

## MS 8: Accelerator Mass Spectrometry II

Time: Thursday 14:00–15:15

Location: H3

MS 8.1 Thu 14:00 H3

**Status of the Project LISEL@DREAMS** — ●OLIVER FORSTNER<sup>1,2,3</sup>, THOMAS WEBER<sup>1</sup>, VADIM GADELISHIN<sup>4</sup>, KURT STIEBING<sup>5</sup>, DOMINIK STUDER<sup>4</sup>, and KLAUS WENDT<sup>4</sup> — <sup>1</sup>Friedrich-Schiller-Universität Jena, Jena — <sup>2</sup>Helmholtz-Institut Jena, Jena — <sup>3</sup>GSI Helmholtzzentrum, Darmstadt — <sup>4</sup>Johannes Gutenberg-Universität Mainz, Mainz — <sup>5</sup>Goethe-Universität Frankfurt, Frankfurt

The LISEL setup (Low-energy Isobar SEparation by Lasers) is currently being built at the University of Jena in the framework of a BMBF funded project. It comprises a gas-filled radio frequency quadrupole cooler where negative ions will be slowed down to thermal energies and overlapped with a laser beam. This allows an elemental selective suppression of isobars by laser photodetachment by careful selection of the photon energy. The tuneable Ti:Sapphire laser system is currently being developed at the University of Mainz. After commissioning the setup LISEL will be transferred to the DREAMS (DREsdn AMS) facility at the Helmholtz Center Dresden Rossendorf (HZDR).

To get the required spectroscopic data especially for negative molecular ions a measurement program is currently being established at the low-energy electrostatic storage ring FLSR at the University of Frankfurt. This allows to study vibrationally cold molecules and acquire photodetachment data to establish further suppression schemes. This allows to study currently unavailable new isotopes and extends AMS to many new applications.

MS 8.2 Thu 14:15 H3

**A new radio frequency quadrupole ion cooler for Accelerator Mass Spectrometry** — ●MARKUS SCHIFFER<sup>1</sup>, OSCAR MARCHHART<sup>2</sup>, SUSAN HERB<sup>1</sup>, MARTIN MARTSCHINI<sup>2</sup>, ROBIN GOLSER<sup>2</sup>, and ALFRED DEWALD<sup>1</sup> — <sup>1</sup>University of Cologne, Institute for Nuclear Physics, Germany — <sup>2</sup>University Vienna, Faculty of Physics, Vienna Environmental Research Accelerator (VERA), Austria

Ion Laser Interaction Mass Spectrometry (ILIAMS) has demonstrated a high isobar suppression capability for a variety of radionuclides by selective laser photodetachment of decelerated ion beams in a gas-filled radio frequency quadrupole cooler (RFQ). Furthermore, the admixture of O<sub>2</sub> gas to the helium buffer gas has revealed an impressively high isobar suppression, larger 10<sup>5</sup> in the case of <sup>90</sup>Sr/<sup>90</sup>Zr, at the Vienna Environmental Research Accelerator (VERA), even without the use of the laser. Therefore, we started to develop a radio frequency quadrupole cooler designed for the deceleration and trapping of ion beams with high beam emittance like heavy molecular anions, e.g. <sup>90</sup>SrF<sub>3</sub>. The new ion cooler will be used with gas reactions and is intended to be improved by the addition of a laser in a later phase. This contribution will present details of the RFQ, like the ion optic calculation of the injection electrodes and the guiding field. Different guiding field structures will be compared by the calculation of multipole expansion coefficients. Additionally, a radio frequency resonance tuning and impedance matching system for heavy radionuclide applications will be presented.

MS 8.3 Thu 14:30 H3

**Relative Formation Probabilities for Fluoride and Oxyfluoride Anions of U, Np, Pu and Am in Accelerator Mass Spectrometry Measurements at VERA** — ●ANDREAS WIEDERIN<sup>1</sup>, ROBIN GOLSER<sup>1</sup>, KARIN HAIN<sup>1</sup>, MICHAEL KERN<sup>1</sup>, AYA SAKAGUCHI<sup>2</sup>, and PETER STEIER<sup>1</sup> — <sup>1</sup>University of Vienna, Faculty of Physics - Isotope Physics — <sup>2</sup>University of Tsukuba, Faculty of Pure and Applied Science

The relative formation probabilities for a range of (oxy-)fluoride molec-

ular anions of uranium, neptunium, plutonium, and americium during the sputtering process in an AMS ion source from an iron oxide matrix mixed with PbF<sub>2</sub> have been systematically investigated at VERA. Identifying this distribution is an important step towards the separation of U and Np isobars via element selective photodetachment and reactive gases in the ILIAMS ion-cooler. A suitable choice of extracted molecular anions can be used to suppress U by an order of magnitude compared to Np. Finally, the distribution and in particular the AF<sub>4</sub><sup>-</sup> to AF<sub>5</sub><sup>-</sup> ratio can help to identify isobaric contaminations for the mentioned actinides. This method was used to estimate the co-production of <sup>236</sup>U during Th irradiation which is considered for the production of <sup>236</sup>Np, a potential isotopic spike for <sup>237</sup>Np.

