# Quantum Thermometry


**Internship and PhD offer**

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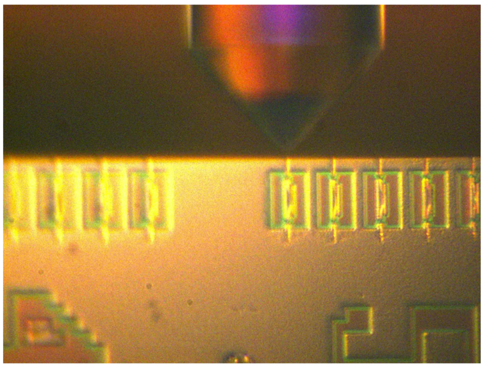
Quantum Optomechanics is a disruptive technology which is experiencing an unstoppable progress that could help face up to present metrology challenges. A particularly exciting new development is the possibility of nano-optomechanical systems to produce quantum primary standards that use fundamental aspects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

Temperature is a key physical variable influencing nearly all physical, chemical, and biological processes. For over a century, the most accurate sensors—standard platinum resistance thermometers—rely on outdated technology that cannot be easily miniaturized or widely deployed. They are also sensitive to mechanical shock, thermal stress, and environmental factors, causing drift and poor reproducibility. These limitations have motivated the development of new photonic thermometers, such as fiber Bragg gratings and on-chip integrated silicon photonic devices, but their ultimate metrological performance and traceability to the kelvin are still to be demonstrated.

**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 team has also launched a side project, susceptible to give short term results. The aim is to study the fluctuation-dissipation theorem in an out of equilibrium system. A large temperature gradient is applied to a cm-size resonator in which mechanical losses can be added at will in order to change the effective temperature of the mechanical modes.

The PhD will take place in the Optomechanics and Quantum Measurements team of LKB and eventually in CNAM and LNE where the PhD will develop methods for the metrological validation of the optomechanical thermometer, and its traceability to the International Temperature Scale.

*Key words: experimental work, quantum physics, laser, cryogenics, micro and nano fabrication, clean room, metrology*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