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MIRACLS - Probing exotic nuclei via laser spectroscopy in an MR-ToF device

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Collinear laser spectroscopy (CLS) is a powerful tool to access nuclear ground-state properties such as nuclear spin, electromagnetic moments and charge radii [1]. However, to explore 'exotic'nuclides with very low production yields at radioactive ion beam facilities, e.g. ^{34}Mg, more sensitive methods have been or are being developed.

To this end, the novel Multi-Ion Reflection Apparatus for CLS (MIRACLS) [2] at ISOLDE/CERN combines the high spectral resolution of conventional fluorescence-based CLS with high experimental sensitivity. This is achieved by trapping ion bunches in an unprecedented 30 keV Multi-Reflection Time-of-Flight (MR-ToF) device, in which the ions bounce back and forth between two electrostatic mirrors. Hence, the laser-ion interaction time is increased with each revolution in the MR-ToF apparatus, while retaining the high resolution of CLS.

The new experimental setup is currently being built and commissioned at ISOLDE's LA2 beam line. It consists of a buffer-gas filled Paul trap for providing cooled ion bunches, an offline ion source, two HV cages and the first MR-ToF device operated at 30 keV, with integrated optical detection region and laser access.

Besides its use for CLS, MIRACLS'30-keV MR-ToF device will enable advanced MR-ToF mass separation with increased ion capacity. At the next stage, this device will thus be able to deliver purified radioactive ion beams to PUMA and other (traveling) experiments at ISOLDE.

This oral contribution will introduce the MIRACLS concept, show the status of the experimental setup and give an outlook on the planned measurements.

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[2] S. Sels et al., Nucl. Inst. Meth. Phys. Res. Sec. B, 463, 310–314 (2020)
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