Ph. D. Thesis

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Scanning Tunneling Spectroscopy of Superconductor/Ferromagnet Interfaces

The interaction between a ferromagnet with natural spin polarization and a superconductor can lead to unconventional triplet superconductivity where the spins of the Cooper pairs are aligned parallel to each other. Such triplet superconductors can harbor, e.g., Majorana zero modes, which are considered to be beneficial for fault tolerant quantum computation. However little is known on the required spin texture at the interface of the two materials.

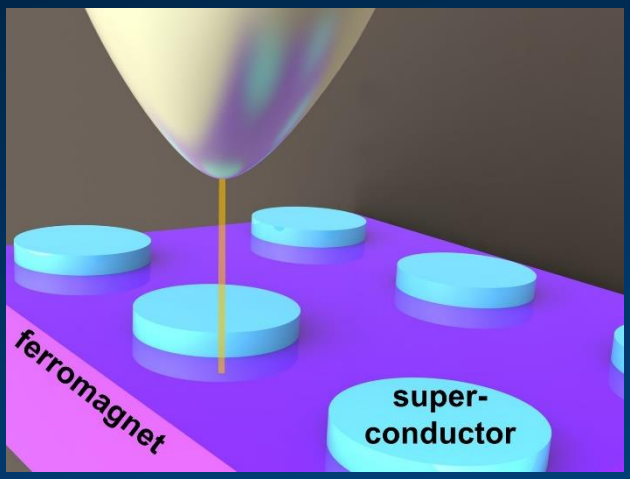

Fig. 1: Rendered image of the sample system.

In the thesis, a novel Joule-Thomsen cooled scanning tunnelling microscopy (STM) system (Fig. 2) should be optimized for measuring the spin texture and the superconducting phase at such interfaces with and without magnetic field. Interfaces are produced employing a novel mask aligner, which operates in UHV and produces lateral interfaces with precision below the coherence length of typical superconductors (Fig. 3; *Rev. Sci. Instr. 112, 161602 (2018)*).

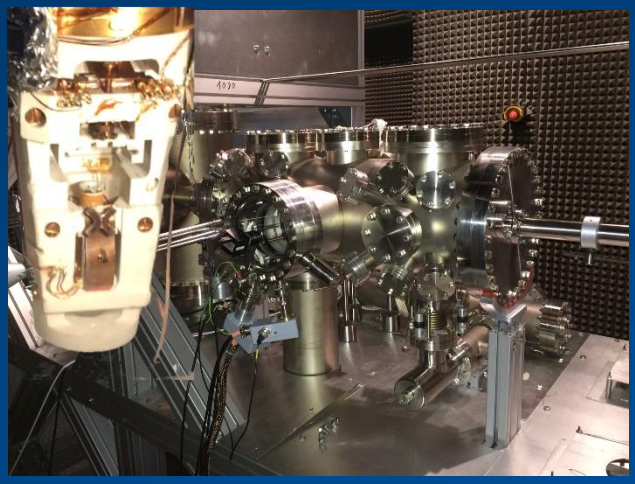

Fig. 2: The UHV-System with the new low temperature STM (inset) made from ceramics.

In addition to the interest in surface magnetism and superconductivity, the candidate should also have extensive experimental and technical skills, preferably in UHV-technology and STM.

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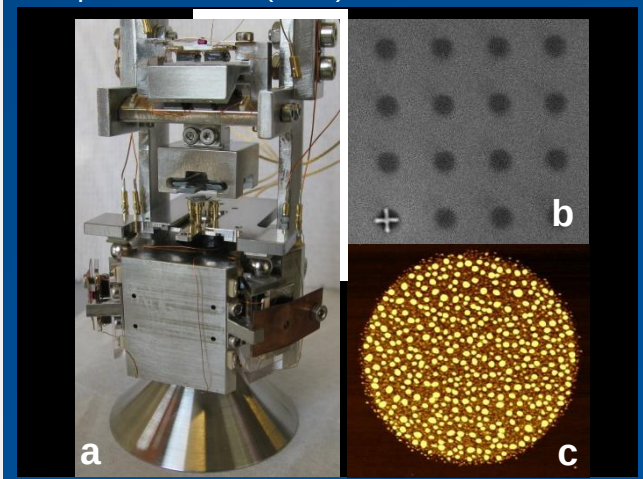

Fig. 3: (a) Photo of the UHV mask aligner. (b) Array of Au disks deposited on Si(001). (c) AFM image of a single disk (diameter: 5 m, edge sharpness: 50 nm).