

PHYSIKALISCHES KOLLOQUIUM

Wintersemester 2025/2026

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/>

01.12.2025

Prof. Dmitri Efetov

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Revealing electron-electron interactions in graphene at room temperature with the quantum twisting microscope

Abstract

The Quantum Twisting Microscope (QTM) is a groundbreaking instrument that enables energy- and momentum-resolved measurements of quantum phases via tunneling spectroscopy across twistable van der Waals heterostructures. In this work, we significantly enhance the QTMs resolution and extend its measurement capabilities to higher energies and twist angles by incorporating hexagonal boron nitride (hBN) as a tunneling dielectric. This advancement unveils previously inaccessible signatures of the dispersion in the tunneling between two monolayer graphene (MLG) sheets, features consistent with a logarithmic correction to the linear Dirac dispersion arising from electron-electron (e-e) interactions with a fine-structure constant of $\alpha = 0.32$. Remarkably, we find that this effect, for the first time, can be resolved even at room temperature, where these corrections are extremely faint. Our results underscore the exceptional resolution of the QTM, which, through interferometric interlayer tunneling, can amplify even subtle modifications to the electronic band structure of two-dimensional materials. Our findings reveal that strong e-e interactions persist even in symmetric, nonordered graphene states and emphasize the QTMs unique ability to probe spectral functions and their excitations of strongly correlated ground states across a broad range of twisted and untwisted systems.

Für die Dozentinnen bzw. Dozenten der Fakultät

Prof. Dr. Palffy-Buß, Prof. Dr. Klembt, Dr. Hammer, Hr. Baumbach, Fr. Schleicher