

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 : 21/09/2018

Responsable du stage / internship supervisor:			
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Nom du Laboratoire / laboratory name: Laboratoire de Physique des Lasers (LPL)			
Code d'identification :	UMR7538	Organisme :	Institut Galilée
Site Internet / web site:	http://www-lpl.univ-paris13.fr/FR/Index.awp		
Adresse / address:	99 Avenue J-B Clément, 93430, Villetaneuse		
Lieu du stage / internship place:	LPL		

Titre du stage / internship title: Near-field probing of atom and molecule-surface interactions	
Résumé / summary	
<p>Vacuum fluctuations of the electromagnetic field lead to spontaneous emission and energy shifts of isolated atoms and molecules. Macroscopic objects modify vacuum fluctuations giving rise to interactions between atoms or molecules and macroscopic objects (Casimir-Polder interaction) or between macroscopic objects themselves (Casimir interaction).</p> <p>The interaction of atoms and molecules with the macroscopic environment is a fundamental problem of quantum electrodynamics that has far-reaching implications in metrology, precision measurements and our understanding of the electromagnetic properties of matter and vacuum. Furthermore, choosing, or even engineering, the dielectric properties of materials offers the possibility of shaping the vacuum fluctuations thus tailoring the properties of quantum emitters.</p> <p>The SAI group has developed selective reflection and thin cell spectroscopy as a technique to probe Casimir-Polder interactions between dielectric surfaces and excited atoms at distances comparable or smaller than the reduced wavelength of excitation ($\lambda/2\pi$). The group has also demonstrated strong modifications of the atom-surface interaction due to the coupling of atomic transitions to plasmon-polariton surface waves. (Lalot <i>et al.</i> Nat. Commun. 5:4364 2014).</p> <p>The Master's project, leading to a PhD thesis, focuses on one or more of the group's ongoing topics of interest:</p> <ol style="list-style-type: none">1) <u>Performing the first spectroscopic measurements of the Casimir-Polder interaction with molecules</u>: Molecule-surface systems are interesting for physical-chemistry applications, but they are also of fundamental importance due to their complex internal molecular geometry. The effects of molecular orientation (anisotropy) and chirality to the molecule-surface interaction are of particular interest.2) <u>Measuring the atom-surface interaction of highly excited Rydberg states</u>: Rydberg atoms display huge interactions with their neighbors and with their environment, making them good candidates for quantum technology applications. Towards this end, compact vapor cells offer simple attractive platforms. The group will first probe Rydberg-surface interactions with selective reflection spectroscopy in a macroscopic cell. In parallel, we're also <u>designing a nanofabricated vapor cell in collaboration with the Paris13 clean room to confine atomic vapors</u> (and eventually Rydbergs) at distances comparable to optical excitation wavelengths. <p>This predominantly experimental project requires working with tunable lasers and spectroscopically probing atomic or molecular gases. It is also possible to work in the Paris13 clean-room, depending on the applicant's interests. Applicants should also have a theoretical background in optics, quantum physics and light-matter interactions.</p>	
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: ECOLE DOCTORALE, INSTITUT GALILLE (POSTE FLECHE)	
Lumière, Matière, Interactions	x Lasers, Optique, Matière x

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