Scientists propose alternative method for the study of ions

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Scientists at the Department of Physics of the University of Oulu have teamed up with scientists in France, Russia and Japan to propose a new experimental method for researching positively charged ions. The study, In the Finnish side carried out by postdoctoral researcher Saana-Maija Huttula and Professor Marko Huttula in Oulu, was published in *Physical Review Letters* on 12 March 2013. The study involved investigating the electronic structure of the argon ions using synchrotron radiation. The proposed theoretical simulations were done using methods developed by an electron spectroscopy research group based at the University of Oulu. The study was co-financed by the Academy of Finland.

Studying the electronic properties of positively charged ions is very difficult using traditional methods, due to the very low density available in ionic beams. The alternative method proposed by the international research team is based on the single-photon multi-ionisation of the corresponding neutral atom and on coincidence techniques, which allows for the near-simultaneous detection of all the electrons scattered from a single atom.

According to Saana-Maija Huttula, the principal investigator of the present publication, the method has two advantages: the huge intensity generated and the accurate configuration of the electronic initial states of ions. The scientists expect the method to become a common tool that has the potential to lead to important new discoveries in the field of ion research. Coincidence techniques can also be applied directly in the study of the properties of molecular materials. In fact, researchers at the

University of Oulu are already expanding their work to heavy-metal compounds and nanoparticles.

More recently, the research team has been studying, for example, the electronic structure and dynamics of mercury molecules and clusters. Mercury compounds, though environmentally hazardous, are an important raw material for the electronics industry, but they also play an important role in atmospheric chemistry, for instance. The team has focused its efforts on the investigation of metallic nanoparticles. In addition, the scientists are actively engaged in international cooperation at the interface of fundamental free-electron laser research and multinational corporate collaboration. At the national level, the team is an active promoter of using synchrotron radiation for research and analysis purposes.

More information: Huttula. S. et al. *Phys. Rev. Lett.* 110, 113002 (2013) prl.aps.org/abstract/PRL/v110/i11/e113002

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