



Contribution ID: 230

Type: Poster

## Studies of Highly Charged Ion Ensembles in the ARTEMIS trap and Direct Mass Measurements of Radio-nuclides at SHIPTRAP at GSI, Germany

*Tuesday, 26 September 2023 21:10 (20 minutes)*

Penning traps are high-precision tools for mass spectrometry and spectroscopy experiments. Two such experiments based on Penning traps at the GSI Helmholtz Centre for Heavy Ion Research are: ARTEMIS and SHIPTRAP. The ARTEMIS Penning trap experiment aims to measure the magnetic moment of an electron bound to heavy, highly charged ions using the laser-microwave double-resonance spectroscopy technique with  $10^{-9}$  level of accuracy. These high-precision  $g$ -factor measurements would be the most stringent test of QED in the limits of extreme electromagnetic fields of the nucleus.  $^{40}\text{Ar}^{13+}$  is the first candidate for these high-precision measurements followed by  $^{209}\text{Bi}^{82+}$ . In order to perform the double-resonance spectroscopy, a pure cooled cloud of  $\text{Ar}^{13+}$  ions needs to be prepared in the spectroscopy trap of ARTEMIS.

The SHIPTRAP mass spectrometer enables high-precision measurements of superheavy and exotic nuclei with rather short half-lives of about 200\,ms and above. These mass measurements are performed using the phase-imaging ion-cyclotron-resonance technique. This talk will present the studies of highly charged argon ions produced in ARTEMIS and high-precision mass measurements of radio-nuclides obtained from the recoil-ion sources:  $^{225}\text{Ac}$  and  $^{223}\text{Ra}$ , installed in the cryogenic gas cell of SHIPTRAP.

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**Session Classification:** Tuesday Poster