TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Physics

PHYSICS COLLOQUIUM

Speaker: **Dr. Libor Šmejkal**
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Dresden

Topic: **Altermagnetism and Antialtermagnetism: From Spin Symmetries to Experimental Discoveries**

Time and place: Tuesday, April 29, 2025, **2:50 pm** – hybrid event
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: Prof. Carsten Timm

Abstract: Symmetries play a key role in many areas of modern physics. For example, the symmetry-breaking paradigm describes how various phases of matter emerge. In magnetism, spontaneous symmetry breaking leads to well-known phases of ferromagnets and antiferromagnets. Ferromagnets have a net magnetization, while antiferromagnets have atomic magnetic moments that cancel out. Surprisingly, recent research shows this magnetic dichotomy, developed in the 1930s, is incomplete. In this talk, we introduce a previously overlooked way to classify magnetic phases using spin-lattice symmetries. These are combined operations in both spin and crystal space. This approach led us to discover two new quantum phases: altermagnets and antialtermagnets. Both have compensated magnetic order, similar to antiferromagnets. Simultaneously, they also show spin-polarization in their electronic structures similar to ferromagnets. The main difference between altermagnets and antialtermagnets is their behaviour under time reversal. Altermagnetic electronic structure breaks it, leading to features like d-wave spin order. In contrast, the antialtermagnetic electronic structure preserves time-reversal symmetry and shows, for example, the p-wave spin order. We'll also discuss how the discovery of altermagnets was motivated by our earlier work predicting an unconventional spontaneous Hall effect. Furthermore, we will overview photoemission experiments which recently confirmed altermagnetic order in MnTe and CrSb materials. Finally, we will explore how altermagnetism and spin symmetries can benefit other fields. These include spintronics, magnonics, topological and 2D materials, and multiferroics. All offer promising paths to faster, smaller, and more energy-efficient nanoelectronic devices.

Bio: Libor Šmejkal is a head of the Functional Quantum Matter Group at the Max Planck Institute for the Physics of Complex Systems in Dresden. After studying theoretical and experimental physics in Brno and Vienna, he received his PhD in 2020 in Prague and later led a research team in Mainz. His research focuses on quantum matter, including altermagnets and spintronic functionalities. His scientific contributions have been recognized with several awards, including the Walter Schottky Prize (2025), an ERC Starting Grant (2024), the Falling Walls Science Breakthrough of the Year (2023), the European Magnetism Association Young Scientist Award (2021), the Czech Head Prize (2021), and the Siemens Award (2020).