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Interdisciplinary Scientific Conference

FUTURE WINS

21 – 22 November 2024

Cross-sections and interfaces in science, careers, and communication

Register here:

Erwin Schrödinger-Zentrum
Humboldt-Universität zu Berlin
12489 Berlin-Adlershof

Berlin University Alliance

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FUTURE WINS:

Cross-sections and interfaces in science, careers, and communication

Interdisciplinary conference
21.–22. November
Adlershof

WHY FUTURE WINS?

The upcoming edition of Future WINS will look into the exciting developments occurring at the interfaces between different fields. In today's rapidly changing world, disruptive innovation often happens where disciplines intersect. Future WINS will explore three topics:

- **Interdisciplinary Innovation:** Explore how combining knowledge from different areas leads to creativity and breakthroughs
- **Inspiring Career Paths:** Discover how diverse experiences and transitioning between fields can contribute to personal growth and open up unique opportunities
- **Effective Communication:** Learn why clear communication is essential for collaborating successfully and connecting to a wide audience

Future WINS will bring together a community of natural scientists and put the spotlight on interdisciplinary challenges, in particular in the fields of energy research, environmental and material sciences. The aim of this biannual event is to empower and give visibility to excellent early career researchers mainly. As experts in their fields they will act as role models and thus inspire participants with their unique career path.

Join Future WINS for an opportunity to:

- **Present** your research with a poster and win a poster prize
- **Participate** in an interactive workshop
- **Connect** to like-minded scientists and get inspired

VENUE
Erwin-Schrödinger-Zentrum
Lecture Hall 0'101 + Foyer
Rudower Chaussee 26
12489 Berlin Adlershof

CONTACT
Center for Career Development Adlershof
Humboldt-Universität zu Berlin
Faculty of Mathematics and Natural Sciences
PostDoc Center Adlershof
Petya Jordan (petya.jordan(at)hu-berlin.de)
Rudower Chaussee 25, D-12489 Berlin

PROGRAMME
21.–22. November

THURSDAY, 21. NOVEMBER

12:45	*Registration and coffee*
13:00	**Welcome** Caren Tischendorf (Humboldt-Universität zu Berlin)
13:15	**Synchrotron science across continents: Big machine to see small things with infrared** Ljiljana Puskar (Helmholtz-Zentrum Berlin)
13:45	**Small Particles, Big Impact: Exploring How Iron Chemistry Transforms Our Atmosphere** Daniele Firak (Leibniz Institute for Tropospheric Research (TROPOS), Leipzig, Germany)
14:15	*Coffee break*
14:30	**Fungal mycelium-based materials meet additive manufacturing** Ulla Simon (Technische Universität Berlin)
15:00	**Composite Repairs for Wind Turbine Blades** Carineh Ghafafian (University of Southern Calfiornia, USA)
15:30	**Introduction to Soapbox Science** Erika Martínez Ruiz (Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin)
15:45	**Transform Your Research into Business with HU Startupservice** Diana Matz-Wassenberg (Startup Service, Humboldt-Universität zu Berlin)
15:50	*Coffee break*
	PARALLEL SESSIONS:
16:00	**WORKSHOP "STEMpowerment Improtheater X Birgit Blasche"** (Room 0'101)
16:00	**WORKSHOP "Pitching your science for lay audience"** (Room 0'311)
17:15	*Poster session & drinks*

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PROGRAMME

FRIDAY, 22. NOVEMBER

8:30	*Welcome and coffee*

This year's awardees of the international „WINS Postdoctoral Fellowships“ present their research projects

