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State-selective preparation and reactive collisions of translationally cold molecular ions in ion traps

The recent progress in the generation of translationally cold molecules and molecular ions in the gas phase has enabled the study of molecular collisions and chemical reactions in a new physical regime. To unravel the fine details of ultralow-temperature collisional dynamics, it is necessary to precisely control the translational energy and internal quantum state of the collision partners. In the presentation, we review recent results on reactive collisions between translationally cold ions and neutral molecules [1,2] and highlight a novel, recently developed method for the preparation of fully quantum-state selected, translationally cold molecular ions in ion traps [3]. Finally, we discuss prospects for fully quantum-state- and energy-controlled ion-neutral collision studies.

[1] S. Willitsch et al., Phys. Rev. Lett. 100 (2008), 043203 [2] M.T. Bell et al., Faraday Discuss. 142 (2009), 73 [3] X. Tong, A. H. Winney and S. Willitsch, Phys. Rev. Lett. 105 (2010), 143001

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