

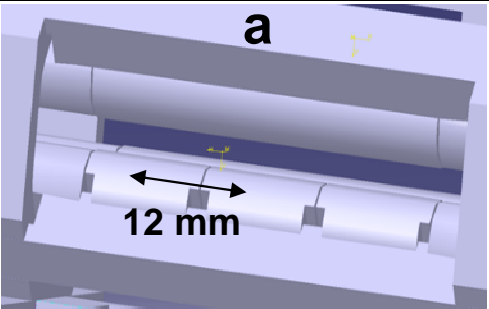
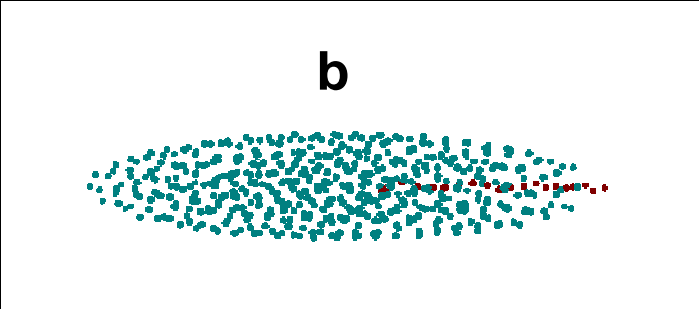
Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 27/10/2014

Responsable du stage / internship supervisor:	
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Nom du Laboratoire / laboratory name: Laboratoire Kastler Brossel	
Code d'identification : UMR 8552	Organisme : UPMC / CNRS / ENS / CdF
Site Internet / web site : http://www.lkb.ens.fr/-Metrologie-de-l-ion-H-2-	
Adresse / address: 4 place Jussieu, Case 74, 75005 Paris	
Lieu du stage / internship place: Campus Jussieu, couloir 13-12, 2 ^{ème} et 3 ^{ème} étages	

Titre du stage / internship title: Laser cooling of Be⁺ ions for studies on cold molecular ions	
<p>Laser-cooled ions confined in radiofrequency (Paul) traps constitute an almost ideal quantum system, in the sense that they can be maintained for long times in a well-controlled environment, virtually free from external perturbations. This makes them attractive for applications such as quantum information processing and high-precision measurements.</p> <p>Our project is to perform high-resolution spectroscopy of the simplest molecule, the molecular hydrogen ion H₂⁺. A Doppler-free two-photon vibrational transition will be probed, and comparison between theory and experiment will lead to an improved determination of a fundamental physical constant, the ratio of the electron and proton masses m_e/m_p [1,2].</p> <p>In general, molecular ions cannot be directly laser-cooled, but they can be sympathetically cooled (through the Coulomb interaction) by laser-cooled ions (Fig. 1b). A linear ion trap has been designed and built (Fig. 1a), and laser sources at λ = 313 nm for cooling of beryllium ions (Be⁺) are under construction. The main task of the internship will be to put the new trap in operation, demonstrate trapping, and eventually laser cooling of Be⁺ ions. The next steps, to be studied during the PhD, will be the sympathetic cooling and spectroscopy of H₂⁺ ions.</p>	
	
<p>Fig. 1 (a) Linear ion trap. (b) Simulation of sympathetic cooling of a few tens of H₂⁺ ions (red) in a crystal of a few hundred laser-cooled ions Be⁺ ions (blue-green).</p> <p>[1] V.I. Korobov, L. Hilico and J.-Ph. Karr, Phys. Rev. Lett. 112, 103003 (2014). [2] U. Bressel et al., Phys. Rev. Lett. 108, 183003 (2012).</p>	

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: EDPIF			
Lasers, Optique, Matière	X	Lumière, Matière, Interactions	X
Plasmas : de l'espace au laboratoire	X		

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