanding Ph.D. theses completed during the current or past year in the field of research with synchrotron radiation and performed at either Helmholtz-Zentrum Berlin für Materialien und Energie (HZB) in Berlin or Deutsches Elektronen-Synchrotron (DESY) in Hamburg as the main places of activities of Ernst-Eckhard Koch. Furthermore, the association bestows the Innovation-Award on Synchrotron Radiation since 2001, which is announced Europe wide for an outstanding technical achievement or experimental method that promises to extend the frontiers of research with synchrotron radiation.

All natural or juristic persons may become member of the association. The regular annual membership fee amounts to 10 € for undergraduate and graduate students, 40 € for other natural persons and, as a rule, 150 € for juristic persons. In its work, the association depends also on donations which can also be addressed with a specific purpose, such as "Ernst-Eckhard-Koch-Prize" (Account-No: 414 44 40 at the Deutsche Bank AG, BLZ 100 700 00, IBAN: DE48 1007 0000 0414 4440 00, BIC: DEUTDEBBXXX). Fees and donations are enjoying tax privileges.

If somebody else feels associated with Helmholtz-Zentrum Berlin and its circle of friends we kindly ask him to support our activities by becoming a member.

The Board of the Association

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Hiermit beantrage ich die Aufnahme in den Verein Freundeskreis Helmholtz-Zentrum Berlin e.V.

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The regular annual membership fees amount to 40,- Euro for natural persons, 150,-/100,-/50,- Euro for legal entities, 10,- Euro for students.

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VENDOR EXHIBITION

Wednesday, 03 December 2025 from 12:00 to 17:00

Thursday, 04 December 2025 from 09:00 to 14:00

WISTA Event Center

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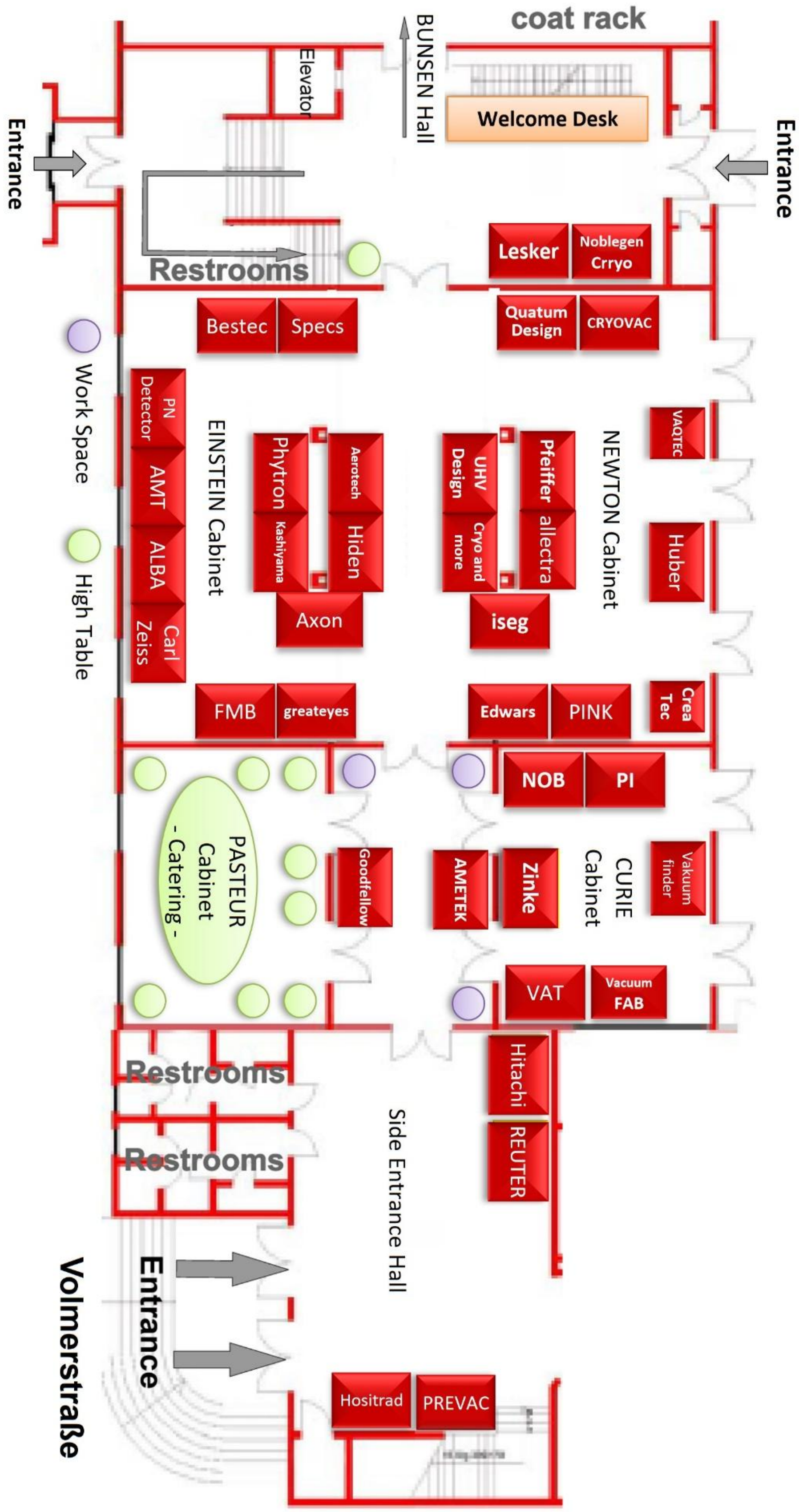
Floor Plan - Vendor Exhibition at WISTA Event Center



