Internship position
Graphix: Measurement-Based Quantum Computing with Continuous Variables

An internship position is available jointly between the *Multimode Quantum Optics* team at the Laboratoire Kastler Brossel and the *QAT* team at ENS Paris.

Measurement-based quantum computing is an alternative way of performing quantum computations to the traditional circuit model and exists in both the discrete variable (DV) and continuous variable (CV) settings. Graphix (https://github.com/TeamGraphix/graphix) is a state-of-the-art, open-source Python library for measurement-based quantum computing with qubits. In CV, the model also exists but has been less explored despite recent efforts to develop similar concepts (see e.g. [1]).

The internship aims at extending the Graphix software from discrete variables to continuous variables while keeping in mind optical CV architectures. As a first step, the Gaussian case will be investigated in order to assess which concepts can be translated and which have to be added to take into account the specificities of the CV realm and a first implementation will be realised. This work is expected to have a long-term impact on the field of quantum computing, enabling deeper exploration of computing protocols, architectures and compilation issues for Quantum Photonic Unit providers and their users. It will also contribute to advances in error-correction techniques and benchmarking across different quantum platforms.

The **multimode quantum optics group** at LKB carries out leading research in the study of multimode Gaussian and non-Gaussian states of light, useful in quantum information protocols on a large scale. The group has a strong experimental focus, but is also engaged in purely theoretical activities aiming at developing quantum technologies in the CV framework. This project also fits within its technology transfer strategy.

The **QAT team** adopts a comprehensive approach to the development of quantum information processing, integrating architectures, algorithms, and applications within a unified framework. The team focuses on establishing the necessary connections between these elements, recognizing that progress in one area directly supports advances in the others. In particular, the group investigates how algorithmic design and architectural choices can maximize the practical impact of quantum technologies on current and future hardware, especially in the context of limited computational resources. The team also puts an emphasis on developing robust, open and reproducible code for the research community.

[1] R. I. Booth and D. Markham, Flow Conditions for Continuous Variable Measurement-Based Quantum Computing, *Quantum* **7**, 1146 (2023).

In a nutshell,

Why apply?

- You would like to explore close interplay between quantum information theory and quantum optics experiments
- You will benefit of an international team of researchers, expert in continuous variables quantum optics
- It is an opportunity to build an extensive network of researchers within the Graphix community, joining and building research consortia at national, european and world level.

Our specific view:

- Photonic quantum computing with continuous variables
- Developing open source solutions for the quantum information community

Practical information

Candidates must hold Master 1 in a field related to theoretical quantum physics. For M2 students, a first experience or past research track record in either theoretical quantum optics or quantum information theory is a plus. Familiarity with numerical methods and willingness to contribute to software development is strongly recommended.

Application procedure

Inquiries and applications should be sent by email to Valentina Parigi (valentina.parigi@lkb.upmc.fr) AND qat-hiring@inria.fr. Applications should include a detailed CV and two names of potential referees.

Salary:

Application deadline: Preferentially apply before November 28th 2025.

Starting date: flexible from February to April 2026

Duration: 4 to 6 months