EU Marie-Curie PhD Student Opening: Collective Interaction of Small Ensembles of Superconducting Qubits with Microwave Frequency Radiation.

Job summary: The ETH Zurich Quantum Device Lab at the Department of Physics seeks to appoint a PhD student financed by the EU FP7-People Marie Curie Initial Training Network (ITN) Circuit and Cavity Quantum Electrodynamics (CCQED). You will advance the state of the art of experimental research in the field of circuit quantum electrodynamics (QED) in a world class laboratory. You have a strong background and deep interest in experimental and/or theoretical aspects of quantum optics and quantum information. In addition, you will actively contribute to the CCQED network by bridging two renowned disciplines in physics, namely the quantum electrodynamics of atoms or ions interacting with light in resonators, and the field of solid-state superconducting circuits. You will link fundamental to applied research, participate in the organization of conferences and establish bonds between theory and experiment.

Job description: The Quantum Device Lab is one of the leading labs doing research on quantum optics and quantum information processing with superconducting circuits. In particular, we have made rapid progress in recent years towards the investigation of collective interactions of a precise number of artificial atoms with a single mode of the radiation field stored in a microwave transmission line resonator. The generation of Dicke states and the phenomenon of super-radiance will be investigated by you. In parallel you will be exploring the strong interaction of microwave frequency radiation with superconducting quantum bits in the absence of any cavity, i.e. in free space. In this different regime of strong coupling that can be achieved in superconducting circuits, you will investigate the coherent interaction of a number of artificial atoms with the free space propagating field. To explore the physics of the artificial multi-atom circuit QED systems you will make use of recently developed efficient techniques to perform photon correlation measurements in the microwave domain using linear detectors and digital FPGA-based electronics. This will allow the characterization of the quantum properties of non-classical radiation fields, such as those generated by sources of single photons or squeezed light. You will employ and continue the development of non-linear parametric amplifiers to improve the signal to noise ratio attainable in such experiments. For the correlation measurements chip-based microwave frequency beam splitters and interferometers will be developed and employed which will allow for a new range of linear optics experiments to be approached in circuit QED. More details on ongoing and planned research can be found at **www.qudev.ethz.ch**.

We are seeking: a highly motivated student with a deep interest and a solid background in experimental and/or theoretical aspects of quantum optics and quantum information processing. He or she will participate in a research training program of an EU-funded Marie Curie Initial Training Network (ITN) and will work in a highly interactive international environment with other Marie-Curie PhD students and researchers from 10 research centres and 3 companies. Network-wide courses and trainings will be organized by partners in different EU countries. For more information see also **www.ccqed.eu**.

Important note: Eligibility to the Marie-Curie ITN scheme includes that the candidate has not spent more than 12 months in Switzerland in the 3 years immediately preceding his appointment for this position.

Apply: The applicants should send a full CV including relevant diploma certificates, a letter of motivation (1 page) and the contact details of three referees to **qudevadm@phys.ethz.ch**. Candidates will be considered until the position is filled. Early applications (before Jan. 15, 2012) will be given preference.

For informal inquiry contact: Andreas Wallraff, ETH Zurich, Department of Physics, HPF D 8/9, Schafmattstr. 16, 8093 Zurich, Switzerland, **qudevadm@phys.ethz.ch**, **www.qudev.ethz.ch**.