Contribution ID: **56** Type: **Contributed talk**

In-Source Laser Spectroscopy with the Laser Ion Source and Trap for the Study of Neutron-Rich Polonium

Friday, 12 June 2015 11:30 (20 minutes)

At the isotope separator facility ISOLDE, the Laser Ion Source and Trap (LIST) unit is now applied routinely for the production of ultra-high purity ion beams of neutron-rich polonium isotopes [1]. The LIST significantly reduces the remaining amount of unwanted surface-ionized contaminants in radioactive ion beams produced by the Resonance Ionization Laser Ion Source (RILIS) [2]. For this purpose, it involves an electrostatic ion-repeller electrode and a radiofrequency-quadrupole ion-guide structure, which is coupled to the ISOLDE thick-target assembly immediately downstream of the hot cavity [3,1].

On-line application of the LIST offers two modes of operation:
In so-called LIST mode, a positive potential at the repeller electrode prevents any ions from leaving the hot atomizer cavity and entering the RFQ. Correspondingly, selective ionization by the RILIS lasers exclusively takes place on neutral atoms, which have diffused into the LIST cavity. This way, an increase in selectivity of more than a factor of 1000, associated with an acceptable reduction of laser-ionization efficiency of only a factor of 20 has been achieved [1].
In ion-guide mode, a negatively charged repeller even favors the passage of ions into the RFQ and, in terms of efficiency and selectivity, guarantees a similar performance to that of the standard RILIS configuration.

Application of the LIST at ISOLDE enabled studies on the previously inaccessible neutron-rich isotopes 217,219Po. Laser-spectroscopy directly inside the LIST revealed the hyperfine structure and isotope shift of 217Po, which contributes to the understanding of octupole nuclei above Z=82 and N=126 [4], while nuclear spectroscopy was performed on 219Po for the first time [5].

A summary of the LIST technology and the results of these on-line experiments are given, together with an outlook for the planned future applications and on-going modifications and upgrades of the LIST.

[1] D. A. Fink, S.D. Richter et al. NIMB 344 83 (2015)
[2] V. N. Fedosseev, Yu. Kudryavtsev, and V. I. Mishin, Phys. Scr. 85, 058104 (2012).
[3] K. Blaum et al. NIMB 204 331 2003
[4] L. P. Gaffney, Nature 497, 199 (2013)
[5] D. A. Fink. T. E. Cocolios et al. PRX 5, 011018 (2015)

Primary author: Dr FINK, Daniel (CERN)

Co-authors: Dr BARZAKH, Anatoly (Petersburg Nuclear Physics Institute, Russia); Prof. ANDREYEV, Andrei (University of York, United Kingdom); Dr BASTIN, Beyhan (GANIL, France); Dr MARSH, Bruce (CERN, Switzerland); Mrs VAN BEVEREN, Celine (KU Leuven, Belgium); Dr PAUWELS, Dieter (KU Leuven, Belgium); Dr FEDOROV, Dimitry (Petersburg Nuclear Physics Institute, Russia); Dr RAPISARDA, Elisa (CERN, Switzerland); Dr VALENTIN, Fedosseev (CERN, Switzerland); Prof. MARK, Huyse (KU Leuven, Belgium); Dr LYNCH, Kara (CERN, Switzerland); Dr FLANAGAN, Kieran (University of Manchester, United Kingdom); Prof. BLAUM, Klaus (Max--Planck-Institut für Kernphysik, Heidelberg, Germany); Prof. WENDT, Klaus (University of Mainz, Germany); Mr GHYS, Lars (KU Leuven, Belgium); Dr SJOEDIN, Marica (GANIL, France); Dr LECESNE, Nathalie (GANIL, France); Dr IMAI, Nobuaki (KEK, Japan); Prof. VAN DUPPEN, Piet (KU Leuven, Belgium); Mr ROSSEL, Ralf (CERN, Switzerland); Mr HEINKE, Reinhard (University of Mainz, Germany); Dr ROTHE, Sebastian (CERN, Switzerland); Dr MAXIM, Seliverstov (Petersburg Nuclear Physics Institute, Russia); Dr ANTALIC, Stanislav (Comenius University Bratislava, Slovakia); Mr RICHTER, Sven (University of Mainz, Germany); Dr STORA, Thierry (CERN, Switzerland); Mr KRON, Tobias (University of Mainz, Germany)

Presenter: Dr FINK, Daniel (CERN)

Session Classification: Instrumentation and Fundamental interactions

Track Classification: Production and manipulation of RIB