

## PHYSIKALISCHES KOLLOQUIUM

**Sommersemester 2024**

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**. (Der jeweilige Link wird noch zur Verfügung gestellt.)

**08.07.2024**

Prof. Dr. Markus Donath  
Universität Münster, Physikalisches Institut

**Two-dimensional electron states: historical remarks and new insights**

### Abstract

For electrons in a periodic potential, Kronig and Penney identified forbidden regions in the energy spectrum. Tamm introduced a crystal boundary: surface states were “born”. Shockley defined a particular class of states in so-called Shockley-inverted band gaps. This all happened about 90 years ago and shaped our understanding of two-dimensional (2D) electron states.

Today, we have extended our knowledge to interface states, quantum-well states, image-potential states and even topological surface states. Apart from energy and momentum, the electron spin is an important characteristic of electron states in view of spintronic applications. However, in many systems, the electron states are spin degenerate. Two interactions are able to lift the spin degeneracy: (i) exchange interaction in magnetically ordered materials and (ii) spin-orbit interaction, which is present in all materials but becomes relevant in systems with high atomic number. The interplay of both spin-dependent interactions is of special research interest for properties of ferromagnet/heavy-metal hybrid systems. After some historical remarks, this talk will review a selection of recent results on spin landscapes of 2D electron states.

Für die Dozentinnen bzw. Dozenten der Fakultät

Prof. Dr. Hinkov, Prof. Dr. Hinrichsen, Prof. Dr. Porod, Dr. Ünzelmann und Hr. Kuhr