

SNI PhD fellowship in Nano-Physics at Ultra-Low Temperatures, University of Basel

Project Nanostructure Quantum Transport at Microkelvin Temperatures

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We are **looking for an outstanding and highly motivated graduate student** who would like to join our microkelvin team in Basel working on nano-physics at ultra-low temperatures. In the envisioned experiments, we will develop a new experimental method for cooling nanoscale samples to microkelvin temperatures with the goal to study new low-temperature nano-physics.

Quantum transport experiments in this temperature range would be entirely unprecedented: no nano-samples have been measured below 1 mK, as far as we know. Energy resolution would be at least one order of magnitude better than previous experiments – comparable to a microscope with a much improved resolution – paving the way for discoveries at this new frontier. **The new technique would open the door to investigate new ultra-low temperature physics** – in particular a novel GaAs **nuclear helimagnet** where a helical, full nuclear spin polarization is induced by the interacting electrons via the hyperfine interaction. This novel state of matter was predicted by Daniel Loss (Co-PI) and co-workers (Braunecker, Simon and Loss, PRB 2009), with whom we collaborate closely. Ultimately, these experiments are also aimed at achieving and exploiting excellent quantum coherence for spins in nanostructures, laying the foundation for quantum computing.

The project will be a **hands-on, experimental effort** where significant time will go into developing and improving nuclear cooling for nanosamples, achieving low temperatures in the samples, and finally exploiting these efforts to investigate new physics at ultra-low temperatures. Techniques involved include low temperature methods incl. dilution refrigerators, low noise electrical measurements, microwave filtering and thermalizing schemes, automated data acquisition and extensive data analysis incl. programming, low temperature thermometry as well as nanofabrication in a clean-room environment. As a **technological aspect**, the nuclear refrigerators will be installed on a cryogen-free dilution refrigerator, potentially making demagnetization and ultra-low temperatures widely available.

Candidates need to hold a masters (or equivalent) degree, preferably in physics. Some prior experience in (experimental) condensed matter physics or nano-fabrication would be helpful but is not required. German language proficiency is not necessary. Graduate students are expected to work together with postdoctoral fellows as well as graduate and undergraduate students. Graduate students in our Department are required to assume teaching assistant responsibilities during the semester (about one day per week effort during semesters). Starting date early 2013. Duration of Ph. D. research: 4 years.

The **Department of Physics in Basel** offers a highly stimulating and collaborative environment with active and internationally recognized research groups in both experimental and theoretical condensed matter physics. Our group is part of

- Swiss Nanoscience Institute (SNI), sponsor of this fellowship
- Quantum Science and Technology NCCR QSIT (Swiss NSF)
- Basel QC2 Center for Quantum Computing and Quantum Coherence

To apply, please submit

- curriculum vitae
- publications and/or a thesis, if available
- names and contact info of referees
- detailed (scanned, pdf) Master and Bachelor degree grades
- short description of interests and skills might be helpful

Please contact Dominik.Zumbuhl@unibas.ch with any questions.