PHYSIKALISCHES KOLLOQUIUM

Sommersemester 2026

Das Kolloquium findet (soweit nicht anders angegeben) **jeweils montags um 14:15 Uhr im Röntgen-Hörsaal** des Physikalischen Instituts, Hubland Campus Süd, Universität Würzburg **und online via Zoom statt**.
Zugangsdaten siehe https://www.physik.uni-wuerzburg.de/aktuelles/veranstaltungen-aus-der-physik/physikalisches-kolloquium/

01.06.2026

Prof. Dr. Peter Liljeroth
Aalto University, Finland, Quantum Materials

Designer quantum materials using van der Waals heterostructures

Abstract

Conventional materials hosting exotic quantum phases typically have complex atomic structures, inhomogeneities from defects, impurities, and dopants making it difficult to rationally engineer their electronic properties. This can be overcome using van der Waals (vdW) materials and their heterostructures that allow an almost arbitrary selection of the heterostructure building blocks. In a vdW heterostructure, proximity effects cause properties to “leak” between the adjacent layers and allow creating exotic quantum mechanical phases that arise from the interactions between the layers. These key features have recently made it possible to realize exotic quantum phases by design and engineer responses that do not readily occur in natural materials. I will highlight these concepts through our recent results on monolayer multiferroic materials [1,2], quantum spin liquid candidates [3] and vdW heterostructures realizing artificial heavy fermion states [4,5]. In general, these examples highlight the versatility of vdW heterostructures in realizing quantum states that are difficult to find and control in naturally occurring materials.

Mohammad Amini, Adolfo O. Fumega, Héctor González-Herrero, Viliam Vaňo, Shawulienu Kezilebieke, Jose L. Lado, Peter Liljeroth, Atomic-scale visualization of multiferroicity in monolayer NiI2, Adv. Mater. 36, 2311342 (2024).

Mohammad Amini, Tiago V. C. Antão, Liwei Jing, Ziying Wang, Antti Karjasilta, Robert Drost, Shawulienu Kezilebieke, Jose L. Lado, Adolfo O. Fumega, Peter Liljeroth, Observation of electromagnons in a monolayer multiferroic, https://arxiv.org/abs/2510.08253.

Ziying Wang, Adolfo O. Fumega, Ana Vera Montoto, Mohammad Amini, Büşra Gamze Arslan, Aleš Cahlík, Yuxiao Ding, Jose L. Lado, Robert Drost, Peter Liljeroth, Moiré modulated quantum spin liquid candidate 1T-TaSe2, https://arxiv.org/abs/2511.03311.

Viliam Vaňo, Mohammad Amini, Somesh C. Ganguli, Guangze Chen, Jose L. Lado, Shawulienu Kezilebieke, Peter Liljeroth, Artificial heavy fermions in a van der Waals heterostructure, Nature 599, 582-586 (2021).

Xin Huang, Jani Sainio, Jose L. Lado, Peter Liljeroth, Somesh C. Ganguli, Doped Mott phase and charge correlations in monolayer 1T-NbSe2, Phys. Rev. Lett. 134, 046504 (2025).

Für die Dozentinnen bzw. Dozenten der Fakultät

Prof. Dr. Neuenfeld, Dr. Feichtner, Dr. Ünzelmann, Hr. Plote, Hr. Schwarzkopf