

Spécialité de Master « Optique, Matière, Plasmas »

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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Code d'identification : UMR CNRS 7092		Organismes : UPMC / CNRS	
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Lieu du stage / internship place: LPMAA (Paris6) and University of Sherbrooke (Canada)			

Titre du stage / internship title: Selection of nuclear spin states of water molecules
Résumé / summary
<p>Due to Pauli's exclusion principle, molecules like H₂, H₂O, H₂CO, NH₃ or CH₄ having protons in exchangeable positions exist in several nuclear spin configurations. In case of water, they are called <i>ortho</i> and <i>para</i> depending if the spins of the protons are parallel (total nuclear spin $I=1$) or anti-parallel ($I=0$). In gaseous phase, each rotational state is associated with only one of the nuclear magnetic species and in the high temperature limit (above 50 K), it is known that 1/4 of the molecules are <i>para</i> while 3/4 are <i>ortho</i>. Below 50 K, the <i>Ortho-to-Para Ratio (OPR)</i> at equilibrium becomes strongly temperature dependent. While experimental set-ups allow to control the OPR of H₂ using low temperature magnetic catalysis of nuclear spin conversion, only few allow to enrich efficiently the medium with one of the other species for strongly polar molecules like H₂O. Efforts are made in the world to develop such techniques as the applications for medical NMR imaging or astrophysics problematic are important.</p> <p>During this internship, we propose to one student to participate to the development of experiments to enrich vapour water in one species (<i>ortho</i> or <i>para</i>) within a collaboration with Professor Patrick Ayotte (University of Sherbrooke-Canada).</p> <p>In LPMAA (France), a gaseous phase chromatography technique set-up will be optimized to attempt to reach the high rate of enrichment obtained by a Russian group (Tikhonov and Volkov, Science 2002) which has not been reproduced by other groups up to now. In the meanwhile, a new way will be explored using optical pumping for molecules embedded in a noble gas solid at low temperature. In both cases, the nuclear spin states of water molecules will be probed using High Resolution Fourier Transform InfraRed Spectroscopy. These techniques will be compared to experiments using magnetic lenses and UV Resonant Electron Multi Photon Ionization Spectroscopy under construction in the university of Sherbrooke (Canada).</p>
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: MENRT (Co-tutelle envisaged with U. of Sherbrooke (Canada))			
Lasers et matière	OUI	Lumière, Matière : Mesures Extrêmes	OUI
Optique de la science à la technologie		Plasmas : de l'espace au laboratoire	

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