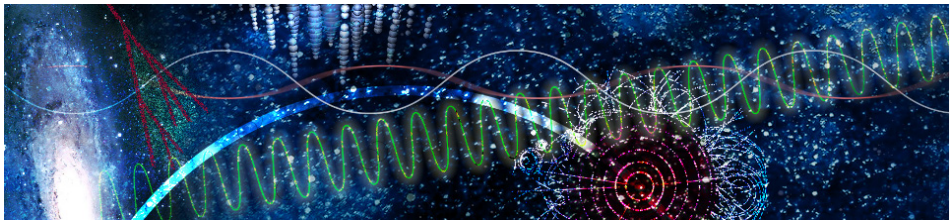

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Discovery of isotopes and broadband high precision mass measurements of neutron-deficient light lanthanides

Approaching the limits of nuclear binding, the structure and properties of drip-line nuclei is of great interest and draws a lot of attention from both, experiment and theory. The nuclear properties in the light lanthanide region are shaped by the interplay between large beta-decay Q-values, low or negative proton separation energies, and the confining effects of the Coulomb barrier. From precise mass values, differential quantities, such as the proton and neutron separation energies, can be determined, and different phenomena, including a variety of beta-delayed particle emission channels, proton radioactivity, and two-proton radioactivity as well as exotic pairing phenomena, can be addressed.
Nuclei in the region north-east of Sn-100 were produced at relativistic energies and separated in-flight with the fragment separator FRS at GSI/FAIR. They were identified by their proton number and mass-to-charge ratio in the FRS, before being slowed down, thermalized in the cryogenic stopping cell (CSC) of the FRS Ion Catcher and transported to a multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) for high-resolution mass measurements.
In this FAIR Phase-0 experiment, new isotopes towards the proton drip-line could be identified by the FRS particle identification. The masses of more than 10 nuclides were measured for the first time with the FRS Ion Catcher setup, and the mass uncertainties of more than 10 nuclides were significantly reduced. These results give insight into the nuclear structure and pin down the exact location of the proton drip-line all the way up to Lu.

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