

## MS 3: Resonance Ionization MS, ICPMS and others II

Time: Monday 16:30–17:45

Location: V57.06

## Invited Talk

MS 3.1 Mon 16:30 V57.06

**The resonance ionization laser ion source RILIS - leading all-rounder of on-line ion sources** — ●SEBASTIAN ROTHE<sup>1,2</sup>, VALENTIN FEDOSSEEV<sup>1</sup>, DANIEL FINK<sup>1</sup>, RALF ROSSEL<sup>1,2,3</sup>, MAXIM SELIVERSTOV<sup>1</sup>, and KLAUS WENDT<sup>2</sup> — <sup>1</sup>CERN, Geneva, Switzerland — <sup>2</sup>Institut für Physik, Uni Mainz, Germany — <sup>3</sup>Hochschule Rhein-Main, Wiesbaden, Germany

The resonance ionization laser ion source (RILIS) of the on-line isotope separator facility ISOLDE at CERN, is based on the method of step-wise resonant laser excitation and ionization of atoms. The element selectivity of the RILIS complements the mass selection process of the ISOLDE separator magnets to provide high purity ion beams of many isotopes. The RILIS, which now includes two complementary and independent tunable laser systems (dye and titanium:sapphire lasers), has been significantly improved since its first demonstration of selective ionization of Yb isotopes in 1992. Today, on account of the high degree of selectivity for the 27 elements now offered, the annual operation of RILIS exceeds 2500 h, making it the most versatile and commonly used ion source at ISOLDE. The use of a narrow band dye laser enables precision in-source laser spectroscopy of isotope shifts and hyperfine structures of isotopes far from stability as well as the production of isomer pure beams as has been demonstrated for Ag, Cu, Pb, Bi, Po, and Tl. A recent upgrade of the RILIS comprises the incorporation of a complementary all solid state laser system as well as the Laser Ion Source Trap (LIST), which greatly enhances selectivity by suppressing any surface ionized isobars.

MS 3.2 Mon 17:00 V57.06

**Performance of a high repetition rate pulsed laser system for in-jet laser ionization and spectroscopy studies in the Leuven laser ion source, LISOL** — ●VOLKER SONNENSCHNEIN<sup>1</sup>, RAFAEL FERRER<sup>2</sup>, MARK HUYSE<sup>2</sup>, TOBIAS KRON<sup>3</sup>, YURI KUDRYAVTSEV<sup>2</sup>, NATHALIE LECESNE<sup>4</sup>, IAIN MOORE<sup>1</sup>, JOHANNES ROSSNAGEL<sup>3</sup>, SEBASTIAN RAEDER<sup>5</sup>, HERVE SAVAJOLS<sup>4</sup>, PAUL VAN DEN BERGH<sup>2</sup>, PIET VAN DUPPEN<sup>2</sup>, and KLAUS WENDT<sup>3</sup> — <sup>1</sup>University of Jyväskylä, Finland — <sup>2</sup>Instituut voor Kern- en Stralingsfysika, Katholieke Universiteit Leuven — <sup>3</sup>Institut für Physik, Universität Mainz — <sup>4</sup>GANIL, Caen, France — <sup>5</sup>TRIUMF, Vancouver, Canada

The laser ionization efficiency of the Leuven gas cell-based laser ion source at the LISOL facility was investigated under on- and off-line conditions using two distinctly different laser systems - a medium repetition rate dye laser system (200 Hz) as well a high repetition rate Ti:sapphire laser system (10 kHz). A systematic study of the ion signal dependence on repetition rate and laser pulse energy was performed in off-line tests on stable cobalt and copper isotopes. Off-line studies also included high resolution in-jet laser spectroscopy measurements of the hyperfine structure of <sup>63</sup>Cu and the investigation of laser ion pulse time profiles.

A final on-line run with the short-lived radioisotope <sup>59</sup>Cu showed a very comparable yield from the two laser systems for in-cell ionization, however, a considerable advantage of using the high-repetition rate system for in-jet laser ionization within the sextupole extraction structure could be demonstrated.

MS 3.3 Mon 17:15 V57.06

**High Resolution Mass Identification with Calorimetric Low Temperature Detectors** — ●ARTUR ECHLER<sup>1,2</sup>, ALEXANDER BLEILE<sup>1,2</sup>, PETER EGELHOF<sup>1,2</sup>, STOYANKA ILIEVA<sup>1</sup>, SASKIA KRAFT-BERMUTH<sup>3</sup>, JAN PATRICK MEIER<sup>1</sup>, and MANFRED MUTTERER<sup>1</sup> — <sup>1</sup>GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — <sup>2</sup>Johannes Gutenberg Universität, Mainz, Germany — <sup>3</sup>Justus-Liebig-Universität, Gießen, Germany

Calorimetric low temperature detectors (CLTD's) for heavy-ion detection provide, as compared to conventional ionisation detectors, due to their detection principle, substantial advantages in detector performance, such as energy resolution and linearity, etc. The absence of any pulse height defect makes them an ideal tool for detection of low energetic heavy ions. CLTD's have been frequently demonstrated to achieve an excellent relative energy resolution of  $\Delta E/E = 1-2 \times 10^{-3}$  in a wide range of ions and energies. The combination of CLTD's as high resolution energy detectors with time-of-flight (ToF) detectors provides a detector system for high resolution mass identification of low energetic heavy ions. Possible applications are, among others, the mass identification of superheavy elements, of heavy fission products, or of reaction products in experiments with radioactive beams. Recent experiments with an array of 8 CLTD-pixels with a total active area of  $12 \times 6 \text{ mm}^2$  combined with a ToF-detector have shown a mass resolution of  $\Delta m$  (FWHM) = 1.3 amu for <sup>238</sup>U-ions in an energy range of 65 - 150 MeV. These and other results from experiments with various ions and energies will be presented and discussed.

MS 3.4 Mon 17:30 V57.06

**First Performance Results of a Mobile High-Resolution MR-TOF Mass Spectrometer for in-situ Analytical Mass Spectrometry** — ●JOHANNES LANG<sup>1</sup>, TIMO DICHEL<sup>1,2</sup>, WOLFGANG PLASS<sup>1,2</sup>, JENS EBERT<sup>1</sup>, HANS GEISSEL<sup>1,2</sup>, EMMA HAETTNER<sup>1,2</sup>, MIKHAIL YAVOR<sup>3</sup>, and CHRISTOPH SCHEIDENBERGER<sup>1,2</sup> — <sup>1</sup>II. Physikalisches Institut, JLU Giessen — <sup>2</sup>GSI, Darmstadt — <sup>3</sup>RAS St. Petersburg

A mobile multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) has been designed, built and commissioned. While other mobile mass spectrometers are restricted to low or medium mass resolving power, this MR-TOF-MS allows for the first time for a mass resolving power exceeding 100,000 and a sub ppm accuracy in a transportable format. It can thus resolve isobars and enables to accurately determine the composition and structure of biomolecules. An atmospheric pressure interface provides compatibility to various atmospheric ion sources. The mass spectrometer part comprises an RFQ mass filter, ion cooler, ion trap, time-of-flight analyzer and detector. Supply electronics, DAQ and control system are mounted together with the spectrometer into a single frame with a total volume of only 0.8m<sup>3</sup>. First results with the MR-TOF-MS will be presented, and an overview of envisaged life science applications will be given, such as real-time tissue recognition in electrosurgery, identification of mycotoxins and analysis of soil samples for environmental studies.