MS 8.4 Thu 14:45 H3

**Increasing the ionization yield for the detection of <sup>236</sup>U and <sup>233</sup>U by AMS** — ●MICHAEL KERN, KARIN HAIN, PETER STEIER, ANDREAS WIEDERIN, and ROBIN GOLSER — University of Vienna, Faculty of Physics - Isotope Physics, Vienna, Austria

The detection efficiency of Accelerator Mass Spectrometry for uranium isotopes <sup>236</sup>U or <sup>233</sup>U is mainly limited by the rather low yield of the corresponding negative ions extracted from a caesium sputter ion source ( $\approx 10^{-4}$ ). With our new sample preparation method environmental U is embedded in only 200  $\mu$ g Fe<sub>2</sub>O<sub>3</sub> matrix which is then mixed with PbF<sub>2</sub>. Extracting U as UF<sub>5</sub><sup>-</sup> instead of UO<sup>-</sup> yields an improvement in detection efficiency of up to a factor of 10. Thus significantly shortened measurement duration can be obtained, while maintaining the same statistical uncertainty. UF<sub>5</sub><sup>-</sup> extraction seems advantageous for the suppression of molecular isobaric background (<sup>233</sup>ThH<sup>3+</sup>, <sup>233</sup>UH<sup>3+</sup>) and allows operation at lower He stripper gas pressure. This presentation will give detailed insights on the new sample preparation as well as ion current characteristics and method verification.

MS 8.5 Thu 15:00 H3

**Low-level <sup>166m</sup>Ho measurements with AMS for the ECHO-project** — ●GEORG RUGEL<sup>1</sup>, SEBASTIAN BERNDT<sup>2</sup>, CHRISTOPH E. DÜLLMANN<sup>2,3,4</sup>, HOLGER DORRER<sup>2</sup>, OLIVER FORSTNER<sup>5,6</sup>, TOM KIECK<sup>2,7</sup>, NINA KNEIP<sup>2,7</sup>, JOHANNES LACHNER<sup>1</sup>, SILKE MERCHEL<sup>1,8</sup>, CARLOS VIVO-VILCHES<sup>1</sup>, ANTON WALLNER<sup>1</sup>, and KLAUS WENDT<sup>7</sup> — <sup>1</sup>Accelerator Mass Spectrometry and Isotope Research, Helmholtz-Zentrum Dresden-Rossendorf, Dresden — <sup>2</sup>Department of Chemistry, Johannes Gutenberg University, Mainz — <sup>3</sup>GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — <sup>4</sup>Helmholtz Institute Mainz, Mainz — <sup>5</sup>Friedrich-Schiller-University Jena — <sup>6</sup>Helmholtz Institute Jena, Jena — <sup>7</sup>Institute of Physics, Johannes Gutenberg University — <sup>8</sup>Isotope Physics, Faculty of Physics, University of Vienna, Vienna, Austria

The Electron Capture in <sup>163</sup>Ho experiment (ECHO) aims at measuring the mass of  $\nu_e$  by analysing the EC spectrum of the long-lived radionuclide <sup>163</sup>Ho ( $T_{1/2} = 4570$  a) with a metallic magnetic calorimeter (MMC). For the determination of a reasonable upper limit for the neutrino mass it is mandatory to keep any contamination with the long-lived radionuclide <sup>166m</sup>Ho nine orders of magnitude below the <sup>163</sup>Ho content. The ion-implantation of ultra-pure <sup>163</sup>Ho into a MMC for the experiment is carried out by the RISIKO mass separator. The separation from <sup>166m</sup>Ho, however, cannot be quantified to such low levels as needed. Here we present our approach to determine the corresponding low isotopic ratio with accelerator mass spectrometry (AMS). This requires the formation of negative ions, we find the highest negative ion yield for the anion HoO<sub>2</sub><sup>-</sup>. For first tests <sup>165</sup>Ho was implanted by RISIKO in various metal foils and we obtained results for the Ho detection efficiency. This allows for extrapolations for the expected measurement limit of the <sup>166m</sup>Ho/<sup>163</sup>Ho ratio.