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Commissioning of a Paul trap for Collinear Laser Spectroscopy of Exotic Radionuclides performed in a 30 keV MR-ToF device

Friday, 17 February 2023 21:30 (15 minutes)

The Multi-Ion Reflection Apparatus for Collinear Laser Spectroscopy (MIRACLS) is a novel approach in performing high-resolution collinear laser spectroscopy (CLS) in a multi-reflection time-of-flight (MR-ToF) device. By trapping a 30-keV ion beam in-between the MR-ToF's electrostatic mirrors and revolving it around a few thousand times through an optical detection region (ODR), significant gains in experimental sensitivity can be achieved compared to a single passage in conventional CLS. This increase will allow for studying exotic radionuclides that are produced with low yields at radioactive ion beam facilities such as ISOLDE at CERN or ISAC and ARIEL at TRIUMF, thus opening a new region of the nuclear chart to CLS experiments.

In order to fully benefit from the MIRACLS approach, the MR-ToF device requires cooled ion bunches with strict emittance requirements. This necessitates the use of a dedicated Paul trap tailored to match ion-bunch properties to the MR-ToF requirements.

In this presentation we will describe the MIRACLS concept, its science goals, and its current status with an emphasis on the recent commissioning of its Paul trap. Experimentally, the Paul trap is shown to provide ion bunches with temporal widths of 123 ns (FWHM), well matched to perform highly sensitive CLS of exotic radionuclides in the MIRACLS MR-ToF device.

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