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In-gas-jet spectroscopy of actinium isotopes

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To perform laser spectroscopy measurements of exotic nuclides at the borders of stability, highest efficiencies in combination with a high spectral resolution are required. In this contribution we report on the first on-line results reconciling these requirements by applying the In-Gas Laser Ionization and Spectroscopy (IGLIS) technique in the supersonic gas jet produced by a de Laval nozzle installed at the buffer gas cell exit at the Leuven Isotope Separator On-Line (LISOL) facility.
In the last years IGLIS was employed within the gas cell at the LISOL facility to measure magnetic moments of Cu [1] and Ag [2] isotopes. A typical spectral resolution of 5 GHz was obtained. The measurements were recently extended to the heavy mass region by resolving the hyperfine structure (HFS) of neutron deficient 212-215Ac [3]. Carrying out laser ionization in the low-temperature and low-density supersonic gas jet formed at the exit nozzle allows eliminating the pressure broadening thus improving significantly the spectral resolution [4].
A narrow bandwidth, high repetition rate laser system brought together from GANIL, Mainz University and JYFL has been used to investigate the HFS of the 438 nm atomic transition in 214,215Ac. The data obtained reveals a total spectral resolution of ~400 MHz. Thus, the isotope shifts as well as the hyperfine parameters are extracted with a 25-fold higher precision than obtained for these isotopes by in-gas-cell spectroscopy. Additionally, a better spin assignment for the N=126 nuclide 215Ac($T_{1/2}$=0.17 s) is possible. Moreover, the results show that the total ionization efficiency in the gas jet is comparable to that in the gas cell (~0.5%) and can potentially be improved up to one order of magnitude by increasing the duty cycle. Further characterization and optimization of the technique is investigated at the off-line IGLIS laboratory, being 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 [5] linked to the Superconducting Separator Spectrometer (S3) at the new radioactive ion beam facility SPIRAL2 (GANIL).

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

Primary author: Dr RAEDER, Sebastian (IKS, KU Leuven, B-3001 Leuven, Belgium)

Co-authors: BASTIN, B. (GANIL, CEA/DSM-CNRS/IN2P3 14076 Caen, France); GRANADOS, C. (KU Leuven); VAN BEVEREN, C. (KU Leuven); MOGILEVSKIY, E. (KU Leuven); TRAYKOV, E. (GANIL); LUTTON, F. (GANIL); SAVAJOLS, H. (GANIL); MOORE, I. (JYFL, Department of physics, FI-40014 University of Jyväskylä, Finland); PIOT, J. (GANIL); WENDT, K. (University of Mainz); GAFFNEY, L. (KU Leuven); GHYS, L. (KU Leuven); HIJAZI, L. (GANIL); BLOCK, M. (GSI, 64291 Darmstadt, Germany); HUYSE, M. (KU Leuven); LAATIAOUI, M. (GSI Darmstadt); LESCENE, N. (GANIL); CREEMERS, P. (KU Leuven); DELAHAYE, P. (GANIL); NAUBEREIT, P. (University of Mainz); VAN DEN BERGH, P. (KU Leuven); VAN DUPPEN, P. (KU Leuven); Dr FERRER, Rafael (KU Leuven); HEINKE, Reinhard (Institute of Physics, University of Mainz); FRANCHOO, S. (IPN Orsay, 91406 Orsay, Cedex, France); SAMBI, S. (KU Leuven); SELS, S. (KU Leuven); ZADVORNAYA, S. (KU Leuven); Dr ROTHE,

Sebastian (CERN, Geneva, Switzerland); KRON, T. (University of Mainz); SONNENSCHEIN, V. (University of Jyväskylä); FLECHARD, X. (GANIL); MARTINEZ, Y. (KU Leuven); Dr KUDRYAVTSEV, Yuri (KU Leuven)

Presenter: Dr RAEDER, Sebastian (IKS, KU Leuven, B-3001 Leuven, Belgium)

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