Internship / Phd offer : Quantum optomechanical thermometer

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3-years advantageous PhD funding already secured within the European Project PhotoQuant

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Temperature is probably the most important physical variable of state, influencing almost every physical, chemical, and biological process. Surprisingly, the world's most accurate temperature sensors rely on antiquated technologies that do not lend themselves to miniaturization, portability, or wide dissemination. In recent years a wide variety of novel photonic thermometers have been proposed including photosensitive dyes, fiber Bragg gratings, and on-chip integrated silicon photonic nanostructures. Even more recently, the field of optomechanics, based on the reading of the mechanical motion of an object thanks to light, has emerged. Quantum optomechanics is now going into a new era by trying to develop new technologies based on / using high sensitive quantum measurements. At the forefront of these technologies, thermometry is one of the most obvious but also one of the most demanding.

The aim of the Internship/phd is to demonstrate and validate an innovative primary temperature sensor using quantum technologies. The device under study is based on an optomechanical system combined with quantum measurements techniques that allow one to directly compare thermal fluctuations of a resonator with its quantum noise.

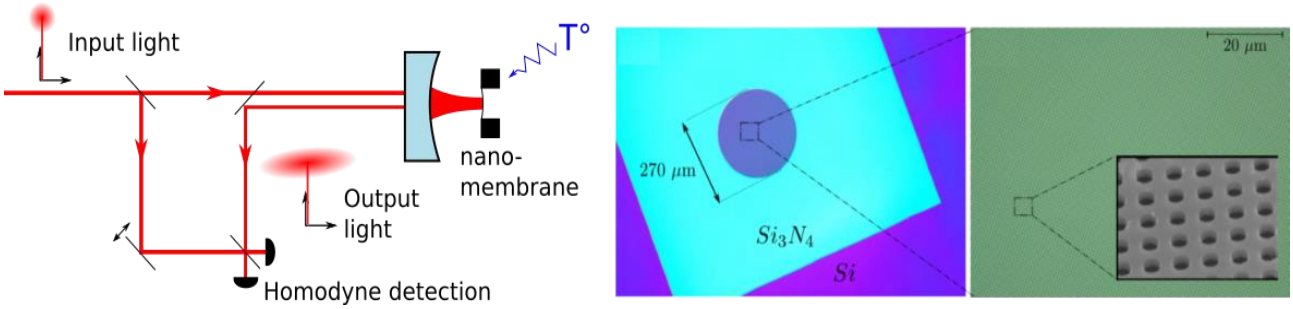

Fig: Left: simplified design of the readout protocol envisionned. Right: example of photonic crystal nanomembrane designed and fabricated by LKB and C2N.

Methods and techniques: The Optomechanics and Quantum Measurements group at Laboratoire Kastler Brossel has a unique expertise to perform such a project, including collaborations with nanofabrication laboratories (C2N) and metrological Institute (CNAM-LNE), availability of quantum-limited laser sources, detection setups, and a dilution refrigerator compatible with optical operation. The optomechanical thermometer envisioned here will be based on a suspended high-Q dielectric nano-membrane with a high finesse photonic cristal membrane.

Key words: quantum optics, optomechanics, quantum sensor, nanofabrication, metrology.