

Master OAM – Proposition de stage M1

Institute of Physics
The University of Tokyo

INPHYNI
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Laser cooling of Cs and quantum sensing toward a search for Dark Matter

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General context.— In a collaboration between Institute de Physique de Nice and The University of Tokyo in Japan, experiments on spectroscopy of Cs and laser cooling of Cs have been launched and are on the way. The long term goal of the project is to study fundamental physics, such as parity non-conservation and the existence of dark matter.

Dark Matter is one of the mysteries of modern physics and has been explored in astrophysics and elementary particle physics. The quantum sensing technique has been developed in atomic, molecular and optical physics to measure various physical quantities precisely, and also is expected to be useful to search for dark matter.

Objectives of the internship.— To prepare for the future search for dark matter using quantum sensing, the student will laser cool Cs atoms and develop the quantum sensing technique at the University of Tokyo, Japan. The laser cooling technique makes it possible to prolong the interaction time sufficiently to be able to measure the weak interaction. The quantum sensing technique controls atomic quantum states using microwaves. Therefore, the student will do fundamental laser and microwave experiments.

The project is experimental. A substantial time will be spent in the laboratory at Komaba Campus, University of Tokyo, under the guidance and supervision of Prof. Aoki. This will require an interest and some skill in technical work. At the same time, the student is expected to learn the main lines of the underlying physics involved and the long-term goals of the project.

Practicalities.— The student will initially spend two weeks in Nice, working with Prof. Kastberg in order to prepare for the rest of the project. That will be followed by 2.5 months in Tokyo. The University of Tokyo will finance the air fare Nice–Tokyo, and also student accommodation on the campus (shared bathroom).

The interested student should send a letter of motivation, in English, to Profs. Aoki and Kastberg (addresses as above). Suitable student(s) will then be called to an interview, in English, in Nice, and possibly also one with Prof. Aoki via zoom (or equivalent).