FELION: A CRYOGENIC ION TRAP APPARATUS FOR SPECTROSCOPIC STUDIES WITH FELIX

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The combination of ion trapping techniques with sensitive action spectroscopy schemes has been developed in recent years as a powerful tool to obtain spectra of gas-phase molecular ions from the UV to the (F)IR spectral regions.[a] Here we report on the status of a specifically designed, dedicated cryogenic 22-pole ion trap apparatus (FELion), developed and built in Cologne, Germany, and intended to be installed permanently at the "Free-Electron Lasers for Infrared eXperiments" (FELIX) facility in Nijmegen, the Netherlands. This instrument will allow to record gas-phase IR and FIR spectra of mass-selected, internally cold molecular ions at temperatures in the range $4 - 300$ K. By the use of diverse ionization methods, e.g. electron impact and electrospray ionization, a multitude of molecular ions can be generated and stored in the trap, including astrophysically relevant species ranging in size from the three-atomic H_3^+ up to large polycyclic aromatic hydrocarbon (PAH) ions, but also biomolecular ions like amino acids, peptides, or nucleobases. In combination with the powerful (F)IR radiation of the free electron lasers FELIX-1 and -2 ($60 - 2500$ cm^{-1}) and FLARE[b] ($6 - 100$ cm^{-1}) at the FELIX facility, a variety of action spectroscopy schemes can be employed to study the ro-vibrational spectra of the stored ions, such as IR multiphoton dissociation, (F)IR/UV double resonance spectroscopy, or the method of laser induced reactions (LIR). In this talk we will give a detailed account of the experimental setup and present the first results obtained with the new apparatus.

[a] e.g., S. Schlemmer, E. Lescop, J. von Richthofen, D. Gerlich, and M. A. Smith, J. Chem. Phys. 117, 2068 (2002); J. Oomens, B. G. Sartakov, G. Meijer, and G. van Helden, Int. J. Mass Spectrom. 254, 1 (2006); T. R. Rizzo, J. A. Stearns, and O. V. Boyarkin, International Reviews in Physical Chemistry 28, 481 (2009)

[b] FLARE: Free-electron Laser for Advanced spectroscopy and high-Resolution Experiments