Master internship position with PhD available

Internship location: Institut de Physique de Nice (INPHYNI) https://inphyni.univ-cotedazur.fr
17 rue Julien Lauprêtre, 06200 Nice, FRANCE
Contacts: Mathilde Hugbart — Mathilde Hugbart@univ-cotedazur.fr
Salary: ~ 600 euros/months
PhD thesis possibility after internship: YES Thesis funding: Doctoral school scholarship or funding within the "cold atoms" research team

Antibunching effect in a cold atom ensemble

Context — **Cold atoms coupled to photons** are a promising platform for **quantum information, computation and communication**: atoms are adequate systems to store and/or correlate photons, while the photons themselves can be efficient carriers of information over great distances. **Antibunching** naturally occurs in the light emitted by a single quantum emitter and vanishes for many emitters. Still, antibunched light can be obtained using many atoms. This has been demonstrated recently by the group of Arno Rauschenbeutel in Germany in a 1D system with cold atoms trapped and optically interfaced with an optical nanofiber [1]. However, the nanofiber experiment requires a complex setup and is difficult to implement in practical applications.

Objectives — The goal on our experiment is now to try to detect **antibunched light with many quantum emitters in a 3D system**. This will be implemented and studied :

- on our cold-atom experiment, taking advantage of our experience with generating clouds of cold atoms with large optical thickness, a prerequisite for this project
- with an experimental technique based on intensity correlation measurement, an experimental tool largely used on our experiment to study the light scattered by a cold atomic cloud [2].

This master internship is experimental but can also include numerical studies in collaboration with Romain Bachelard (UFSCar, Brazil).

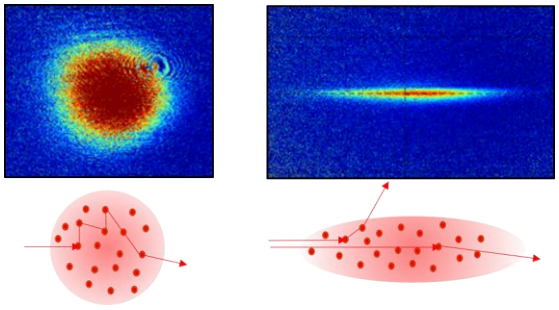

Illustration of light scattering in a cold atom cloud. Light that has scattered multiple times within the cloud will cause decoherence and destroy the antibunching. The cloud geometry (3D on the left, quasi-1D on the right) serves as the control parameter to manage this decoherence.

You will learn :

- Extensive experience with cold atom experiments
- Practical skills in optics experiments, including alignment, fiber coupling, and AOM setup for example
- Practical skills in operating advanced instrumentation (single-photon detectors, time-to-digital converter,…)

Profile :

- Strong interest in **atomic physics** and **experimental optics**
- A strong motivation and a proactive attitude
- An inclination for collaborative work

References:
[1] A. S. Prasad et al., Nat. Phot. **14**, 719 (2020). J. Hinney et al., Phys. Rev. Lett. **127**, 123602 (2021).
[2] A. Eloy et al., Phys. Rev. A **97**, 013810 (2017). L. Ortiz-Gutiérrez et al., New J. Phys. **21**, 093019 (2019). D. Ferreira et al., Am. J. Phys. **88**, 831 (2020). P. Lassègues et al, EPJD **76**, 246 (2022). P. Lassègues, et al, Phys. Rev. A **108**, 042214 (2023).