

Spécialité de Master « Optique, Matière, Paris »

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

Proposition de stage (**ne pas dépasser 1 page**)

Date de la proposition : 02/11/2016

Responsable du stage / internship supervisor:			
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Nom du Laboratoire / laboratory name: Laboratoire de Physique des Lasers			
Code d'identification :	UMR 7538	Organisme :	CNRS / Université Paris 13
Site Internet / web site:	www-lpl.univ-paris13.fr		
Adresse / address:	99 avenue J.-B. Clément 93430 Villetaneuse		
Lieu du stage / internship place:	Laboratoire de Physique des Lasers		

Titre du stage / internship title: Precision Measurements and tests of fundamental physics with cold molecules
Résumé / summary
<p>Context: During this internship, the student will participate in the development of new cutting-edge technologies for the study of polyatomic molecules with unprecedented precision. Those developments are at the forefront of the fields of cold molecules and of precision spectroscopic measurements, paving the way towards the realisation of tests of fundamental physics and the exploration of the limits of the standard model.</p> <p>Compared to atoms, molecular systems, owing to their numerous degrees of freedom, offer promising perspectives for improving tests of fundamental physics and precision measurements in general. Molecules are currently used to test fundamental symmetries, measure fundamental constants or their variation in time. Many of these experiments can be cast as measurements of resonance frequencies of molecular transitions highlighting the importance of frequency metrology. Moreover, they require advanced manipulation techniques already standard for atoms, such as the ability to cool both internal and external degrees of freedom. The instrumental developments to which the student will participate constitute major step in providing such techniques for molecules. These tools will be directly useful for the precision spectroscopic measurements around 10 μm under progress in our team, in particular a test of left-right (parity) symmetry in chiral molecules, or the measurement of the possible variation in time of the fundamental constant m_e/m_p, the electron to proton mass ratio.</p> <p>Our approach is that of “time-frequency” metrology. We are developing a molecular clock, that is to say a high precision mid-infrared (frequency ~ 30 THz, wavelength ~ 10 μm) laser spectroscopy experiment. To this end, we plan to probe slow and intense beams of cold molecules using a quantum optics technique called Ramsey interferometry.</p> <p>Internship objectives: The student will participate in the development of novel instruments essential for the construction of such a molecular clock of the highest precision. Depending on his taste and on the status of the project he will work on some of the following aspects:</p> <ul style="list-style-type: none">- implementation of new laser sources emitting in the mid-infrared (3-25 μm) called quantum cascade lasers (QCLs) and development of the instrumentation required to control their frequency at a metrological level;- implementation of a high-sensitivity microwave detector, for the detection of individual internal quantum states populations of cold molecules;- implementation of a new source of cold polyatomic molecules, produced in a cryogenic chamber, in collaboration with a team from Imperial College London. <p>If time allows, these instruments will be used to carry out precision spectroscopic measurements.</p> <p>The student will be supervised by a researcher, a lecturer and two PhD students working on the setup.</p>
Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : yes			
Si oui, financement de thèse envisagé/ financial support for the PhD: usual research ministry grant/team's own contract			
Lumière, Matière, Interactions	YES	Lasers, Optique, Matière	YES

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