9:00	**Harnessing the power of peptide (semi)synthesis to bridge between chemistry and biology** Shaswati Mandal (École polytechnique fédérale de Lausanne (EPFL), Switzerland)
9:20	**REALSEI: Real-Time Analysis of the Electrolyte Interface for Sustainable Sodium-Ion Batteries** Giorgia Greco (Italian National Agency for New Technologies (ENEA), Rome, Italy)
9:40	**Integrated single-photon sources for quantum technologies** Marianna D'Amato (Sorbonne University, Paris, France)
10:00	**Parking a car using contact geometry** Monika (Indian Institute of Technology, Gandhinagar, India)
10:20	*Coffee break*
10:35	**A journey in catalysis: from the lab bench to high-performance computing and back** Julia Schumann (Humboldt-Universität zu Berlin)
11:05	**Exploring the Complexity of Career Path Discovery** Sarah Kleest-Meißner (Humboldt-Universität zu Berlin)
11:35	**Translanguaging interventions for the participation of migrant multilingual children in science museums** Lucia Chisari (Utrecht University, The Netherlands)
12:05	**Poster award ceremony**
12:15	*Lunch*
13:15	**WORKSHOP "Good Supervision Culture – Why good supervision matters"** Caroline Bacciu and Weronika Karle (Berlin University Alliance and Technische Universität Berlin)
14:45	*Coffee and departure*

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SCIENTIFIC TALKS ABSTRACTS

Synchrotron science across continents: Big machine to see small things with infrared

Ljiljana Puskar

Helmholtz-Zentrum Berlin für Materialien und Energie GmbH,
Institute for Electronic Structure Dynamics, Berlin, Germany

Synchrotrons produce extremely bright and broad-spectrum infrared light, which allows for comprehensive analysis across different spectral regions, providing more detailed insights into the chemical composition and molecular structures of materials [1]. This makes it ideal for advanced research in many fields like biology, materials science, the analysis of cultural heritage artifacts, and environmental studies, allowing analysis of everything from biological cells and tissues, protein structures to pollutants with high precision.

Presented here is a range of activities encountered at various international facilities, reflecting advancements in synchrotron infrared beamline science and progression from micron-scale spatial resolution to nanometer-scale precision. Examples include microscopy studies at the Australian Synchrotron and Synchrotron SOLEIL, faster imaging that enabled IR tomography or nano IR spectroscopy and imaging as seen at US synchrotrons such as the Advanced Light Source in Berkeley [2], and finally the recent developments at the nano-IR beamline at BESSY II [3]. These advancements demonstrate the versatility of synchrotron IR technologies for cutting-edge research across continents and diverse fields of application.

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Small Particles, Big Impact: Exploring How Iron Chemistry Transforms Our Atmosphere

Daniele Scheres Firak, Thomas Schaefer, Nazanin Taherkhani, Celine Kula, Hartmut Herrmann

Atmospheric Chemistry Department (ACD),
Leibniz Institute for Tropospheric Research (TROPOS), 04318, Leipzig, Germany

Reactions between Fe(II) and peroxides, known as Fenton reactions, take place in deliquescent aerosols particles, being regarded as major sources of oxidants in the atmosphere. Hydroxyl radicals ($HO^{\cdot}$) are the most important oxidizers formed in this environment [1]. Modeling studies have demonstrated that the high concentration of salts and dissolved organic compounds present in aerosols affect the rate constants and oxidant yields coming from these reactions [2]. This work aims to experimentally describe how the Fenton chemistry is affected by salt concentrations and inorganic ligands typically found in aerosols. For this, Fenton reactions were investigated in the presence of two major aerosol components, sulfate and oxalate.
The isolated effect of ionic strength (*Ic*) was initially investigated in the presence of an inert anion, perchlorate. At $Ic = 4$M, the rate constant of the Fenton reaction decreased when compared to the measured rate constant in diluted solutions (24 ± 1 vs. 44 ± 1 M^{-1} s^{-1} at pH 3 and 293 K). In the presence of sulfate ($SO4^{2-}$, $Ic = 2.7$ M), the Fe(II) speciation was shifted to FeSO4, and the rate constants increased to 245 ± 10 M^{-1} s^{-1}. When oxalate was added to the system, different oxalate complexes were formed, and the rate constant significantly increased, reaching $(3.5 \pm 0.3) \times 10^3$ M^{-1} s^{-1}. The $HO^{\cdot}$ production remained unchanged in the presence of $FeSO^4$ and H2O2, but was notably reduced when perchlorate and oxalate were present. This study reveals how the Fenton chemistry is modified in aerosol conditions, showing that interactions between iron and anions can counterbalance the ionic strength effect, and enhance the role of Fenton chemistry in aerosol particles. This study provides valuable insights for improving the accuracy of atmospheric models, such as those developed using the Chemical Aqueous Phase Radical Mechanism (CAPRAM) [3].

