UNIVERSITÄT BASEL

Swiss Nanoscience Institute Prof. Dr. Christian Schönenberger Klingelbergstrasse 82 CH-4056 Basel Tel. +41 61 267 36 90 Fax +41 61 267 37 84

www. nanoscience.ch christian.schoenenberger@unibas.ch

March 2016

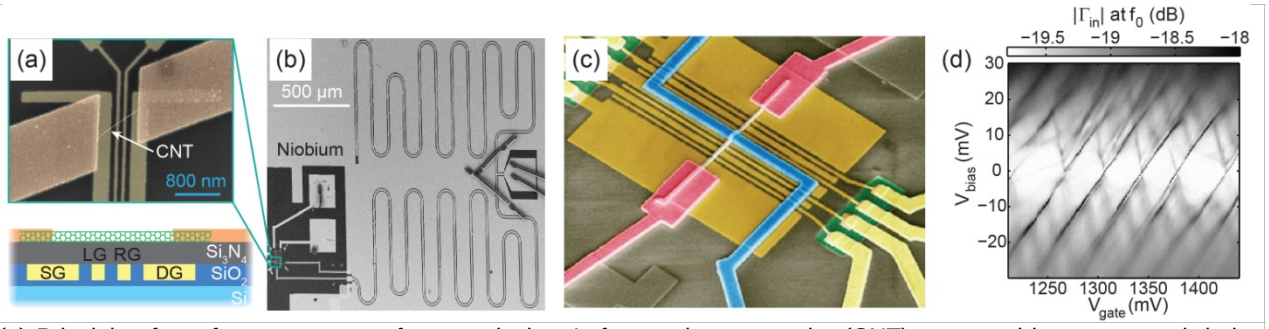
Post-Doctoral Position

Novel Quantum Phenomena in Hybrid Nanoelectronic Devices

A post-doctoral position is available in the **nanoelectronics group** (Prof. Christian Schönenberger) at the Department of Physics of the University of Basel, www.nanoelectronics.ch. We are interested in quantum transport phenomena occurring in **low dimensional nanoscaled devices** at low temperatures (mK – K).

Our current projects are strongly motivated by the recent excitement about **topological phases and Majorana bound states** that can appear in **hybrid devices** in low dimensions, for example in semiconducting nanowires with strong spin-orbit coupling, coupled to **superconducting contacts**. The combination of time-reversal symmetry breaking, spin-orbit field and superconducting pairing can give rise to new states of matter with **non-trivial topological phases** and unconventional pairing (triplet and p-wave). To unravel the emergence of Majorana bound states, we develop new probes with which the proximity gap and proximity-induced bound states (Andreev-, Shiba states) can be tested. Our approach is based on measuring both DC and AC transport, the latter at GHz frequencies using reflectometry. We are also in the position to measure non-equilibrium distribution functions via shot-noise providing access to properties beyond linear conductance, such as charge and spin correlations. We have also started to develop nanoelectronics systems in which **helical states** form, using for example nuclear spin coupling and/or synthetic spin-orbit fields.

The successful candidate should have a PhD in physics and be, if possible, experienced with *GHz experiments,* with low *temperature systems*, in particular *dilution refrigerators*, *transport measurements of nanoelectronic devices*, and *nanofabrication technology*.



(a) Principle of an rf measurement of a nanodevice. Left: a carbon nanotube (CNT) contacted by source and drain electrodes with 4 bottom gates used to tune the potential profile along the CNT. Right: The device is directly coupled to a coplanar transmission line resonator (meander line. (b) shows the kind of hybrid devices that are at the focus of our research. The device consist of a wire (here a semiconducting NW) with a series of bottom gate electrodes. The device has three terminals, allowing for non-local measurements. The middle electrode shown in blue is a superconductor S, the other two are normal metals (N1, N2). (d) AC reflectance measurement of a CNT quantum dot.

The **nanoelectronics group** at the University of Basel (**www.nanoelectronics.ch**) has many years of experience in exploring fundamental electrical properties of nano-devices and pioneered shot-noise correlation measurement early on. We performed the first shot-noise experiment in the Coulomb blockade regime of a single-electron tunneling device, displaying charge correlation induced shot-noise suppression. This was followed by a series of noise experiments, including the textbook Hanbury-Brown-Twiss beam splitter experiment for electrons (Science 1999). We introduced quantum-dots coupled to superconducting electrodes, displaying an intriguing interplay between a superconducting and magnetic ground state, leading later to Cooper-pair splitters (Nature 2009). These novel experiments were only possible, because we have realized early on the great potential of novel materials, in particular of carbon nanotubes and semiconducting nanowires, for the realization of hybrid devices embodying superconducting and ferromagnetic electrodes.

The appointment is planned for autumn 2016, but other dates can be negogiated. The position will initially be for two years with the possibility of a further extension. Candidates should e-mail a letter of application together with a brief CV to Prof. Christian Schönenberger, Department for Physics, Klingelbergstrasse 82, CH-4056 Basel, Switzerland; e-mail: Christian.Schoenenberger@unibas.ch.

UNI BASEL

SNI SWISS NANOSCIENCE INSTITUTE
EINE INITIATIVE DER UNIVERSITÄT BASEL UND DES KANTONS AARGAU