

PROPOSITION DE STAGE DE M1 POUR ETUDIANTS PHYSICIENS

2019 - 2020

INTERNSHIP OFFER – LEVEL: M1 – DURATION: 2 MONTHS

For M2 level, please check the openings for PhD positions

Topic: Optimisation of operating conditions for high-density or high-field MEOP

Scientific content

The objective is to boost up metastability exchange optical pumping (MEOP) efficiency in somewhat extreme operating conditions, as met in our studies of low field MRI (high gas pressure) or of hyperpolarisation of ^3He in magnetised plasmas (high magnetic field). In both cases, rf gas discharges sustained in cylindrical gas containers usually lead to highly inhomogeneous distributions of metastable He atoms, characterised by strongly-peaked annular transverse profiles with a maximum near the cylinder wall and a depletion in the central area. A key parameter is the amount of resonant pump light that is absorbed by small pool of metastable He atoms. Hence, the radial profiles of the incident light intensity and of the metastable atom number density should be matched. Annular shaping of a Gaussian beam can easily be achieved with a pair of axicons (conical lenses). A prototype system has been prepared and optically characterised during prior internship work.

Internship work

The student will use this prototype to try and optimise the diameter and width of the collimated pump laser beam to achieve maximal light absorption. Tests will be performed in cylindrical cells of fixed shapes filled with various amounts of gas. Optical and NMR measurements may be used to quantify actual ^3He nuclear polarisation rates and to validate the results in current MEOP or MEOP-based experiments.

Read more about context and motivation: <http://www.lkb.upmc.fr/polarisedhelium/openings-op/>.

Techniques/tools: Commercial 1083 nm laser diodes or fibre lasers, beam profilers and CCD cameras will be used. Various optical and optomechanical components are available for polarimetry if needed.

Field(s): Optics, lasers, atomic physics, gas discharges.

Type of internship: Instrumental and experimental. Data processing may be included.

Host institution

Place: Laboratoire Kastler Brossel (site: ENS-Lhomond)

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Director of the host laboratory: Antoine Heidmann

Supervision and contact

Supervisor(s): Geneviève Tastevin / Pierre-Jean Nacher

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