MASTER 1 / 2 RECHERCHE PHYSIQUE

PROPOSITION DE STAGE

TITRE	**Spectroscopie et asservissement d'un laser pour le refroidissement du Potassium.**
LABORATOIRE	**Laboratoire Photonique Numerique et Nanosciences (LP2N) – Institut d'Optique d'Aquitaine (IOA)**
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RESUME DU SUJET DE STAGE

The recent years have seen tremendous progress in the realization and the study of artificial quantum materials using ultracold atomic gases. By trapping fermionic or bosonic atoms in artificial crystals of light (so-called optical lattices), fundamental condensed matter phenomena traditionally only observed in solid-state materials have become accessible in a different and highly controlled environment. Experiments are now reaching up the level where these quantum gases start to be considered as true "quantum simulators" for tackling a broad range of open physics problems, including among others quantum magnetism or superfluidity.

The long-term objective of our project is to explore quantum transport in this setting, and how it is influenced by lattice geometry, band structure topology, disorder or interactions. To this end, we are currently building a novel experimental apparatus specifically adapted to the production of ultracold bosonic and fermionic potassium gases with adjustable interactions. The fermionic species studied will be potassium 40 that presents a low field Feshbach resonance. The lasers (767 nm) to cool potassium will be developed in collaboration with the company Muquans. Muquans has expertise in frequency doubled telecom lasers for laser cooling of Rubidium (780 nm).

During its internship, the student will set-up and characterize a laser that will serve as a frequency reference for our entire optical bench for laser cooling experiment of potassium. For this, the student will have to study the working principle of an extended cavity diode laser. Then he will temperature lock the laser diode and the cavity and will realize the doppler free spectroscopy of Potassium atoms on which the laser will finally be frequency locked.
The laser thus realized will serve as a frequency reference for the optical bench of Muquans. Depending on his experience (M1 or M2), the student could progress further on the construction of the optical bench.

For M2 students, depending on the intern and the financial opportunities, this master thesis could lead to a PhD thesis in the team.