



NUSTAR Seminar

Markus Vilen
CERN, Switzerland

Wednesday, August 03 2022 at 02:30 pm

Zoom Link

<https://gsi-fair.zoom.us/j/66491909707>

Meeting-ID: 664 9190 9707

Kenncode: 952047

Development of a 30-keV MR-ToF MS for collinear laser spectroscopy and beam purification at ISOLDE

Low energy branches of Radioactive Ion Beam (RIB) facilities and experiments are faced with an ever increasing need to deliver high-quality ion beams and develop measurement techniques better suited for low yields of ions of interest. Experiments are commonly limited by isobaric contamination, resulting in decreased signal-to-noise ratios, systematic uncertainties caused by impure ion samples, or the need to process ever larger quantities of ions to reach more exotic isotope species of interest. This challenge is shared by various research activities at RIB facilities across different fields, such as nuclear-structure research, studies in fundamental symmetries, nuclear astrophysics, solid state physics, and medical isotope production. A novel Multi-Reflection Time-of-Flight (MR-ToF) mass separator operating at an unprecedented ion beam energy of 30 keV is currently being built at MIRACLS [1,2] to address these challenges. The new apparatus will initially serve as a high-sensitivity, high-resolution Collinear Laser Spectroscopy (CLS) experiment, where trapped 30-keV ion bunches are repeatedly probed by a laser beam over an extended period of time. The resulting boost in sensitivity, estimated to be a factor of 30 up to 700 for closed two-level systems, depending on half-life, mass, and spectroscopic transition, will extend the reach of fluorescence-based CLS farther towards more weakly produced nuclides. Traditionally mid-shell nuclei have been challenging cases for theoretical nuclear models in predicting electromagnetic ground-state properties. With recent advances in nuclear ab-initio models, the island of inversion near $N=20$ in the Mg isotopic [3] chain has become accessible to nuclear theory [4,5,6]. However, experimental data to benchmark these models and improve the understanding of the nuclear properties is not available to all isotopes accessible to theoretical models. The first physics campaign of the new 30-keV apparatus will be dedicated to measurements in this region of the Mg isotopic chain. The system will be later reconfigured to serve as a first-generation 'high-energy' beam purification apparatus at CERN/ISOLDE, designed to deliver isobarically purified ion samples to downstream experiments. In this seminar the first planned physics campaign of the novel system on the Mg isotopic chain at the island of inversion at $N=20$ will be presented, together with the technical design of the system and its use for both CLS and beam purification.

[1] S. Sels, et al., *NIM B*, 463:310–314, 2020. [2] V. Lagaki, et al., *Detectors and Associated Equipment*, 1014:165663, 2021. [3] Takaharu Otsuka, et al., *Rev. Mod. Phys.*, 92:015002, Mar 2020. [4] T. Miyagi, et al., *Phys. Rev. C*, 102:034320, Sep 2020. [5] S. J. Novario, et al., *Phys. Rev. C*, 102:051303, Nov 2020. [6] G. Hagen, et al., *arXiv*, 2201.07298, 2022

Convener: T. Dickel
Secretary: R. Krause / D. Press
<https://indico.gsi.de/event/15487/>