PHYSIKALISCHES KOLLOQUIUM

Sommersemester 2021

Das Kolloquium findet (soweit unten nicht anders angegeben) jeweils montags **jeweils montags um 17:15 Uhr online via Zoom** statt.
(Der jeweilige Link wird noch zur Verfügung gestellt.).

3. Mai 2021

Vorstellungsvortrag im Rahmen des Habilitationsverfahrens
Dr. Artem Odobesko
Universität Würzburg, Experimental Physics II

Topological superconductivity in artificially constructed structures

Abstract

The prediction of Majorana zero modes (MZMs) bound to defects in topological superconductors triggered numerous experimental investigations. Various systems, such as 1D-assembled magnetic chains or vortices induced in topological insulators epitaxially grown on s-wave superconductors, have been examined as potential candidates. However, the coexistence of topological and trivial bound states in these system not only complicated their thorough understanding, it also complicated controlling the emergent electronic band structure which is key towards future applications.We utilize the (110) surface of superconducting Nb, which possesses the highest Tc = 9.2K among elemental superconductors, as a platform to deposit and manipulate magnetic adatoms by means of an STM. The observed electronic properties are dominated by Yu-Shiba-Rusinov (YSR) bound states which are energetically positioned inside the superconducting gap and carry information about the coupling between the magnetic impurity and the superconductor. We find that the relative adsorption site of the Fe atoms strongly influences the YSR states. Interestingly, a quantum phase transition is observed when changing the position of the Fe atom from a clean Nb site towards oxygen-reconstructed regions. Furthermore, we examine Fe dimers aligned along various crystalline orientations of the Nb(110) substrate. A hybridisation of the Yu-Shiba-Rusinov states is observed for the dimers oriented along the nearest-neighbor direction, suggesting a very short exchange coupling length.As a type-II superconductor Nb forms an Abrikosov lattice of vortices if placed in an external magnetic field. We study the bound states arising inside the vortex core on Nb(110) surface which are known as Caroli-de-Genes-Matricon (CdGM) states, and observe a strong anisotropy of these states. We explain this results by the pronounced nesting of the Nb(110) Fermi surface. Intriguingly, the CdGM states disappear for oxidized Nb(110). This observation is interpreted as a transition from the clean (long scattering range) to the dirty limit. In the next stage, we plan to (i) assemble 1D chains of magnetic atoms that may host MZMs at the ends, (ii) epitaxially grow 3D bulk topological insulator on the Nb(110) surface, for which MZMs arise in the vortex core.

Für die Dozentinnen bzw. Dozenten der Fakultät

Prof. Dr. Hankiewicz, Prof Dr. Höfling, PD. Dr. Meyer, Prof Dr. Sing und Hr. Frerichs