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Fungal mycelium-based materials meet additive manufacturing

Huaiyou Chen [1], Bertram Schmidt [2], Sophie Klemm [3], Carsten Freidank-Pohl [2], Aleksander Gurlo [1], Christina Völlmecke [4], Vera Meyer [2], **Ulla Simon** [1]

[1] *Technische Universität Berlin, Faculty III Process Sciences, Institute of Materials Science and Technology, Chair of Advanced Ceramic Materials, Berlin, 10623, Germany*

[2] *Technische Universität Berlin, Faculty III Process Sciences, Institute of Biotechnology, Chair of Applied and Molecular Microbiology, Berlin, 10623, Germany*

[3] *Technische Universität Berlin, Faculty III Process Sciences, Institute of Materials Science and Technology, Chair of Materials Science and Engineering, Berlin, 10623, Germany*

[4] *Technische Universität Berlin, Faculty V Mechanical Engineering and Transport Systems, Institute of Mechanics, Berlin, 10587, Germany*

Fungal mycelium-based materials are a promising class of materials to substitute petroleum-based materials in the near future. They are of renewable origin, biodegradable, and show a low or even negative CO_2 footprint as during lab cultivation fungi can upcycle lignocellulosic biomass side streams from forestry, food sector, or agriculture. Thus, these materials are interesting for the transition from linear to circular economy [1]. Usually, filamentous fungi species such as *Ganoderma lucidum*, *Fusarium sp.*, *Pleurotus sp.*, *Trametes vesicolor*, or *Fomes fomentarius* can be used to produce fungal mycelium-based materials. Up to now, most fungal mycelium-based materials on the market rely on the growing of fungal mycelium-lignocellulosic biocomposites in moulds (e.g. as packaging material for fragile goods or as acoustic panels in interior design with limited load-bearing functions) or growing pure fungal mycelium mats and post-processing afterwards (e.g. as animal leather substitute materials or meat and fish substitutes). However, Additive Manufacturing (AM) has gained traction in the last 5-10 years to produce customized shaped fungal mycelium-based materials and thus further exploit the versatile potential of fungal mycelium-based materials [2].

In this context we focus on investigating versatile AM approaches for structuring fungal mycelium-based materials. Pure fungal mycelium mats have been load-path optimized by printing patterns with compostable biopolymers on them. Hereby, sheet-like structures with tailored mechanical strength have been prepared. By using extrusion-based AM with inactive [3] or active fungal mycelium-based pastes, customized 3D structures can be built with mechanical strength comparable to EPS or with self-healing characteristics, respectively. Due to its huge versatility, AM shows a huge potential to increase the portfolio of fungal mycelium-based materials in the future.

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Composite Repairs for Wind Turbine Blades

Carineh Ghafafian, Steven Nutt

University of Southern California,
M.C. Gill Composites Center, Los Angeles, USA

Wind turbine blades, made primarily of polymer matrix composites, often fail significantly before their 20-30 year service life. Localized repairs offer a sustainable, efficient and cost-effective alternative to replacing entire blades. However, there are no universally accepted repair practices, and methods as well as material property restoration are not fully understood to-date. Scarf repairs are especially known for effective load transfer due to flat joint angles, which decrease eccentricity in load distribution and minimize peel stresses, and are taken as a focus for an in-depth understanding of how to better tailor composite blade repairs. Findings reveal that for off-axis laminates, the mechanical performance of a repaired structure can exceed the pristine structure by modifying the repair ply thickness and layup. Adopting the resulting strategies can benefit wind turbine blades and restore structural integrity, and the simple parameters considered here can be readily implemented in on-site field repairs.

