NISQ2LSQ - Job Offer

Junior Research Leader

In Theoretical Quantum Control

The engineering of bosonic GKP qubits or cat qubits relies on complex and subtle mechanisms, involving numerous approximations such as the rotating wave approximation, adiabatic theory, and adiabatic elimination. In practice, the validity of some of these approximations may be questioned, in particular due to the appearance of chaotic phenomena or simply as the precision of the systems studied increases. For a high-precision bosonic code, it is essential to precisely understand the phenomena, even very weak ones, likely to generate logical errors, as well as to what extent the reduced models studied are capable of accounting for these phenomena.

In addition to understanding the limits of the models obtained, the development of bosonic codes requires precise and efficient simulations of superconducting circuits. These simulations are crucial for identifying limiting phenomena, optimizing the controls underlying logical gates and quickly estimating system parameters (calibration). The QUANTIC team, ENS de Lyon and the start-up Alice&Bob use techniques based on the engineering of dissipative systems, modeled by the Lindblad equation. However, these simulations quickly become very complex when it is necessary to model several cavities (for logic gates and/or buffer cavity modeling) or a large number of photons (GKP codes, large cat qubits). The development of new stable, robust and fast numerical schemes for temporal discretization and space truncation would represent an innovative and reliable tool for the bosonic codes community.

These research topics are central for all theoretical and experimental tasks of WP1 of NISQ2LSQ, concerning superconducting bosonic codes. A better understanding of the error models and limitations of the bosonic encodings could then be exploited in a transversal manner with WP3, where the concatenation of such bosonic qubits and LDPC codes can be investigated. Furthermore, the numerical tools can go well beyond the particular applications of WP1 and could provide efficient and stable schemes for simulating bosonic systems including those encountered in WP2.

The junior research leader will work within the Inria-ENS-Mines-CNRS Quantic team with a small team of 1 PhD student and/or 1 postdoc to address the above issues. The position is open for a fixed-term contract of 3 years for a junior research leader. The applicant can also be a young researcher, already hired on a permanent position and intending to pursue a research topic in line with the above theme. In this second case, the funding will be used to cover the hiring of a PhD student and a postdoc, collaborating with the young researcher.

At Quantic team, Inria de Paris, 48 Rue Barrault, 75013 Paris, https://quantic.phys.ens.fr

Apply before: 15/09/24

Job requirements: The candidate must have expertise in quantum physics, numerical methods, and control theory, a PhD, and a good track record

How to apply: Please send your application to mazyar.mirrahimi@inria.fr
Required documents: CV, publication list, research statement, recommendation letters

PROGRAMME DE RECHERCHE QUANTIQUE