MS 4: New Developments

Time: Tuesday 14:00–14:45 Location: R 1.020

Invited Talk MS 4.1 Tue 14:00 R 1.020

First molecular beam cooled to its lowest quantum states at the Heidelberg Cryogenic Storage Ring — •Christian Meyer[1], Arno Becker[1], Klaus Blaum[1], Christian Breitenfeldt[1,2], Sebastian George[1], Jürgen Göck[1], Manfred Grieser[1], Florian Grussie[1], Claude Krantz[1], Holger Kreckel[1], Preeti M. Mishra[1], Oldřich Novotný[1], Felix Nuesslein[1], Aodh P. O'Connor[1], Roland Repnow[1], Sunny Saurabh[1], Stefan Schippers[3], Lutz Schweikhard[2], Kaija Spruck[1,3], Stephen Vogel[1], Robert von Hahn[1], Patrick Wilhelm[1], and Andreas Wolf[1] — [1]Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany — [2]Institut für Physik, Ernst-Moritz-Arndt Universität Greifswald, 17487 Greifswald, Germany — [3]Justus-Liebig-Universität Gießen, 35392 Gießen, Germany

The Heidelberg Cryogenic Storage Ring (CSR) [1] is a fully cryogenic, electrostatic ring with a circumference of 35 m. By cooling the experimental chambers down to 6 K, a residual gas density below 140 cm^{-3} can be reached. Thus ion beams can be stored up to several hours. Under such conditions infrared-active molecules can radiatively cool down to their rovibrational ground state. The excitation of OH^- was probed in a 60 keV ion beam by near-threshold photodetachment revealing radiative lifetimes of the lowest rotational states (∼190 s for $J = 1$) and an effective molecular temperature of 15 K [2]. Hence we are ready to study molecular ions in collisions with neutral atoms, electrons and photons under truely interstellar conditions. The experimental approach and results will be discussed.

[1] R. von Hahn et *al.*, Rev. Sci. Instrum. 87, 063115 (2016)

[2] C. Meyer et *al.*, Phys. Rev. Lett. 119, 023202 (2017)

MS 4.2 Tue 14:30 R 1.020

High-resolution mass separation by transversal contaminant-ion ejection from a multi-reflection time-of-flight device — •Paul Fischer, Stefan Knauer, Gerrit Marx, and Lutz Schweikhard — Institut für Physik, Universität Greifswald, 17489 Greifswald, Germany

Synchronized transversal ejection of unwanted species in an electrostatic ion-beam trap (EIBT) or multi-reflection time-of-flight (MR-ToF) device [1,2,3] has been studied in detail at a new setup at the University of Greifswald [4]. As this separation is performed within the trap, there is no need for additional devices such as ion gates or further traps for either pre- or postselection of ions of interest. Contaminant ions are kicked out by appropriate deflector pulses.

The parameters affecting selection effectivity and resolving power are illustrated with tin-cluster isotopologues. Deflection voltages of 10 V were found to be sufficient for the transversal ejection with as few as three deflection pulses. The duty cycle, i.e. the pulse duration with respect to the period of ion revolution, has been optimized with respect to separation resolving powers, leading to values of up to several tens of thousands.

[1] M. Dahan et al., Rev. Sci. Instrum., 69:76-83(1998).
[2] W. H. Benner, Anal. Chem. 69:4162(1997).
[3] H. Wollnik et al., Int. J. Mass. Spectrom., 96:267-274(1990).
[4] S. Knauer et al., Int. J. Mass. Spectrom., online: https://doi.org/10.1016/j.ijms.2017.10.007(2017).