



Universität
Basel

Research Project

Two-dimensional semiconductor platforms for superconductor hybrid nanostructures

Third-party funded project

Project title Two-dimensional semiconductor platforms for superconductor hybrid nanostructures

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Organisation / Research unit

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Department

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Status Completed

We aim to develop a new material platform for nanoelectronic devices, with a strong focus on superconducting hybrid systems based on two-dimensional (2D) semiconducting layered materials (2D-SC) with a strong intrinsic spin-orbit interaction (SOI). We will establish standard surface bulk and 1D side-contacts in encapsulated 2D-SCs and perform “standard” experiments in this new type of structures, for example the measurement of a Josephson current, weak (anti-) localization and the quantum Hall effect. These experiments will form the basis for first Majorana bound state devices in a new type of geometry, and develop first topgate-defined nanostructures, with the aim to fabricate gate-tunable quantum dots and Cooper pair splitters. This project will pave the way towards deterministic double nanowire devices expected to host Parafermions, a generalization of Majorana bound states and many other more exotic superconductor-semiconductor hybrid structures.

Keywords Majorana bound states; Quantum physics; Nanoelectronics; Superconductor; 2D Materials; Semiconductor; Topological states; Van der Waals materials; Quantum confinement; Josephson effect; Low dimensions; Spin-orbit interaction; TMDC

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