Harnessing The Power of Protein (Semi)Synthesis to Bridge Between Chemistry and Biology

Shaswati Mandal

Laboratory of Molecular and Chemical Biology of Neurodegeneration,
Institute of Bioengineering, School of Life Sciences, École Polytechnique Fédérale de Lausanne,
Lausanne CH-1015, Switzerland

Proteins possess the power to advance our knowledge of intracellular protein-protein interactions, protein localization and functions. Intracellular delivery of biologically relevant proteins, particularly those having crucial cellular functions to disease state could find useful applications for basic research and as therapeutics. However, due to their physical properties, proteins cannot cross the plasma membrane on their own. To this end, we have developed a novel synthetic peptide that could allow the live-cell delivery of our protein of interest [1]. Aided by several biochemical methods (such as confocal microscope, gel, western blot etc.) we could successfully establish the protein's functionality towards the promise of protein therapeutics.

Posttranslational modifications (PTMs) of proteins play central roles in controlling numerous biological processes essential for the proper functionality of living cells. Among these PTMs, phosphorylation and nitration are of particular interest for the modification of alpha-Synuclein (α-Syn) protein which upon dysregulation causes neurodegenerative diseases. There is a knowledge gap due to the unavailability of the right PTM-mimics for studying their effect in regulating health and disease. Combining the protein expression technology with catalysis, we prepared a focused library of site-specifically nitrated and phosphorylated α-Syn protein, which enabled, for the first time, deciphering the role of these competing modifications in regulating α-Syn conformation aggregation in vitro [2].

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REALSEI: Real-Time Analysis of the Electrolyte Interface for Sustainable Sodium-Ion Batteries

Giorgia Greco [1], Katja Frenzel[2], Burkhard Beckhoff [2], Philipp Adelhelm[3], Sergio Brutti [1]

[1] University of Rome La Sapienza, Piazzale Aldo Moro 5, 00183, Rome, Italy and ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Casaccia Research Center, via Anguillarese 301, 00123 Rome, Italy

[2] Physikalisch-Technische Bundesanstalt, X-ray Spectrometry Abbestr. 2-12, 10587, Berlin, Germany

[3] Humboldt-University Berlin Brook-Taylor-Strasse 2, 14489 Berlin, GermanyP. Adelhelm; Joint Research Group Operando Battery AnalysisHelmholtz Centre for Materials and EnergyHahn-Meitner-Platz 1, 14109 Berlin, Germany

email: giorgia.greco@unirima1.it

The goal of the REALSEI project (MSCA-IF-2020) is to visualize for the first time in real-time the Solid Electrolyte Interphase formation at the hard-carbon (HC) anode in a Na-ion battery (NIB). Local electrochemical processes occurring at the solid-liquid interface of Na-ion batteries are currently largely unexplored. To keep global warming around 2.7°C by 2100, the installed global grid energy storage capacity needs to be tripled by 2050. A technological breakthrough is required to meet this challenge: we need a low cost and sustainable alternative to Li-ion batteries. Thanks to recent advances, the so-called 'beyond-lithium' batteries (BLB) such as K+ and Na+ based systems could be an everyday reality. Bio-waste mesoporous hard carbon (BHC) is one of the most promising anode materials as a universal ion host for BLBs. The use of BHC as a low-cost and recycled solution in BLBs might provide the breakthrough required and give rise to the next generation of batteries. However, uncontrolled SEI formation limits the large-scale application of BHC in BLBs, in particular for Na-ion batteries (NIBs), the most mature and promising. For NIBs, the SEI is still an unresolved issue that limits its long-term stability. REALSEI established a comprehensive operando time- and space- resolved characterization methodology to transit from bulk (transmission mode) to surface analytical characterization (grazing incidence mode) based on lab and synchrotron high-resolution X-ray techniques which resulted for the first time in a comprehensive visualization and quantification of the species forming the SEI in real-time on HC. REALSEI will apply principles of physics and electrochemistry and its results have substantial scientific, technological, and societal impact.

