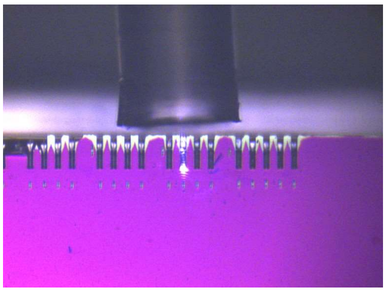
PhD (and master internship) and **Post Doctoral** fellowship proposals on **Quantum Thermometry**



Quantum Optomechanics is a disruptive technology which is experiencing an unstoppable progress that could help face up to present metrology challenges. A particularly exciting new development is the possibility of nano-optomechanical systems to produce quantum primary standards that use fundamental aspects of quantum mechanics to gauge thermodynamical quantities. The project aims at developing optomechanical sensors for nanoscale and quantum temperature metrology.

Temperature is probably the most important physical variable of state, influencing almost every physical, chemical, and biological process. Since more than 100 years the world's most accurate temperature sensors rely on antiquated technologies that do not lend themselves to miniaturization, portability, or wide dissemination: the standard platinum resistance thermometer. Moreover, these sensors are sensitive to mechanical shock, thermal stress and environmental variables such as humidity and chemical contaminants that cause irreproducibility and drifts. These fundamental limitations have stimulated the quest for improved temperature sensors. In recent years a wide variety of novel photonic thermometers have been proposed as fiber Bragg gratings, or on-chip integrated silicon photonic nanostructures. However, the ultimate limitations in optical and metrological performances of these technologies have yet to be reached, and traceability to the kelvin has still to be demonstrated (https://www.mdpi.com/2673-3269/3/2/17) .

The aim of this project is to demonstrate and validate innovative primary temperature sensors using quantum technologies that could either work at low temperature near the quantum regime of the device up to room temperature far from this regime. The monitoring of both thermal and quantum fluctuations of a mechanical resonator allow to scale the size level of thermal motion in term of quantum energies determined by Planck's constant and can lead to a quantum primary determination of the temperature.

The research project will be undertaken in tight collaboration between three laboratories with an expertise in multiple domains. The fabrication of the photonics and phononics crystals will be done in the clean-room facilities housed by C2N. Quantum readout will be developed in collaboration with the Optomechanics and Quantum Measurements team of LKB and finally CNAM-LNE will develop methods for the metrological validation of the optomechanical thermometer, and its traceability to the International Temperature Scale.

The work will be conducted within the European Project Horizon Europe "Quantify" (QUantum enhANced phoTonic Integrated sensors For metrologY) and within a French ANR project.

Key words: experimental physics, quantum physics, laser, photonics, cryogenics, micro and nano fabrication, metrology

Candidate profile:
We are seeking for a highly motivated candidates (for a PhD or a PostDoc position) with a strong background in experimental physics: Photonics / Optics / Quantum physics / Applied Physics.
The following skills and experience will be highly appreciated:
- Knowledge: lasers, fiber optics, cryogenics, clean-room facilities (nano, micro-fabrication)
- Computer-aided design (CAD) software / Simulations: Comsol, MEEP, Solidworks.
- Programming skills: Python and LabView

Location: Paris and Ile de France region: Paris 5eme (LKB), St Denis (Cnam), Palaiseau (C2N)
Starting date for PhD: 01/09/2024 (Thesis); feb.2024 (Master Intership);
Starting date for PostDoc: from 01/01/2024 (duration from 12 to 24 months)
Funding: Horizon Europe Project

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