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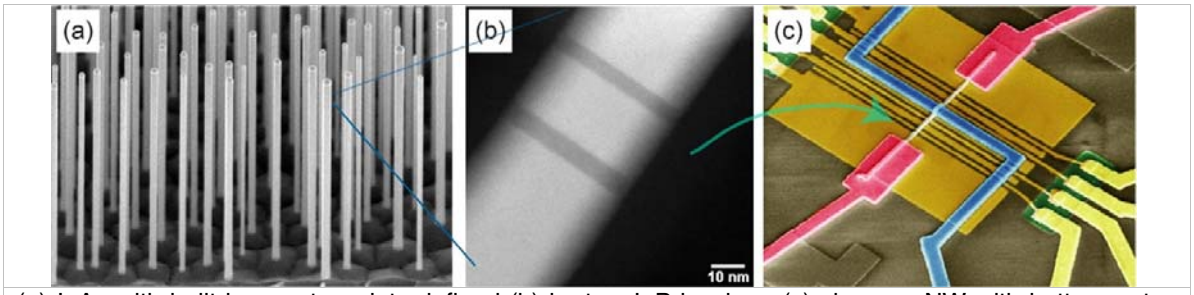
PhD fellowship "Spectroscopy of Subgap States in Semiconducting Nanowires with Proximitized Superconductivity"

A fellowship for an **experimental PhD thesis** work is now available in the **Nano- and Quantum Electronics** group at the Department of Physics of the University of Basel: www.nanoelectronics.ch

The project is motivated by the recent discovery of spectral features at zero energy in tunneling spectroscopy of semiconducting nanowires proximitized by a superconductor. These "zero-bias anomalies" show features in agreement with **Majorana bound states** (MBSs), expected to appear in topological superconductors. A one-dimension topological superconductor can be engineered in semiconducting nanowires (NWs) with strong spin-orbit inter-action (SOI) coupled to a "normal" BCS-type superconductor in magnetic field. To unravel the emergence of MBSs in single and coupled NWs, we develop new probes with which the proximity gap and **proximity-induced bound states** can be quantified. Our approach is based on measuring both DC and AC transport, the latter also at GHz frequencies using reflectometry. As a complementary test, we can also study the microwave radiation in the GHz domain emitted by the quantum device. With the current project we aim to deepen our understanding of the **superconductive proximity effect** in a NW with strong SOI by studying the evolution of the gap spectroscopically. For the latter we exploit **quantum dots (QDs) as spectrometers**. Here, the QDs are established by heteroepitaxy during growth. This is done in collaboration with Prof. Lucia Sorba *et al.* from CNR-Nano at Pisa, where the InAs NWs are grown (see figure). These QDs are very promising due to the large confinement potential. We further plan to test different SCs beyond Al, e.g. Pb and MoRe, and optimize the evaporation together with collaborators from the Niels-Bohr Institute in Copenhagen, Jesper Nygard *et al.*



(a) InAs with built in quantum dots defined (b) by two InP barriers. (c) shows a NW with bottom gates (orange), a superconducting (blue) middle contact and two normal metal contacts (red).

We are looking for a highly motivated student (preferably a physicist) who is keen to explore fundamental aspects of **quantum devices**. You will design and fabricate your own devices using tailored nanowires and state-of-the-art micro- and nanofabrication.

All PhD fellows are expected to work in a team and collaborate with other PhD and postdoctoral fellows, as well as bachelor and master students joining the lab part of their time. Start of the project 1st of July 2019 or earlier. Duration 3-4 years. **Requirement**: you need to have a **profound understanding of quantum and solid state physics** as it is taught in a physics curriculum.

To apply, please email to Christian.Schoenenberger@unibas.ch your short curriculum vitae including names and contact info of referees and scanned copies of grades. Please add a short statement (few lines only) on your motivation and your education / background in quantum physics and solid-state physics.

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