IN-GAS-JET LASER SPECTROSCOPY OF NEUTRON-DEFICIENT ^{214,215}Ac ISOTOPES AND PROSPECTS FOR STUDIES OF THE ACTINIDE REGION

P. Van Duppen[1], B. Bastin[2], P. Delahaye[2], R. Ferrer[1], X. Flechard[2], S. Franchoo[5], L.P. Gaffney[1], C. Granados[1], R. Heinke[3], M. Huyse[1], T. Kron[3], Yu. Kudryavtsev[1], M. Laatiaoui[6], N. Lecesne[2], F. Luton[2], I. Moore[4], Y. Martinez[1], E. Mogilevskiy[1], P. Naubreit[2], J. Piot[2], S. Raeder[6], S. Rothe[7], H. Savajols[2], S. Sels[1], V. Sonnenschein[3], E. Traykov[2], P. Van den Bergh[1], K. Wendt[3], S. Zadvornaya[1]

[1] KU Leuven, B-3001 Leuven, Belgium, [2] GANIL, CEA/DSM-CNRS/IN2P3, 14076 Caen, France, [3] Institut für
Physik, Johannes Gutenberg Universität, 55128 Mainz, Germany, [4] JYFL, Department of physics, FI-40014
University of Jyväskylä, Finland, [5] Institute de Physique Nucléaire (IPN) d'Orsay, 91406 Orsay, Cedex, France, [6]
GSI-Darmstadt, Planckstraße 1, 64291 Darmstadt, Germany, [7] ISOLDE
RILIS

Laser spectroscopy studies provided charge radii, spins and nuclear moments, key ingredients to test and validate nuclear models. To perform laser spectroscopy on exotic nuclides, the highest efficiencies in combination with a high spectral resolution are required. The In-Gas Laser Ionization and Spectroscopy (IGLIS) technique whereby radioactive atoms stopped in a buffer gas cell and subsequently positioned in a supersonic gas jet produced by a de Laval nozzle are resonantly ionized using resonant, multistep laser ionization fulfills these requirements.

The in-gas jet laser ionization spectroscopy was recently proven in an on-line experiment at the Leuven Isotope Separator On-Line facility measuring the short-lived ^{214,215}Ac isotopes produced in the ^{22}Ne(^{197}Au,xn) reaction. The data obtained reveal a total spectral resolution of ~400 MHz. Thus, the isotope shifts as well as the hyperfine A- and B- parameters could be extracted and a firm spin assignment for the N=126 ^{215}Ac ($T_{1/2}$=0.17 s) and 214Ac was obtained. The results are compared to shell-model calculations and atomic physics calculations. A ~0.5 %total ionization efficiency that can be improved up to one order of magnitude by increasing the duty cycle was obtained. Further characterization and optimization of the technique is investigated at the off-line IGLIS laboratory, recently commissioned at KU Leuven. Here, the physical and technical limits of the IGLIS technique will be explored. This will ensure the best performance in spectral resolution and ionization efficiency for the future IGLIS setup linked to the Superconducting Separator Spectrometer (S3) at the new radioactive ion beam facility SPIRAL2 (GANIL).