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Reactions of cold trapped anions

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Interactions of negative ions with small organic molecules represent model systems for the investigation of reaction dynamics in few-body systems. Their corrugated potential energy landscape, originating in long-range attractive and short-range repulsive forces, requires the coupling of different degrees of freedom for reactions to occur. We have adopted two complementary approaches to study anion-molecule reaction dynamics. Using velocity map imaging in combination with crossed beams at low energy we study the differential cross section of negative ion reactions. For nucleophilic substitution reactions we have observed several distinct reaction mechanisms when varying the collision energy [1]. Total reaction rate measurements, which we carry out in the box-shaped potential of a 22pole ion trap [2], have revealed unexpected temperature-dependences for proton transfer and for cluster stabilisation at low temperatures. In addition, laser-induced photodetachment is studied in the trap to obtain absolute destruction cross sections for negative ions in light fields [3]. These results are relevant for the understanding of the negative ion abundances in interstellar molecular clouds.

[1] J. Mikosch et al., Science (in press)
[2] J. Mikosch et al., Phys. Rev. Lett. 98, 223001 (2007)
[3] S. Trippel et al., Phys. Rev. Lett. 97, 193003 (2006)