PHYSIKALISCHES KOLLOQUIUM

Wintersemester 2024/25

Das Kolloquium findet (soweit nicht anders angegeben) **jeweils montags um 16:15 Uhr in Präsenz 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/

25.11.2024

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Physics with a New Type of 1D Metal

Abstract

A mirror twin boundary in a single layer of MoS2 is an extremely well insulated straight wire with a diameter well below 1 nm. The one-dimensional (1D) band linked to the wire originates from the necessity to compensate polarization charge arising at discontinuities in the polar MoS2. Using scanning tunneling spectroscopy, we determine the polarization charge to be 2/3 of an electron per unit cell along the boundary in full agreement with theoretical predictions. While mirror twin boundaries are obstacles for transport normal to them, they can successfully be applied as ultimately thin gates in field effect transistors. On the fundamental side, mirror twin boundaries can be used to construct a new type of Kondo system, for which the entire spectral function is resolved, including the impurity levels underlying the resonance. Using this information, with the help of numerical renormalization group calculations one is able to test the predictive power of the Anderson model with high accuracy. Lastly, through the excellent insulation from the environment and its one-dimensional character, electronic correlations in the wires are strong. Therefore, low-energy electronic excitations are expected to be bosonic collective modes, which fractionalize into independent spin- and charge-density waves. Indeed, measuring the single particle density by scanning tunneling microscopy a Tomonaga-Luttinger liquid is document in finite length boundaries.

Using molecular beam epitaxy, it is possible to overcome the limitations set by the approach of creating 2D materials through exfoliation from bulk crystals. While a rich world of new 2D materials opens, we exemplify for the case of CrxSy 2D materials the difficulties to determine the structure of the material and how density functional theory may lay out misleading traces.

Für die Dozentinnen bzw. Dozenten der Fakultät

Prof. Dr. Porod, Prof. Dr. Hinkov, Dr. Leisegang, Dr. Ünzelmann, Hr. Baumbach