

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 :

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 : Université Paris13
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, équipe SAI	

Titre du stage / internship title: Miniaturized molecular spectroscopy
Résumé / summary <p>Molecules have recently gained importance in fundamental physics measurements but can also provide frequency references from visible to mid-infrared wavelengths [1]. Miniaturizing molecular spectroscopy is extremely challenging due to the low transition probabilities of molecular transitions. Our group has recently managed to perform high resolution reflection spectroscopy on a gas of NH₃ molecules at 10,6µm. Selective reflection is a linear spectroscopic technique, sensitive to a slice of vapor whose size is comparable to the wavelength of optical excitation $\lambda/2\pi$, which in our experiments corresponds to an effective confinement of 1-2µm. We are currently planning the fabrication of a micrometric thin cell filled with molecular vapor.</p> <p>These experiments carry significant impact in the field of gas sensing and pave the way towards miniaturized, compact and high-resolution molecular frequency references. Additionally, selective reflection on a molecular vapor allows us to envisage the first spectroscopic precision measurements of the Casimir-Polder interaction between a molecule and a surface. Molecule-surface interactions are of fundamental interest mostly due to the complex geometry of molecules (chirality and anisotropy) but they are also of importance in physical chemistry [2].</p> <p>This is a mainly experimental internship. The applicant will participate in the group's efforts to increase the resolution of selective reflection spectroscopy and expand the technique to different molecules such as SF₆ or C₂H₂, which provides frequency references in the telecommunication wavelength window (~1.55µm). The applicant will also participate in the fabrication and testing of the new molecular thin cell. Finally, we expect that the applicant would acquire a solid theoretical background on selective reflection and thin cell (high-resolution by Dicke narrowing effect) spectroscopy.</p> <p>[1] F. Benabid, 'Compact, stable and efficient all-fibre gas cells using hollow-core photonic crystal fibres', <i>Nature</i>. 434, pp. 488 (2005); T. Svensson et al. 'Disordered, Strongly Scattering Porous Materials as Miniature Multipass Gas Cells', <i>Phys. Rev. Lett.</i> 107, 143901 (2011). [2] C. Wagner et al. 'Non-additivity of molecule-surface van der Waals potentials from force measurements', <i>Nat. Commun.</i> 5, 5568, (2014) ; C. Brand et al. 'A Green's function approach to modeling molecular diffraction in the limit of ultra-thin gratings' <i>Ann. Phys. (Berlin)</i>, 527, 580-591 (2015).</p>
Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Possibly Yes			
Si oui, financement de thèse envisagé/ financial support for the PhD: Ecole Doctorale, Institut Galilée			
Lumière, Matière, Interactions	X	Lasers, Optique, Matière	X

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