



Announcement for a Research Assistant Position

“Real-time FPGA based signal processing and fast data acquisition for quantum computing architectures based on superconducting electronic circuits”

Project abstract: Quantum information processing is an interdisciplinary field of research in which quantum mechanical properties of physical systems are put to use to solve complex computational problems more efficiently than in conventional approaches. These systems are also useful to gain physical insight into fundamental quantum processes. The Quantum Device Lab at the Physics Department of ETH Zurich explores the use of superconducting quantum bits (qubits) operating at GHz frequencies to realize components for a quantum processor. These quantum devices, operated at low temperatures, are typically controlled and read out by room-temperature microwave and signal processing electronics. For this purpose we have developed specialized programs (firmware) which run on field programmable gate arrays (FPGA). This firmware, combined with high-frequency analog electronics, enables real-time analysis of the output signals of quantum devices and fast feedback operations. Current project goals include both streamlining and extending the existing firmware, developing new applications and improving the performance and user interface of the existing firmware.

Work description: This research project is carried out in the Quantum Device Lab (www.qudev.ethz.ch) headed by Prof. Andreas Wallraff. In the context of the project you will have the opportunity to learn about state of the art superconducting electronics for quantum information processing applications. You will be introduced to the use of FPGA electronics for real-time signal analysis. This will allow you to become familiar with the FPGA applications presently in operation in our lab. Under guidance of a close collaborator you will gain experience in the development of these applications using MATLAB Simulink and VHDL. You will design, implement and test extensions to existing applications and develop new ones. A specific goal is to extend the configurability of the firmware via a user interface realized in LabView. Your focus will be on creating flexible firmware which will be integrated into a number of ongoing research projects. You will test the new and modified firmware in an already existing test environment and in real world experiments with quantum devices.

Requirements: Strong interest and preferably experience in one or more of the following subjects:

Digital electronics - field programmable gate arrays (FPGA) - Very High Speed Integrated Circuit Hardware Description Language (VHDL) - programming languages/computer science - microwave electronics - quantum information processing - solid state physics and superconductivity - quantum optics and atomic physics

Type of Position: We will consider candidates at all levels. These include undergraduate and graduate level students doing work for academic credit but also experienced researchers or engineers interested in contributing to our projects in a professional engagement. We envisage employment initially for 3 to 12 months on the candidate's interests. For students doing work for academic credit the duration can also be shorter than 3 month. The position will be paid at typical ETH levels and includes standard ETH benefits. The position is available immediately. To apply for this position, please send an email including a motivation letter and a CV to Andreas Wallraff (qudevadm@phys.ethz.ch). You may strengthen your application by having one or more letters of reference sent directly by their providers to the above email address. For technical questions and information please contact Yves Salathé (ysalathe@phys.ethz.ch). The announcement can be found under www.qudev.ethz.ch/positions.