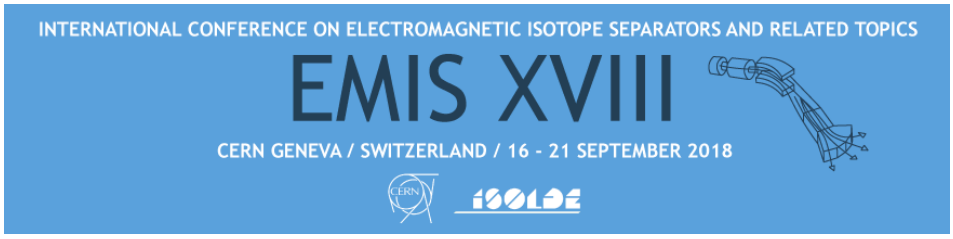

Contribution ID: **86** Type: **Submitted Oral**

MIRACLS: Multi Ion Reflection Apparatus for Collinear Laser Spectroscopy

Wednesday, 19 September 2018 11:40 (15 minutes)

Laser spectroscopy is a powerful tool for studying nuclear ground-state properties in a model-independent way. It provides access to the charge radii and electromagnetic moments of the nuclear ground state as well as of isomers by observing the isotope shifts and hyperfine structures of the atoms'spectral lines [1, 2]. While in-source laser spectroscopy in a hot cavity is a very sensitive method that is able to measure rare isotopes with production rates below one particle per second [3], the spectral resolution of this method is limited by Doppler broadening to ˜5 GHz. Collinear laser spectroscopy (CLS) on the other hand, provides an excellent spectral resolution of ˜10 MHz [1] which is of the order of the natural line widths of allowed optical dipole transitions. However, CLS requires yields of more than 100 or even 10,000 ions/s depending on the specific case and spectroscopic transition [4].
Complementary to the Collinear Resonance Ionization Spectroscopy (CRIS) technique [5], the MIRACLS project at CERN aims to develop a laser spectroscopy technique that combines both the high spectral resolution of conventional fluorescence CLS with an enhanced sensitivity factor of 20-600. The sensitivity increase is derived from an extended observation time provided by trapping ion bunches in an Electrostatic Ion Beam Trap / Multi-Reflection Time-of-Flight device [6] where they can be probed several hundred of thousand times. This talk will introduce the MIRACLS concept and will present the current status of the project as well as the outlook towards further developments.
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Session Classification: Session 10 - Laser techniques

Track Classification: Ion traps and laser techniques