

# Spécialité de Master « Optique, Matière, Plasmas »

Stage de recherche (4 mois minimum, à partir de début mars 2010)

## Proposition de stage pour l'année 2009-2010 (**ne pas dépasser 1 page**)

Date de la proposition : le 29 octobre 2009

<b>Responsable du stage / internship supervisor:</b>			
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<b>Nom du Laboratoire / laboratory name:</b> Laboratoire Aimé Cotton			
Code d'identification :	UPR 3321	Organisme :	CNRS
Site Internet / web site:	www.lac.u-psud.fr		
Adresse / address:	Laboratoire Aimé Cotton, Bat. 505, Université de Paris XI, Orsay, 91405		
Lieu du stage / internship place:	Laboratoire Aimé Cotton		

<b>Titre du stage / internship title:</b> The $H_3^-$ molecule : the simplest molecular anion in the interstellar medium?
Résumé / summary
<p>During the internship, the student will study formation and destruction of the negative polyatomic ion <math>H_3^-</math> in the interstellar medium and laboratory conditions. This is a theoretical (both, analytical and numerical) project. The overview of this important astrophysical problem is discussed below. Analytical part of the project implies a reasonable knowledge of basic principles of quantum mechanics. Numerical calculations will be performed at a supercomputer. So, during the internship the student will learn how to perform parallel calculations.</p> <p>Many chemical reactions in the interstellar medium are powered by cosmic rays: Atoms and molecules (mainly molecular hydrogen) are ionized by the radiation that provides sufficient energy to initiate a chain of chemical reactions in interstellar clouds leading to the synthesis of polyatomic molecules. A number of positive ions have been observed and identified in the interstellar medium, in particular, the <math>H_3^+</math> ion. It is the simplest triatomic positive ion that plays an important role in chemistry and evolution of interstellar clouds, as its abundance is strongly related to the production of <math>H_2^+</math> in the interstellar medium. In contrast, only a few negative ions have been detected so far in the interstellar medium: <math>C_3N^-</math>, <math>C_4H^-</math>, <math>C_6H^-</math>, and <math>C_8H^-</math>. While quite stable, the simplest negative triatomic ion, <math>H_3^-</math> (predicted to be bound by about 0.013 eV) has not been detected so far in the interstellar medium. We will analyze possible formation mechanisms of <math>H_3^-</math> in the interstellar medium in collisions between <math>H^-</math> and <math>H_2</math>, as well as the formation of <math>H^-</math>. The formation of <math>H^-</math> ion in the interstellar medium is itself a controversial issue in the astrophysics: The <math>H^-</math> ion has only one bound state and cannot be directly observed, but it is believed to be present in the interstellar clouds. Therefore, the detection of <math>H_3^-</math> would be a probe for the presence of <math>H^-</math> in the interstellar medium, which has not been detected so far.</p> <p>The internship will be performed in collaboration with two other theorists working at the Laboratoire Aimé Cotton, Maurice Raoult and Viatcheslav Kokoouline.</p>
<b>Toutes les rubriques ci-dessous doivent obligatoirement être remplies</b>

<b>Ce stage pourra-t-il se prolonger en thèse ? Possibility of a PhD ? : Yes</b>
<b>Si oui, financement de thèse envisagé/ financial support for the PhD: Bourse Ministère</b>

Lasers et matière	<b>X</b>	Lumière, Matière : Mesures Extrêmes	
Optique de la science à la technologie		Physique des plasmas	

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