

Hole spin circuit quantum electrodynamics

We are looking for a highly motivated and talented physics or engineering PostDoc with suitable experience to join our spin circuit quantum electrodynamics (cQED) team. Possible starting date: beginning of 2024 with a two-year contract and possible extension upon mutual agreement.

Project description:

Hole spin cQED has emerged as a new promising platform not only for quantum information processing but also for the study of fundamental light-matter interaction and analog quantum simulation. Our group has recently demonstrated large cooperativities between a single hole spin in a gate-define quantum dot in silicon and a photon in a microwave cavity [1]. Based on this achievement, the project will be on one hand to push the current light-matter interaction strengths to its extreme and study fundamental physics questions (ultra-strong and superstrong coupling regimes for example)[2] and on the other hand to leverage the photon as a quantum bus for long-distant spin-spin entanglement. Spin cQED with multiple spins coupled to the same microwave resonator naturally implement an all-to-all connectivity allowing for the study of various spin and impurity models. In addition, multi-cavity systems will be used to precisely engineer the environment of the spin to control and simulate bosonic baths in order to implement an analog quantum simulator [3] to answer longstanding questions of many-body physics.

[1] Yu*, Zihlmann* et al. Nature Nanotechnol. 2023; [2] Forn-Diaz et al. Phys. Rev. Mod 2019; [3] Kim et al. PRX Quantum 3, 040308 (2022)

Environment:

Our research group (www.lateqs.fr), hosted at CEA Grenoble, is part of the French national "Plan Quantique" and closely collaborates with in-house theory colleagues. The lab is located on a big scientific campus gathering not only CEA with its strong microelectronics research (300 mm clean room) but also other major scientific institutions such as CNRS (Institut Néel), ERSF (synchrotron), ILL (neutron source) and many high-tech companies as well as the University Grenoble Alpes.

Grenoble is a vibrant city offering many cultural activities, lovely bars and delicious restaurants. Located in the heart of the Alps it is the paradise for all outdoor enthusiasts.

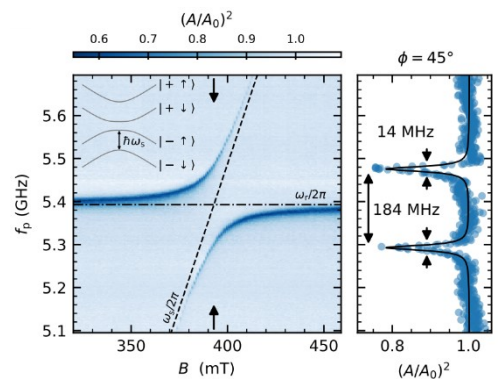
Knowledge, skills and abilities:

PostDoc candidates are required to have a Ph. D. degree in physics or a related discipline (electrical engineering, nanosciences, ...). The successful candidate will bring a strong background in some of the following areas: quantum optics (semiconductor or atomic), superconducting qubits, mesoscopic physics, device nanofabrication, qubit control techniques, cryogenic experiments, experiment control and data acquisition. Strong python programming knowledge is a clear asset. French language proficiency is not necessary. The candidate will work within a team of researchers and will advise graduate and undergraduate students in their research projects.

How to apply:

To apply, please contact Simon Zihlmann by email (simon.zihlmann@cea.fr) including:

- a curriculum vitae (including prior research experience and skills acquired as well as names of potential referees)
- your academic records (Master's and PhD diploma)
- a list of publications
- a short statement of your research interest and how it relates to the project



Avoided crossing between a hole spin and a microwave photon showing the strong coupling between them.