Contribution ID: **23** Type: **not specified**

Commissioning of the HINA Setup for In-Trap Decay Spectroscopy with 19Ne

The HINA project (Highly Charged Ions for Nuclear Physics and Astrophysics) aims to develop in-trap decay spectroscopy of highly charged radioactive ions as a new experimental approach for nuclear physics and astrophysics studies. The method relies on storing HCIs in an electron-beam ion trap (EBIT) and observing their decay under well-defined atomic conditions, enabling studies of nuclear decay properties and atomic-nuclear effects.

We propose a Day-1 experiment at the DESIR facility using a 19Ne beam to validate the in-trap decay method with the HINA-EBIT setup. In addition, stable Ne ions will be used as reference species. The experimental approach is based on measuring ion storage lifetimes, which are determined by the competition between nuclear decay and charge-exchange processes with the residual gas. The measurements will rely on X-ray detection following dielectronic recombination induced by the EBIT electron beam.

19Ne is a suitable benchmark nucleus due to its well-known β+ decay properties, appropriate half-life, and expected availability at DESIR from SPIRAL1. This first experiment is primarily methodological and will demonstrate charge breeding, trapping, storage, X-ray-based lifetime measurements, and background conditions.

The results will validate the experimental concept of the HINA setup and establish the technical basis for future decay studies with exotic highly charged ions at DESIR.

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