Contribution ID: **202** Type: **Poster contribution**

A novel method for deriving decay-energies of unbound isotopes by measurement of longitudinal momenta of their heavy-ion recoils

Tuesday, 21 October 2025 19:44 (1 minute)

In-flight decay spectroscopy is an experimental method that involves observing the decay of radioactive nuclei while they are in swift motion [1,2]. It allows for the study of exotic nuclei at and even beyond the driplines, to unravel their internal structure and their decay; for instance, it provides valuable information about the decay energy and width of the parent nucleus, insight into the decay mechanism and levels and transitions in daughter nuclei. The method is based on tracing and analyzing the angular correlations between the decay products. So far, micro-strip detectors are used to precisely measure the trajectories of the light decay products (such as protons and light clusters) and the magnetic high-resolution spectrometer FRS is used for identification of the heavy (daughter) ions, as they emerge from the decaying nucleus.
The present contribution outlines the further development of the in-flight decay technique by measuring and analyzing the individual longitudinal momenta of the heavy decay products to obtain spectroscopic information independently (i.e., without the invariant-mass information). Such a scheme can be used for determining decay energies of nuclei with half-lives in the nano-second range where other methods are difficult. For instance, the 72Rb half-life deduced by assuming the yield systematics was evaluated to T1/2(72Rb) = 103(22) ns. Based on this estimate, the proton decay energy of ~700 keV may be measured by using this method, which is independent of the mechanism of proton emission. In a similar way,
longitudinal momenta of heavy-ion recoils from neutron-unbound nuclei provide information on the decay of their precursors without the direct registration of neutrons. The measurement principles will be outlined, and simulation results of several case studies will be presented for this novel method, which can be applied at high-resolution spectrometers for exotic nuclei such as FRS or Super-FRS, respectively, and also at other in-flight separator facilities.

Email address

Supervisor's Name

Supervisor's email

Funding Agency

Classification

Primary author: MUKHA, Ivan (GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, 64291 Darmstadt, Germany)

Co-author: SCHEIDENBERGER, Christoph (GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, 64291 Darmstadt, Germany)

Presenter: SCHEIDENBERGER, Christoph (GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, 64291 Darmstadt, Germany)

Session Classification: Poster Session

Track Classification: Low-energy and in-flight separators