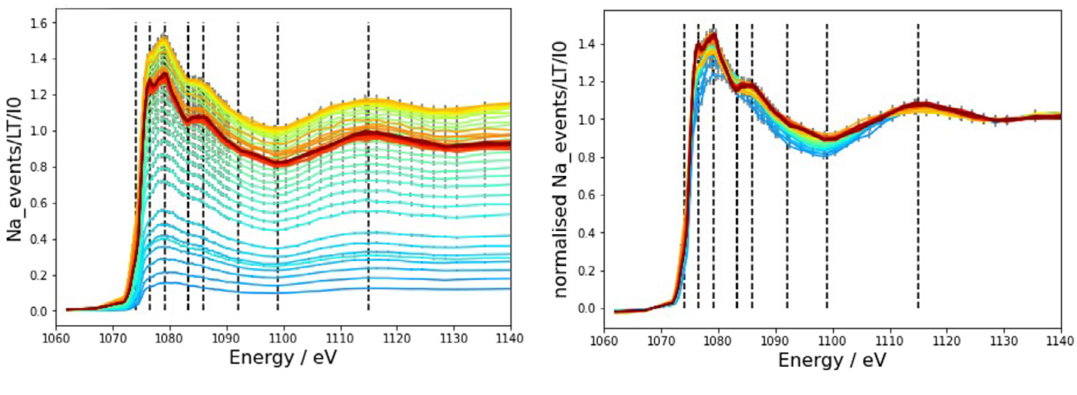

Figure 1: Operando XANES measuremets at Na K-edge of HC composed electrode, a not normalized and b normalized ones.

Integrated single-photon sources for quantum technologies

Marianna D'Amato [1], Antonio Balena [1], Lucien Belzane [1], Chengjie Ding [1], Quentin Glorieux [1], Hanna Le Jeannic [1], Emmanuel Lhuillier [2] and Alberto Bramati [1]

[1] Laboratoire Kastler Brossel, Sorbonne Université, CNRS, ENS-PSL Research University, Collège de France, 4 place Jussieu, 75252 Paris Cedex 05, France

[2] Sorbonne Université, CNRS, Institut des NanoSciences de Paris, 4 place Jussieu, 75005 Paris, France

Integrated single-photon sources are one of the building blocks for the advancement of quantum technologies, offering a compact and efficient way to generate single photons on demand. The ability to manipulate these individual photons is crucial for a range of applications, such as quantum computing, quantum communication, and quantum cryptography. Various materials have been studied for their ability to emit single photons, including single atoms, ions, and solid-state emitters like organic molecules, color centers in diamonds, and quantum dots. Among them, colloidal lead halide perovskite quantum dots (QDs) stand out due to their unique properties, making them promising candidates for use as single-photon sources. However, integrating these QDs with photonic structures, like waveguides and optical fibers, presents challenges for practical applications.

In this presentation, I will showcase a proof of concept for a compact, integrated single-photon source based on perovskite QDs, achieved by coupling a single perovskite QD with a tapered optical nanofiber. To improve the efficiency of this device, I explored a novel fabrication method based on Electron Beam Induced Deposition (EBID), which allows the fabrication of nanostructures on the nanofiber with precise control over their location, composition and geometry. This technique, combined with advanced quantum emitter deposition methods, holds great promise for realizing highly efficient single-photon sources that can be easily integrated into complex optical fiber networks.

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Parking a car using contact geometry

Marc Kegel [1], **Monika** [2]

[1] *Humboldt-Universit¨at zu Berlin, Institut f¨ur Mathematik,10099, Berlin, Germany*
[2] *Indian Statistical Institute, Statistics and Mathematics Unit, 700108, Kolkata, India*

A 3-dimensional contact manifold is defined as a pair (M, ξ), where M is a 3-manifold and ξ is a non-integrable plane field on M [1]. A Legendrian link in such a manifold is a smooth link that is everywhere tangent to the contact planes. A fundamental result in contact topology, due to Ding and Geiges, states that any closed, compact, orientable 3-dimensional contact manifold can be constructed via contact surgery on a Legendrian link in the standard contact 3-sphere (S3, ξst) [2]. However, a given contact manifold can be obtained through contact surgery on several different Legendrian links. This raises the natural question: what is the simplest Legendrian link that produces a particular contact manifold through contact surgery?

The contact surgery number of a contact manifold quantifies this complexity. In this talk, we will recollect the notion of the contact surgery number [3] and discuss the approach we used to compute the contact surgery numbers for contact structures on the real projective space RP3. The results to be presented in this talk are from an ongoing work in collaboration with Dr. Marc Kegel. We intend to finish this project by the end of my research visit to Berlin.

