PhD Position in Early Fault-Tolerant Quantum Computing

Institution: Télécom Paris / Inria (Quriosity and Cosmiq teams) / Laboratoire Aimé Cotton
Location: Palaiseau / Paris, France
Supervisors: Paul Hilaire, Michael Vasmer, Patrick Cheinet
Starting Date: October 2025
Duration: 3 years
Application Deadline: July 13, 2025 (Position will remain open until filled)

Project Overview

Quantum error correction (QEC) and fault-tolerant protocols are essential for scalable quantum computing, but their current implementations impose high overheads and stringent constraints on hardware and software. This PhD project aims to bridge the gap between near-term quantum hardware capabilities and long-term fault-tolerant computation by designing demonstrations of fault-tolerant quantum computing for near-term hardware. There will also be the opportunity to test these protocols on real quantum hardware platforms, provided by the EuroHPC and GENCI projects. The goal is to leverage recent advances in quantum error correction—potentially combined with quantum error mitigation techniques—to protect intermediate-scale quantum systems from noise.

The work will involve identifying, adapting, or creating quantum protocols to match the strengths of available hardware platforms made accessible through EuroHPC and GENCI, proposing viable demonstrations, and carrying out proof-of-principle experiments on photonic and cold atom platforms. The project will also aim at identifying roadblocks in the development of larger fault-tolerant quantum computing demonstrations.

What You'll Do

You will develop a library of compact quantum codes and fault-tolerant protocols tailored to various quantum computing platforms. This involves designing and analyzing quantum error correction-inspired strategies that have reduced resource requirements, making them suitable for near-term quantum devices. You will evaluate and match these protocols to the specific capabilities of hardware available through EuroHPC and GENCI, namely a photonic quantum computer and a cold-atom-based quantum computer.

This PhD will be jointly supervised by **Michael Vasmer**, **Paul Hilaire**, and **Patrick Cheinet**. The student will be embedded in a collaborative, interdisciplinary team at Télécom Paris, Inria Paris and Laboratoire Aimé Cotton.

How to Apply

To apply, please send your **CV and a cover letter** to: paul.hilaire@telecom-paris.fr **and** michael.vasmer@inria.fr. For further inquiries or to learn more about the project, feel free to reach out to either of the supervisors.