Rudower Chaussee 17

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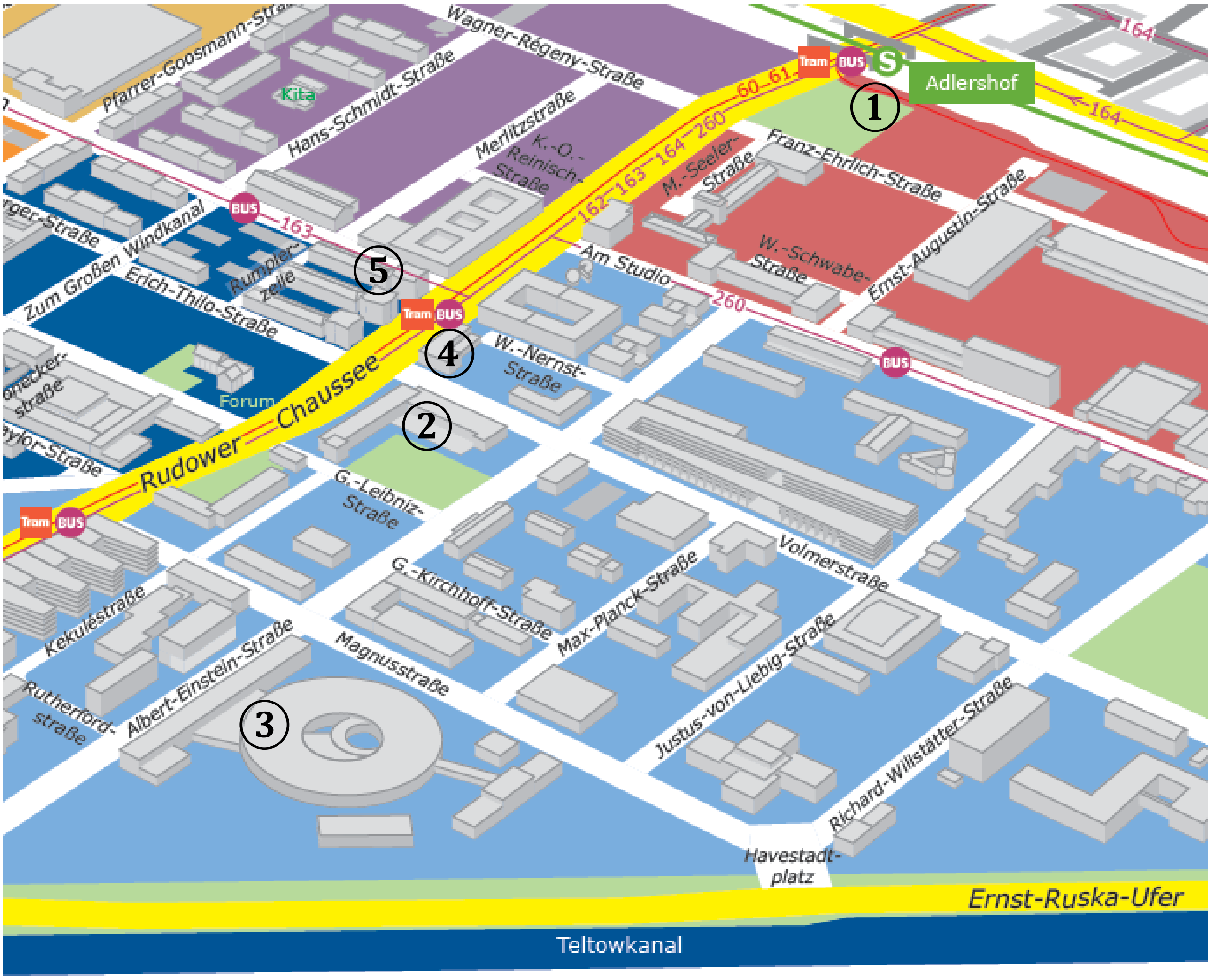
Campus Map Berlin-Adlershof

Helmholtz-Zentrum Berlin
Albert-Einstein-Straße 15
12489 Berlin

WISTA Event Center
Rudower Chaussee 17
12498 Berlin



① Train station Adlershof

② WISTA Event Center
Registration
Bunsen-Hall
Vendor Exhibition

③ BESSY II
Poster Session
Marketplace of Innovations

④ Hotel Essential by Dorint

⑤ Airporthotel Adlershof

CALL FOR BESSY II PROPOSALS

Next allocation period: July 2026 to January 2027

Please submit your BESSY II beamtime proposal via the general access tool GATE (http://hz-b.de/gate)

DEADLINE
1 March 2026