

Master 2: International Centre for Fundamental Physics

INTERNSHIP PROPOSAL

Laboratory: Laboratoire Kastler Brossel (LKB) in cooperation with Mirega SAS

Location: Département de Physique de l'ENS, 24 rue Lhomond, 75005 Paris

Supervisors: Jakob Reichel (jakob.reichel@ens.fr), Romain Long (long@lkb.ens.fr)

Web page: quantumdevices.fr

Thesis possibility after internship: YES

Funding: YES **Type of funding:** CIFRE (to be approved after selection of candidate)

Greenhouse gas analysis with optical fiber microcavities

The need to reduce anthropogenic greenhouse gas (GHG) emissions has created a demand for miniaturized trace gas analyzers that can reliably measure extremely small concentrations of gases such as CO₂ and NH₃, both in industrial and in research situations, while being much more compact than gas analyzers available today. Fiber Fabry-Perot microcavities (FFPs), developed at LKB in the context of atomic quantum technologies offer a unique opportunity to realize such instruments. They combine the proven selectivity, precision and sensitivity of cavity-enhanced laser spectroscopy methods with the miniaturization and robustness known from optical telecom fiber devices. This enables mobile gas analyzers mounted on drones, but also fiber-coupled networks of gas analyzers for emission monitoring on extended sites

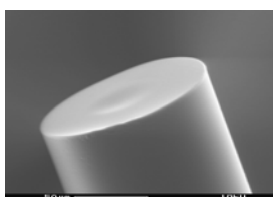


Figure 1 Left: Scanning electron micrograph of a laser-machined, ultralow-roughness mirror shape on an optical fiber. The fiber diameter is 125 μm . Right; Photograph of a complete FFP microcavity.

We have recently demonstrated proof-of-principle detection of CO₂ and CH₄ with FFPs fabricated at LKB (Figure 1). This internship, and the PhD project that will follow, are part of the research program that will take the step from proof of principle to quantitative, precise gas analysis, not only in the laboratory but also in harsh real-world environments. This includes a wide spectrum of research ranging from hands-on experimental work with laser, optical and fiber technologies, development of models and new methods of data analysis, to the exploration of novel routes such as the development of FFPs for the mid-infrared spectral region.

The internship will be carried out in collaboration between the LKB Atom Chips group and the recently founded startup company Mirega SAS. Mirega's R&D being hosted by LKB, the work will take place in a stimulating environment where fundamental quantum science is in close daily contact with startup-driven R&D.

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

Quantum Physics:	Yes	Soft Matter and Biological Physics:	No
Condensed Matter Physics:	Yes	Theoretical Physics:	No