

Invitation à la soutenance publique de thèse

Pour l'obtention du grade de Docteur en Sciences

Monsieur Matthieu GÉNÉVRIEZ

Master, mention physique

Photon- and electron-induced ionization of metastable helium and light anions

Anions are atoms with an extra electron and, as such, they are weakly bound systems in which electron correlations play an important role. Photodetachment, *i.e.*, the photoelectric effect for anions, is a convenient way to probe these fragile systems. Beyond its interest for the basic study of such ions, it is also an important phenomenon for stellar and atmospheric physics, a paramount example being the fact that the photodetachment of H⁻ is responsible for most of the Sun's opacity in the visible and near-infrared parts of the electromagnetic spectrum.

In order to study photodetachment, we have developed a method and an experimental setup to measure all quantities (cross sections) governing the ejection of the photoelectron. Our measurements provide a complete picture of the photodetachment of the oxygen anion, for which long-standing disagreements between theory and experiment are resolved. They further provide benchmark data for the hydrogen anion. We have also studied the double photodetachment of the helium anion, both experimentally and theoretically. The intricate dynamics underlying the absorption of 4 photons and the ejection of 2 electrons were elucidated and showed complex dependence on the orientation of the transient atom and the polarization of the light.

The metastable, first excited state of the helium atom is an important species for plasmas due to its large abundance and its key role in ionization processes. It also enters the diagnosis of thermonuclear fusion plasmas. Unfortunately, the long-standing discrepancy between theory and experiment regarding its ionization by electron impact causes uncertainty in plasma models. We have measured the cross section of this process and, for that purpose, developed a novel source of a fast and pure beam of metastable helium, based on the photodetachment of the helium anion. Our results fall in good agreement with some of the most recent *ab initio* calculations, thus resolving the discrepancy. The double ionization cross sections of metastable helium and the helium anion were also measured.

**Vendredi 22 septembre 2017 à
16h15**

Auditoire BARB 92
Place Sainte Barbe, 2
1348 Louvain-la-Neuve



Membres du jury :

Prof. Xavier Urbain (UCL), promoteur
 Prof. Bernard Piraux (UCL), président
 Prof. Clément Lauzin (UCL), secrétaire
 Prof. Dag Hanstorp (University of Gothenburg, Suède)
 Prof. Michel Godefroid (ULB)
 Prof. Pierre Defrance (UCL)
 Prof. Mariko Terao Dunseath (Université de Rennes 1, France)