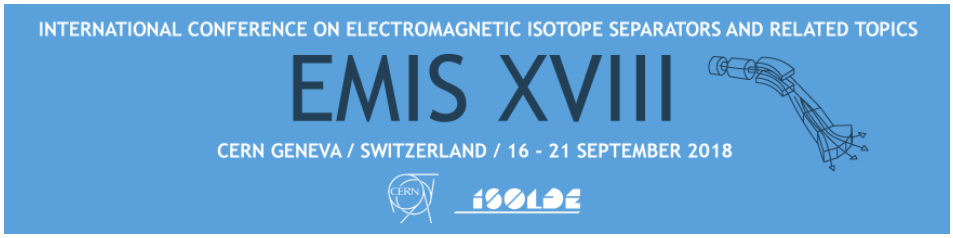

Contribution ID: **33** Type: **Invited**

High-resolution Laser Ionization Spectroscopy of Heavy Elements in Supersonic Gas Jet Expansion

Wednesday, 19 September 2018 10:30 (30 minutes)

Resonant laser ionization and spectroscopy are widely used techniques at radioactive ion beam facilities to produce pure beams of exotic nuclei and measure the shape, size, spin and electromagnetic multipole moments of these nuclei. In such measurements, however, it is difficult to combine a high efficiency with a high spectral resolution. A significant improvement in the spectral resolution by more than one order of magnitude has recently been demonstrated without loss in efficiency by performing laser ionization spectroscopy of actinium isotopes in a supersonic gas jet [1], a new spectroscopic method [2] that is suited for high-precision studies of the ground- and isomeric-state properties of nuclei located at the extremes of stability.

Spatial constraints and limitations of the pumping system in the present setup prevented the formation of a high quality jet and, as a consequence, an optimal spatial and temporal laser-atom overlap. Offline characterization studies at the In-Gas Laser Ionization and Spectroscopy (IGLIS) laboratory at KU Leuven [3] are being carried to overcome these limitations in future experiments when dedicated IGLIS setups are in operation at new generation radioactive beam facilities [4]. These characterization studies include: the flow dynamics and the formation of supersonic jets produced by different gas-cell exit nozzles using the Planar Laser Induced Fluorescence (PLIF) technique on copper isotopes, gas-cell designs with better transport and extraction characteristics, an ion guide system for efficient transport of the photo-ions and a high-power, high-repetition rate laser system.

Extrapolation of the online results on the actinium isotopes show that the performance of the technique under optimum conditions can reach a final spectral resolution of about 100 MHz (FWHM) and an overall efficiency of 10% when applied in the actinide region.

In this presentation I will summarize a number of on-line results and mainly will focus on the characterization studies and future prospects of the in-gas-jet resonance ionization method applied on very-heavy elements.

References:
[1] R. Ferrer et al., Nat. Commun.8, 14520 doi: 10.1038/ncomms14520 (2017).
[2] Yu. Kudryavtsev, R. Ferrer, M. Huyse, P. Van den Bergh, P. Van Duppen, Nucl. Instr. Meth. B 297,7 (2013).
[3] Yu. Kudryavtsev et al., Nucl. Instr. Meth. B 376, 345 (2016).
[4] R. Ferrer et al., Nucl. Instr. Meth. B 317, 570 (2013).

Primary author: FERRER GARCIA, Rafael (KU Leuven (BE))

Co-authors: ZADVORNAYA, Alexandra (KU Leuven); Mrs VERSTRAELEN, Elise (KU Leuven-IKS); VERLINDE, Matthias (KU Leuven (BE)); Mr VAN DEN BERGH, Paul (KU Leuven-IKS); VAN DUPPEN, Piet (KU Leuven (BE)); Mr KRAEMER, Sandro (KU Leuven - IKS); SELS, Simon Mark C (KU Leuven (BE))

Presenter: FERRER GARCIA, Rafael (KU Leuven (BE))

Session Classification: Session 10 - Laser techniques

Track Classification: Ion traps and laser techniques