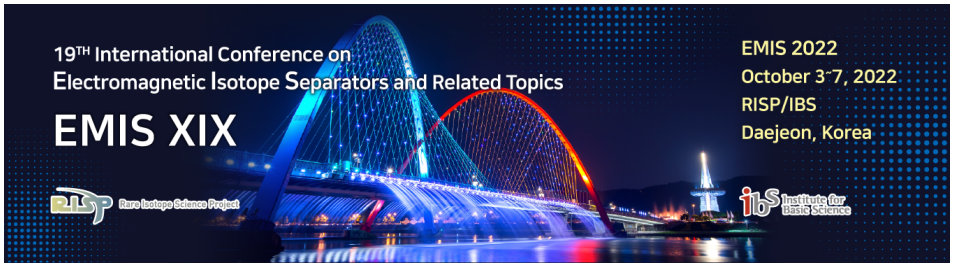

Contribution ID: **96** Type: **Poster Session**

Extending the reach of the mass spectrometer SHIPTRAP towards superheavy elements

Tuesday, October 4, 2022 8:16 PM (8 minutes)

The ultimate boundary of existence of chemical elements remains an open question. The heaviest elements known to date, called Superheavy Elements (SHEs, with $Z > 103$), owe their existence to the stabilizing effect of nuclear shells, which counteracts the strong Coulomb repulsion that would otherwise cause their immediate fission. The SHIPTRAP mass spectrometer, placed behind the SHIP separator at GSI (Darmstadt, Germany), has been used to measure the masses of several isotopes of elements up to dubnium and, through these, to study the evolution of the shell gaps in the region around $Z = 100$ and $N = 152$. Thanks to mass resolving powers of over 10^7 it was also possible to resolve and to characterize several low-lying long-lived isomeric states. Lighter nuclides were studied as well, allowing, for example, the identification of a predicted isomer in californium-241 and the study of the alpha-decay chains stemming from francium-206 and 204, where some previously uncertain isomeric excitation energies have been determined.

The shell-structure investigations of the heaviest nuclides can be complemented by mass measurements of long-lived actinide isotopes. Recently, uranium and plutonium isotopes obtained by laser ablation from drop-on-demand targets have been studied. These measurements included a detailed study of systematic uncertainties in mass measurements for cases with large mass-to-charge ratio differences to the closest suitable reference ion. These problems could be circumvented if the actinide ions were available as doubly charged atomic ions. In that case, stable isotopes from tin or cesium, whose masses are well known, could be used as references.

In this contribution, the latest mass measurements obtained at SHIPTRAP will be presented. In addition, the long-term efficiency of the setup will be addressed. This is fundamental for the study of even heavier nuclei, produced with lowest rates. Furthermore, the development of a compact gas cell to extract doubly-charged actinides (emitted from a radioactive recoil source placed inside the active gas volume) will be introduced.

Primary authors: GUTIÉRREZ, Manuel J. (GSI / HIM); ANDELIC, Brankica (GSI / University of Groningen); ARCILA GONZÁLEZ, Luisa (University of Groningen); BERROCAL, Joaquín (Universidad de Granada); BLAAUW, Lennart (University of Groningen); BLAUM, Klaus (MPIK); BLOCK, Michael (GSI / HIM / JGU Mainz); CHAUVEAU, Pierre (GANIL); CHENMAREV, Stanislav (MPIK / HIM / PNPI); DÜLLMANN, Christoph E. (GSI / HIM / JGU Mainz); EIBACH, Martin (GSI); EVEN, Julia (University of Groningen); FILIANIN, Pavel (MPIK); GIACOPPO, Francesca (GSI / HIM); HESSBERGER, Fritz P. (GSI / HIM); KALANTAR-NAYESTANAKI, Nasser (University of Groningen); KALEJA, Oliver (GSI / HIM / MPIK / University of Greifswald); KANIKA (GSI / University of Heidelberg); VAN DE LAAR, Jacques J.W. (GSI / HIM / JGU Mainz); LAATIAOUI, Mustapha (HIM / JGU Mainz); LOHSE, Steffen (GSI / HIM / JGU Mainz); MINAYA RAMÍREZ, Enrique (ICJLab / CNRS, UPS); MISTRY, Andrew (GSI); MORIN, Elodie (ICJLab / CNRS, UPS); NECHIPORENKO, Yury (PNPI / Saint Petersburg State University); NEIDHERR, Dennis (GSI); NOTHHELFER, Steven (GSI / HIM / JGU Mainz); NOVIKOV, Yuri (PNPI / Saint Petersburg State University); QUINT, Wolfgang (GSI / University of Heidelberg); RAEDER, Sebastian (GSI / HIM); RENISCH, Dennis (HIM / JGU Mainz); RICKERT, Elisabeth (HIM / JGU Mainz); RODRÍGUEZ, Daniel (Universidad de Granada); ROY, Niladri (GSI / ELEMENTS Cluster/ JGU Mainz); SCHWEIKHARD, Lutz (University of Greifswald); THIROLF, Peter G. (LMU Munich); WARBINEK, Jessica (GSI / HIM / JGU Mainz); YAKUSHEV, Alexander (GSI / HIM)

Presenter: GUTIÉRREZ, Manuel J. (GSI / HIM)

Session Classification: Poster Session