



Ph.D. thesis project on the investigation of spin-orbit effects in the supercurrent response of Josephson junctions.

The group of prof. Strunk at the Physics Department of the University of Regensburg has an open PhD position on the study of spin-orbit effects in the supercurrent response of Josephson junctions in epitaxial heterostructures.

The main goal of the project is the study of Josephson junctions made from epitaxial superconductor-semiconductor and superconductor-topological insulator hybrids. The candidate will study the Andreev bound states responsible for the proximity-induced superconductivity and their dependence on the orientation of the junctions with respect to the semiconductor crystal lattice. The Josephson coupling energy and the Rashba SOI will be electrostatically tuned, by virtue of top gates. In addition, the candidate will investigate the formation of ϕ_0 -junctions, which are expected to emerge due to the time-reversal symmetry breaking induced by in-plane magnetic fields or ferromagnetic interlayers. When embedded in closed loops, ϕ_0 -junctions can give rise to spontaneous supercurrents at zero external flux in the loop. A crucial goal of the project is the demonstration of two-dimensional networks of both regular and ϕ_0 -junctions, where exotic frustration phenomena in perpendicular magnetic field are expected. In networks with ϕ_0 -junctions, the candidate will search for artificial ferro- or anti-ferromagnetic ordering of the spontaneous currents. An important part of this project consists in the construction of a low-temperature scanning Hall microscope, which will be able to directly image the local magnetic flux distribution in the Josephson junction arrays.

The project is funded by the SFB 1277 research grant of the Deutsche Forschungsgemeinschaft (Project B8).

