MS 7: New Developments and Techniques

Time: Wednesday 15:00–15:45 Location: U A-Esch 2

MS 7.1 Wed 15:00 U A-Esch 2

Towards the Ion Mobility Measurement of Actinides — •Elisabeth Rickert[1,2], Hartmut Backe[2], Michael Block[1,2,3], Christoph E. Düllmann[1,2,3], Tobias Kron[1,3], Mustapha Laatiaoui[1,2], Werner Lauth[2], Steffen Lohse[1], Sebastian Raeder[1,3], and Fabian Schneider[1,2] — [1]Helmholtz-Institut Mainz — [2]Johannes Gutenberg-Universität Mainz — [3]GSI Helmholtzzentrum für Schwerionenforschung

Ion mobility measurements are a powerful tool to investigate ion-atom interaction potentials. Their sensitivity to the electronic configuration has been demonstrated for many elements across the periodic table. Especially for heavy elements, the impact of relativistic effects on the electronic configuration may lead to deviations in the periodicity, hence to distinct ion mobilities. This opens up a new niche for isobaric purification and element identification in the research of actinides and transactinides. Systematic ion mobility spectrometry measurements performed in the lanthanides [1] are being extended to the actinides. Resonant two-step laserionization will provide an element-selective ion production from a sample filament in argon gas and thus ensure an element-selective detection. In the talk, the experimental approach, the first results and the future plans are presented.

[1]: Laatiaoui, M. et al., EPJD (2012) 66:232

MS 7.2 Wed 15:15 U A-Esch 2

A new gas-jet setup for laser spectroscopy of superheavy elements — •Steven Nothhelfer[1,3], Michael Block[1,2,3], Rafael Ferrer[4], Tobias Kron[2,3], Sebastian Raeder[2,3], Fabian Schneider[1,3], Piet Van Duppen[4], and Elise Verstraelen[4] — [1]Institut für Kernchemie, Johannes Gutenberg-Universität, Mainz, DE — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, DE — [3]Helmholtz-Institut Mainz, DE — [4]Instituut voor Kern- en Stralingsfysica, KU Leuven, Leuven, Belgium

Experimental data on the hyperfine structure in superheavy elements (SHE) is important to obtain valuable information about their nuclear structure. In addition, the atomic properties of SHE are of special interest because they are difficult to predict by theoretical calculations due to complex relativistic effects. Therefore, a new gas-jet experiment is being developed, which aims to enable precise investigation of electronic states of rare atoms with the use of laser spectroscopy in a supersonic gas-jet. The study of SHE is realized by stopping fusion evaporation residues in a buffer gas cell after their production and separation at SHIP at GSI, Darmstadt. Subsequently, the fusion evaporation residues are transferred into a supersonic gas-jet, which is produced by a de Laval-nozzle. Laser spectroscopy in this jet enables a higher resolution compared to the previous RADRIS setup, resulting in spectral linewidths of few hundred MHz, granting access to valuable information on nuclear moments and spins which can be derived from the hyperfine structure and isotope shifts. This talk will summarize the current status of the experiment.

MS 7.3 Wed 15:30 U A-Esch 2

Studies of lanthanide desorption enthalpies and filament work functions for laser spectroscopic investigations of the heaviest actinides — •Tobias Murböck[1,2], Brankica Andelić[1,3], Michael Block[1,2,4], Premaditya Chhetri[5], Julia Even[3], Francesca Giacoppo[2], Oliver Kaleja[2,4,6], Tobias Kron[1,2], Mustapha Laatiaoui[4], Andrew Mistry[1,2], Steven Nothhelfer[4], Sebastian Raeder[2], Elisabeth Rickert[4], and Fabian Schneider[4] — [1]HI Mainz — [2]GSI — [3]KVI-CART, RU Groningen — [4]Uni Mainz — [5]TU Darmstadt — [6]MPIK Heidelberg

To probe the atomic shell structure of the heaviest actinides with $Z > 100$, the sensitive RAdiation Detected Resonance Ionization Spectroscopy (RADRIS) technique is applied at the SHIP velocity filter at GSI. After production in high-energy fusion-evaporation reactions the recoil products are stopped in a buffer-gas cell and collected onto a filament. Subsequent thermal evaporation as neutral atoms allows the atomic structure to be probed using laser spectroscopy. The desorption enthalpy of these elements and the filament work function are crucial for determining the efficiency of the evaporation and the background created by surface ions, respectively. In this talk, a setup for mass spectrometry of surface ionized and laser ionized lanthanides evaporated from different sample filaments is presented. The desorption enthalpies of ytterbium and lutetium from a larger variety of surfaces are discussed with regard to the prospects of laser-spectroscopic investigations of their heavier homologes, nobelium ($Z = 102$) and lawrencium ($Z = 103$).