CFEL SCIENCE

SEMINAR

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CFEL – Building 99, seminar room I+II (ground floor)

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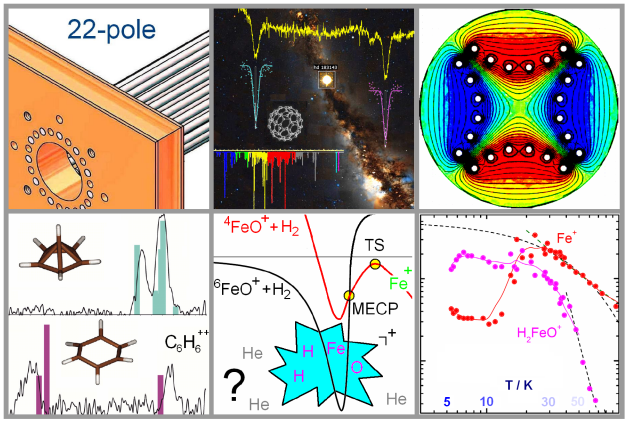
Reaction dynamics in cryogenic ion traps

Progress in molecular science strongly depends on inventions and advances in innovative experimental tools such as specific light sources, molecular beams, imaging detectors, etc. In the center of this contribution are cryogenic radio frequency ion traps and recent break throughs made with such devices.

In the introduction of my talk, I give a short review of this versatile technique. Pushing the trap temperature down to 2.6 K and using He buffer gas pulses with densities above 10^{16} cm^{-3} opened up new applications. Efficient cooling allowed us to record high resolution spectra of He-H_3^+, to identify C_{60}^+ as carrier of diffuse interstellar bands, and to obtain routinely IR spectra of mass selected ions.



Cryogenic traps (e.g. the well-known 22-pole or the linear wire-quadrupole trap) have been used to probe the structures of doubly charged benzene [1] and to provide evidence for C_{60}^+ being a carrier of diffuse interstellar bands [2]. This contribution discusses the steep temperature dependence of the reaction FeO^+ + H_2. and presents IR spectra of the H_2-FeO^+ collision complex [3].

Using the cryogenic ion trap ISORI in Prague [1,3], rate coefficients for the collision system FeO^+ + H_2 + He have been measured from room temperature to below 3 K. The results provide insight into lifetimes and bottlenecks impeding almost completely formation of the exothermic Fe^+ + H_2O^+ product at room temperature. A break through has been the in situ synthesis and characterization of the reaction intermediate $[(H_2)FeO]^+$.

[1] J. Jasik; D. Gerlich, J. Roithova, J. Phys. Chem. A 119 (2015) 2532.
[2] E. K. Campbell, M. Holz, D. Gerlich & J.P. Maier, Nature 523 (2015) 322.
[3] D. Gerlich, J. Jašík, E. Andris, R. Navrátil, J. Roithová, ChemPhysChem 17 (2016) 3723

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