

INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Matériaux et Phénomènes Quantiques (MPQ)

CNRS identification code: UMR7162

Internship director's surname: Valentin Cambier

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Internship location: 10 Rue Alice Domon et Léonie Duquet 75013 Paris

Thesis possibility after internship: YES

Funding: YES/

If YES, which type of funding: ED/ANR...

Realization of a quantum interface between trapped ions and entangled photons

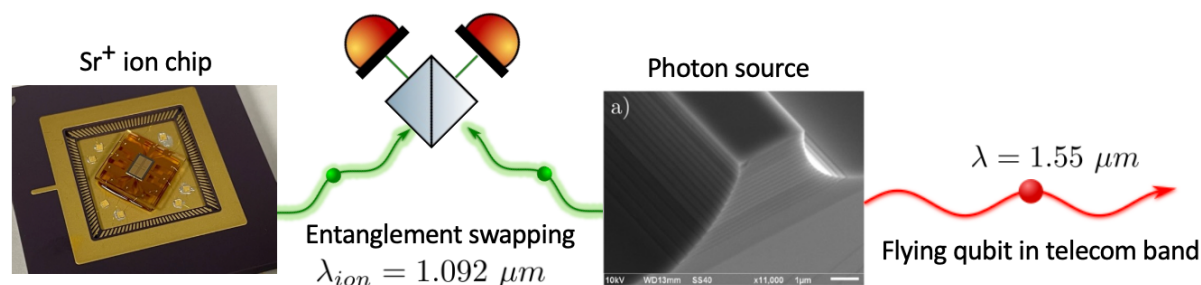
Ion trap technology has undergone spectacular developments over the last decades. Devices are now miniaturized, integrated on chips, and can adopt various geometries—linear, ring, or lattice—facilitating their interconnection and scalability. These advances have enabled pioneering demonstrations of quantum logic gates, ion entanglement, and, more recently, quantum error correction within registers of several qubits. Trapped ions are thus remarkably robust static qubits, combining high fidelity (>99.9%), individual addressability, efficient laser cooling, and environmental isolation. These characteristics make them prime candidates for quantum memory and local quantum logic.

However, in order to design distributed quantum processors or large-scale quantum networks, these static qubits must be able to exchange information over long distances using flying qubits, usually photons.

The development of a robust, efficient, and integrated light-matter interface is therefore a central objective of contemporary quantum technologies.

To develop this interface the intern will work directly on the experimental setup dedicated to trap the strontium ions and collect their light. He or she will implement in-vacuum optical fibers and waveguides, directly connected to the ion trap. He or she will also work on an original entanglement protocol based on a non-degenerate SPDC (Spontaneous Parametric Down Conversion) source.

The successful applicant will be integrated in a dynamic team with 3 permanent staff and 3 PhD students in a motivating scientific environment. The master's internship is planned to start in spring 2026, and can be ideally followed by a PhD thesis.



Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO

Soft Matter and Biological Physics: NO

Quantum Physics: YES

Theoretical Physics:

NO