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A Journey in Catalysis: from the lab bench to high-performance computing and back

Julia Schumann [1, 2]

[1] *Humboldt-Universität zu Berlin, Department of Physics, Center for the Science of Materials Berlin, 12489 Berlin, Germany*

[2] *Fritz-Haber-Institut, Department of Inorganic Chemistry, 14195 Berlin, Germany*

Catalysis is a critical field for addressing global challenges such as climate change by enabling sustainable chemical processes. To accelerate the progress that is necessary in this area, interdisciplinary collaboration is essential. In this talk, I will share examples from my previous research [1-2] where collaboration combining expertise from different disciplines has led to a better understanding of catalytic processes and guided the prediction of new catalysts. Furthermore, I want to share my view of how the interaction between experimental and computational researchers can be facilitated in the future.[3] With these case studies I want to illustrate how a collaborative approach can drive significant advancements in research.

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Exploring the Complexity of Career Path Discovery

Sarah Kleest-Meißner

Humboldt-Universität zu Berlin

This talk offers a personal perspective on the challenges and considerations of pursuing a career in academia. Together, we will take a look behind the scenes of academia, acknowledging that doing research is tough as is staying in academia, – not only due to the small number of long-term opportunities. We will explore pros and cons when coming to career path decisions and the speakers lessons learned during her PhD journey.

Translanguaging interventions for the participation of migrant multilingual children in science museums

Lucia Chisari

Utrecht University, The Netherlands

Research shows that migrant children who visit museums can experience language challenges that hinder their museum participation. Translanguaging, a pedagogical approach based on the use of children's full linguistic repertoires for learning, can be promising in promoting migrant children's museum participation. Particularly for science, translanguaging seeks to leverage and build on the prior scientific knowledge that children have in their own home languages (e.g., Turkish, Arabic) in a context where another language is dominant (Dutch or English).

This presentation will introduce translanguaging and how it can be used in formal and non-formal educational contexts to foster science learning. Additionally, I will present two of our studies on how translanguaging interventions can promote the science learning of migrant children in science museums. The interventions were designed by us in collaboration with our partner science museums (NEMO, Museon-Omniversum and Teylers museum). The first study focuses on visits of the children with their families, while the second study focuses on school visits of newcomer children. We invited sixteen families and nine school groups to participate in the intervened museum visits. The data includes interviews with the families, teachers and children, and audio/video data of the visits. The data shows how children and families draw on their own linguistic repertoires and the languages offered in the museums to engage with scientific knowledge and phenomena. The findings contribute to the understanding of the role of language in the scientific meaning-making of migrant children, and of what challenges and opportunities translanguaging offers for promoting the participation of these children in non-formal science learning contexts.

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WORKSHOPS

WORKSHOP
STEMpowerment Improtheater X Birgit Blasche
(in German)

Begebt Euch auf eine transformative Reise mit unserem STEMpowerment Improvisations-theater Workshop! Gemeinsam mit Euch wollen wir auf spielerische Art und Weise Szenen improvisieren, welche Machtmissbrauch und Diskriminierung in der akademischen Welt thematisieren. Interaktiv werden wir anschließend mit euch Lösungen und Handlungs-optionen entwickeln, die Frauen* und Minderheiten in den MINT-Fächern Unterstützung bieten können.

Begleitet werden wir diesmal exklusiv durch
Coachin und Trainerin **Birgit Blasche**

WORKSHOP
Pitching your science for a lay audience
(in English)

With **Erika Martínez Ruiz**,
Leibniz Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin

In this workshop, you will learn how to explain your scientific project in an accessible language in a short pitch.

WORKSHOP
Good Supervision Culture – Why good supervision matters
(in English)

With **Caroline Bacciu** and **Weronika Karle**
Berlin University Alliance / Technische Universität Berlin

The supervisory relationship represents a crucial element in the successful completion of a doctoral project (or/and master's and bachelor's thesis). But what exactly is good supervision? How can it be defined and evaluated? Why does it matter? During this workshop, based on available data and publications on the subject, the importance of a good supervisory relationship will be discussed. Whether you are a student being supervised or someone with supervisory responsibilities, here you will find inspiration on how to be a better supervisor or what to change to receive better supervision.