

Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Date de la proposition : 2018-11-21

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Circular Rydberg atoms of Strontium for quantum metrology and quantum simulation

Résumé /

Rydberg atoms are highly excited atomic levels for which the electron is far away from the nucleus and only sees the $1/r$ -potential of the atomic core. The spatial extension of the electron wavefunction and their very long lifetime make them of great interest for quantum metrology and quantum simulation. We have used rubidium Rydberg atoms prepared in non-classical Schrödinger cat states to measure electric or magnetic field with an unprecedented precision, well below the standard quantum limit. Chain of circular Rydberg atom, trapped deterministically, would also open very promising perspectives for quantum simulations of spin systems.

The objective of this project is to develop a Rydberg experiment based on strontium. Being an alkali-earth element, the strontium possesses two valences electrons, leaving an optically active ionic core once one of the electrons is promoted to the Rydberg states. The second electron can thus be used to detect the atom by fluorescence, allowing for instance to obtain a spatial image of the electromagnetic field that the atoms are measuring. The ionic core optical transition also enables to implement standard cold-atom techniques to laser-cool the atoms once in the Rydberg states. This opens very exciting perspectives for quantum simulation, where the motion of atom is often the limiting factor that prevent from observing the long-term dynamics of the system.

Project:

The purpose of the internship will be the preparation of circular Rydberg atom of strontium. We will use the existing rubidium setup and build a new optical table with the laser to excite Rydberg level of strontium. We will then characterize the circular levels and observe the first fluorescence signal.

During the PhD, we will develop a cold atom set-up to investigate further the potential of Strontium Rydberg atoms.

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : oui

Si oui, financement de thèse envisagé/ financial support for the PhD: ERC, Ecole Doctorale

Lumière, Matière, Interactions

oui

Lasers, Optique, Matière

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Fiche à transmettre (fichier pdf **obligatoirement**) sur le site <http://stages.master-omp.fr>