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In Gas Laser Ionization and Spectroscopy of neutron deficient 212-215Ac isotopes

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The In-Gas Laser Ionization and Spectroscopy (IGLIS) technique was employed at the LISOL facility to produce radioactive beams of high purity and obtain important information on the nuclear ground- and excited-state properties of, e.g., neutron deficient copper [1] and silver [2]isotopes.
Recent experiments on the actinide region have allowed us to efficiently produce beams of neutron deficient actinium isotopes from ^{212}Ac to ^{215}Ac, in the N=126 shell closure, and perform detailed in-gas-cell laser spectroscopy of the $^{2}D_{3/2} \rightarrow {}^{4}P_{5/2}$transition at 438 nm with a relative spectral resolution $\delta\nu/\nu$=1·10^{-5}.
Unlike in-gas cell laser spectroscopy studies, laser ionization in the low-temperature and low-density gas jet allows eliminating the pressure broadening thus improving the spectral resolution by, at least, one order of magnitude ($\delta\nu/\nu$=5·10^{-7}), as recently demonstrated in off-line experiments on the stable copper isotopes [3].

In the HELIOS laboratory, being commissioned at KU Leuven, the formation of supersonic gas jets using a de Laval nozzle will be investigated in off-line experiments in parallel to tests of a new gas cell design and the characterization of a new high-power high-repetition pulse rate laser system. Visualization of the jets by planar laser induced fluorescence will be carried out to determine the best experimental conditions to perform laser spectroscopy with an enhanced resolution in the new radioactive beam facility S^3 at SPIRAL2 [4].

Results on the isotope shifts and the magnetic moments of the actinium isotopes will be reported in this talk and a summary on the experimental activities to optimize the IGLIS technique at the offline HELIOS laboratory will be presented.

[1] T. E. Cocolios et al., Phys. Rev. Lett. 103 (2009) 102501.,
[2] R. Ferrer et al. Phys. Lett. B 728 (2014) 191.,
[3] Yu. Kudryavtsev et al., Nucl. Instr. Methods B 297 (2013) 7.,
[4] R. Ferrer et al. Nucl. Instr. Meth. B 317 (2013) 570.

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