Laser Photodetachment Studies on negative Ions in the Frankfurt low energy Storage Ring

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The low–energy electrostatic storage ring FLSR at the University of Frankfurt [1] is a room temperature storage ring with 14.23 m circumference in a race track geometry. It allows to store heavy ions up to 50 keV kinetic energy. Recently, it has been equipped with a negative ion source to store atomic and molecular negative ions and to study laser photodetachment of vibrationally cooled molecules. Storage of O^- and OH^- as well as the metastable He^- has been achieved [2]. At a target point in the ring with enhanced ion density optical grade vacuum windows have been installed to allow crossed beam interaction with laser photons. A high–repetitive tunable Ti:sapphire laser with 10 kHz rate developed at the University of Mainz allows to perform photodetachment spectroscopy around the detachment threshold. The neutralized particles can be detected further downstream by position sensitive double sided silicon strip detectors, which are mounted at the end of the straight section of the ring. By varying the laser wavelength the detachment threshold of the negative ion and therefore the electron affinity (EA) can be studied. Preliminary studies on O^- gave promising results.

The precise knowledge of the EA of negative ions is important for a recent project in which laser photodetachment is used as an element selective filter to suppress isobars in accelerator mass spectrometry (AMS). For most atomic negative ions the EA is well known. However, in the case of molecules the EA is not always known and the lack of spectroscopic information especially of AMS relevant molecular negative ions is evident. One reason for this are the internal degrees of freedom of molecules. In that case more effort has to be taken in gathering the required spectroscopic information. The study of vibrationally cooled molecules in the ring can help to provide the required data and make new isotopes accessible for AMS.

[1] K.E. Stiebing *et al.*, FLSR – The Frankfurt low energy storage ring, Nucl. Instr. and Meth. A **614**, 10–16 (2010).

[2] O. Forstner *et al.*, Opportunities for negative ions studies at the Frankfurt Low–energy Storage Ring (FLSR), Hyp. Int. **241**, 53 (2020)