

Faculty of Physics

PHYSICS COLLOQUIUM

Speaker: **Prof. Sebastian F. Maehrlein** Institute of Radiation Physics (FWK) Helmholtz-Zentrum Dresden-Rossendorf (HZDR) and Institute of Applied Physics (IAP) Technische Universität Dresden



Topic:Controlling and Employing Structural Dynamicswith Intense THz Fields – Inaugural lecture

- Time and
 Tuesday, May 27, 2025, 2:50 pm hybrid event

 place:
 The colloquium will be held in REC/C213.

 Online participation possible:
 Zoom-Meeting: Meeting-ID: 631 3817 8900 / passcode: PC-SoSe25

 https://tu-dresden.zoom-x.de/j/63138178900?pwd=TlmGawPz1dtDA6VzO2N1XdqqI7bE6b.1
- Host: Dekanin der Fakultät Physik, Prof. Gesche Pospiech
- Abstract: The advent of high-field terahertz (THz) sources opened the field of nonlinear THz physics and unlocked access to fundamental low energy excitations for ultrafast control of quantum materials, correlated systems and other novel functional materials. Nonlinear driving schemes extend these methods of contemporary IR-spectroscopy even to non-IR-active resonances. Recent concepts employing circularly polarized THz fields for driving helical excitations, such as chiral or axial phonons, provide a novel venue to study the fundamental conservation of angular momentum in solids.

In this talk, I will first introduce the essential concepts of THz-driven structural dynamics and their applications, e.g. for investigating coherent lattice responses of dimensionality-tailored semiconductors, such as hybrid organic-inorganic lead halide perovskites. Afterwards, we employ helicity-tailored fields to prepare and directly observe coherent states of lattice angular momentum. By this, we drive phonon-tophonon angular momentum transfer, a so far elusive prerequisite for spin relaxation processes abundant in nature. We directly observe rotational phonon-phonon Umklapp scattering dictated by pseudo angular momentum conservation in a three-fold rotational symmetric crystal lattice. Our results thus open the field of helical and chiral nonlinear phononics, representing a selective handle for ultrafast control of spins, topology and chiral quasi-particles.

Bio: Prof. Dr. Sebastian F. Maehrlein is Professor for High-Field THz Physics at the Institute of Applied Physics at TU Dresden and head of the High-Field THz-driven Phenomena Department at the Institute of Radiation Physics at HZDR. He leads an Emmy Noether group, still partly based at Fritz Haber Institute of the Max Plank Society (FHI) in Berlin.



After his Physics Diploma at the University of Konstanz, Sebastian Maehrlein obtained his Doctorate in Physics from FU Berlin in 2016. Afterwards, a Feodor Lynen Fellowship of the Alexander von Humboldt Foundation supported his Postdoctoral research at Columbia University in New York City. In 2020, he returned to Berlin to become a group leader in the Department of Physical Chemistry at FHI, supported by the DFG Emmy Noether grant since 2022.