TECHNISCHE UNIVERSITÄT WIEN

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EINLADUNG zum IFP-SEMINAR

Magneto-optical detection of time-reversal symmetry breaking in antiferromagnets

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Host: Silke Bühler-Paschen
Termin: Mittwoch, 29.10.2025, 16:00 Uhr
Ort: TU Wien, Freihausgebäude
Wiedner Hauptstraße 8-10, 1040 Wien
Seminarraum DC rot 07 (roter Bereich, 7. OG)
Zoom: https://tuwien.zoom.us/j/63020566887?pwd=RmYvRmVwOGU5YVBrOHpodWRKaHFWQT09

Abstract:

Optical probes are naturally well suited to detecting broken symmetries, including time-reversal symmetry ($\mathcal{T}$), and are frequently used in this way, for example, to map ferromagnetic domains. But the conditions under which optics can detect $\mathcal{T}$ - breaking in antiferromagnets with no net magnetization are far more subtle. The key distinction is whether the effect of $\mathcal{T}$ can be undone by a simple translation ($\mathcal{S}_{1/2}$); if it can, the product $\mathcal{T}\mathcal{S}_{1/2}$ is a symmetry of the system and $\mathcal{T}$- breaking is usually invisible to bulk probes. In contrast, antiferromagnets that do not preserve $\mathcal{T}\mathcal{S}_{1/2}$ display a range of $\mathcal{T}$- breaking phenomena, such as the magnetoelectric and piezomagnetic effect.

But what exactly does “bulk” mean? And more specifically, are optical probes “bulk”: can they detect $\mathcal{T}$-breaking in $\mathcal{T}\mathcal{S}_{1/2}$ - invariant antiferromagnets? We address these questions by directly comparing two antiferromagnets: $EuIn_2As_2$ that breaks in $\mathcal{T}\mathcal{S}_{1/2}$ and $MnBi_2Te_4$ that does not. In the first case, we show how an unconventional optical probe, linear magneto-birefringence, can reveal symmetry breaking invisible to more standard measurements. In the second, we demonstrate how perhaps the most standard optical probe of magnetism, reflection circular dichroism, can in fact detect antiferromagnetism even when $\mathcal{T}\mathcal{S}_{1/2}$ is preserved.

Together, these experiments demonstrate both the power and the versatility of optics as a probe of symmetry breaking in quantum materials.

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