JOHANNES KEPLER
UNIVERSITÄT LINZ

PHYSIKKOLLOQUIUM
Fachbereich für Physik

Im Rahmen des Physikkolloquiums spricht

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über

From conventional to quantum: A stride down the materials roadmap

Abstract:

The description of the fundamental physical and chemical properties of all materials is rooted in quantum mechanics. While many quantum effects can be approximated by semiclassical approaches at the macroscopic platform, condensed matter physics has witnessed the emergence of material systems in which quantum effects persist over wider range of energy and length scales [1]. Such materials are classified as quantum materials and include topological insulators, topological crystalline insulators, magnetically doped topological quantum materials, 2-dimensional van der Waals materials, superconductors, Kitaev materials, spin-orbit materials *etc* [2]. In this colloquium, the state-of-the-art research status and the roadmap of quantum materials will be highlighted and a collection of the most important research results achieved by the QMag group over the last 10 years will be presented. Starting with the first report of Rashba spin-orbit coupling in wurtzite *n*-GaN:Si [3] and its application in fabrication of a semiconductor spin battery [4], the colloquium will also highlight the intriguing electronic properties of magnetically doped topological crystalline insulator SnTe [5] and intrinsic ferromagnetic topological insulator $MnSb_2Te_4$. Striding further down the quantum materials road, the demonstration of the quantum chiral anomaly in mechanically exfoliated flake of the Weyl semimetal T_d-WTe_2 up to a record temperature of 100 K will be presented [6]. The last part of the colloquium will focus on the bosonic island percolation model in dilute Fe doped superconducting NbN thin films [7]. The epilogue of the talk will present the future research roadmap of emergent phenomena in hybrid quantum and conventional materials with particular attention to topology, symmetry, spin-orbit coupling and superconductivity.

References

1. B. Keimar *et al*. Nat. Phys. **13**, 1045 (2017).
2. F. Giustino *et al*. J. Phys. Mater. **3**, 042006 (2020).
3. W. Stefanowicz *et al*. Phys. Rev. B **89**, 205201 (2014).
4. R. Adhikari *et al*. Phys. Rev. B **94**, 085205 (2016).
5. R. Adhikari *et al*. Phys. Rev. B **100**, 134422 (2019).
6. R. Adhikari *et al*. Nanomaterials **11**, 2755 (2021).
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