CRIS: a new method for isomeric beam production

K.M. Lynch,[1] J. Billowes,[1] I. Budincevic,[2] T.E. Cocolios,[1] R.P. De Groote,[2]
S. De Schepper,[2] K.T. Flanagan,[1] R.F. Garcia Ruiz,[2] H. Heylen,[2] B.A. Marsh,[3] G. Neyens,[2]
T.J. Procter,[1] S. Rothe,[4] G.S. Simpson,[5] A.J. Smith,[1] H.H. Stroke,[6] and K. Wendt[4]

[1]*School of Physics and Astronomy, The University of Manchester, Manchester, M13 9PL, United Kingdom*
[2]*Instituut voor Kern- en Stralingsfysica, KU Leuven, B-3001 Leuven, Belgium*
[3]*Engineering Department, CERN, CH-1211 Geneva 23, Switzerland*
[4]*Institut für Physik, Johannes Gutenberg-Universität Mainz, D-55128 Mainz, Germany*
[5]*LPSC, F-38026 Grenoble, France*
[6]*Department of Physics, New York University, NY, New York 10003, USA*

The Collinear Resonant Ionization Spectroscopy (CRIS) experiment at ISOLDE, CERN uses laser radiation to stepwise excite and ionize an atomic beam for the purpose of ultra-sensitive detection of rare isotopes, and hyperfine structure measurements [1]. The technique also offers the ability to purify an ion beam that is heavily contaminated with radioactive isobars, including the ground state of an isotope from its isomer [2], allowing sensitive secondary experiments to be performed.

A new program using the CRIS technique [4] to select only nuclear isomeric states for decay spectroscopy commenced last year [3]. The isomeric ion beam is selected using a resonance of its hyperfine structure, where it is deflected to a decay spectroscopy station (DSS) [5]. This consists of a rotating wheel implantation system for alpha and beta decay spectroscopy, and up to three germanium detectors around the implantation site for gamma-ray detection.

Laser spectroscopy provides a measurement of the spin, moments and change in mean square charge radii of the ground and isomeric states in the parent nucleus. Complementary information on the level structure of the daughter nucleus comes from the decay spectroscopy, thus providing a wealth of information on the isotope under investigation.

Resonant ionization laser spectroscopy and the new technique of laser assisted decay spectroscopy have recently been performed at the CRIS beam line on the neutron-deficient francium isotopes. Here the latest results from our experimental campaign will be presented, alongside an overview of the CRIS beam line and the DSS.

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[1] K.T. Flanagan *et al.*, CERN-INTC-2008-010 INTC-P-240 CERN, Geneva (2008).
[2] V.S. Letokhov, Opt. Commun. **7** 1 59-60 (1973)
[3] K.M. Lynch *et al.*, Journal of Physics: Conference Series **381** 1 012128 (2012)
[4] T.J. Procter *et al.*, Journal of Physics: Conference Series **381** 1 012070 (2012)
[5] M.M. Rajabali *et al.*, Submitted to Nucl. Inst. and Meth. Phys. B (2012)