First experiments using a table-top electrostatic ion storage ring, the Mini-Ring

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Synopsis We report experiments using a small electrostatic ion storage ring. We demonstrate its capability to measure the lifetime of metastable anions and cations up to hundred of milliseconds produced in the ECR source. First experiments using LASER heating are also presented.

We have built a table top electrostatic ion storage ring, called Mini-Ring [1]. Many configurations have been tested and shown that the storage conditions are not critical. The Mini-Ring is composed of two conical electrostatic mirrors [2] and four pairs of deflector plates (see fig. 1.). Three Faraday cups are positioned around the ring for beam diagnostics.

A channeltron faces one of the straight sections in order to detect neutrals coming out of the ring. All elements are positioned on a single plate to achieve a precise alignment of the electrodes.

The storage beam has a diameter of 3 mm and up to $10^6$ ions can be stored during a time estimated to 0.1 s. The actual main limitation in the storage time is due to collisions with the back-ground gas (the pressure was $2 \times 10^{-9}$ mbars at the best conditions). We have stored ions with large kinetic energy range from 2 q keV to 10 q keV.

The ECR Nanogan ion source has been used to produce the cations and anions . Up to now beams of He+, F+, Ar+ , SFn+ (n=1-5), as well as Polycyclic Aromatic Hydrocarbon and fullerene have been stored. Intense beams of monocharged ions have been obtained using a 10 Ghz very low power HF (less 0.5 W). In this low power conditions dimer and trimer have also been produced. The anions like fluorine and SF6 have been surprisingly produced with this source normally built to produce multicharged ions. The lifetime of SF6 could be measured and compared with other experimental values. Results concerning energy loss measurements in the reactions $A^+ + T \rightarrow A^- + T^2+$ , where A is an atomic or molecular projectile (F+, SFn+ ,….) and T a target vapor or gas (Na, Cs, Ar….), will be presented. The method is based on the measurement of the rotation frequency of the negative ion $A^-$. Recent Laser experiments will be also presented.

Fig. 1. Three dimensional schematic of the mechanical design of the Mini-Ring.

References

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