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# High-precision mass spectrometry of ground states and low-lying isomers in heavy and superheavy nuclei with SHIPTRAP

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A comprehensive understanding of the heaviest elements requires detailed studies of the quantum mechanical nuclear shell effects which determine regions of enhanced shell stabilization and allow the very own existence of such heavy nuclides as bound systems. Investigations of the nuclear structure evolution for different proton to neutron ratios around the deformed neutron shell gap at N=152 are ongoing by applying Penning-Trap Mass Spectrometry (PTMS) with the SHIPTRAP setup. Such investigations at the upper limit of the nuclear chart will provide information for a better understanding of the nature of the underlying strong interaction and will help to constrain predictions attempting to pinpoint the position of the island of stability.

During the last experimental campaigns (2018, 2020 and 2021) the masses of $^{251}$No and $^{254}$Lr have been directly measured for the first time with the mass spectrometer SHIPTRAP at GSI. In addition, the excitation energies of the long-lived, low-lying isomeric states $^{251m}$No and $^{254m,255m}$Lr have been determined with high accuracy applying the Phase-Imaging Ion-Cyclotron-Resonance (PI-ICR) technique. With its supreme mass resolving power, the PI-ICR technique is established as a complementary tool to decay spectroscopy in the region of the heaviest elements. Furthermore, the high sensitivity of the PI-ICR technique allowed a first direct mass measurement of the ground state and the 11/2- metastable state of $^{257}$Rf at a rate of few detected ions per day. These results have been accomplished thanks to careful investigations and improvements of the efficiency of the SHIPTRAP setup: in an online run in February 2020, the rate of $^{257}$Rf extracted from the cryogenic gas cell was increased by about an order of magnitude. Such efficiency boost opened the door to a fist investigation in May 2021 of the more exotic superheavy nuclide $^{258}$Db (Z=105) available at even lower yields.

In this contribution an overview of the recent experimental campaigns will be given.