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Experiments with Stark decelerated and trapped molecules

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Over the last years our group has been developing methods to get improved control over the velocity of molecules in a molecular beam [1]. With the Stark decelerator, a part of a molecular beam can be selected and transferred to any arbitrary velocity, producing bunches of state-selected molecules with a computer-controlled velocity and with longitudinal temperatures as low as a few mK. So far, this new molecular beam technology has been used mainly to decelerate packets of molecules to standstill, and to subsequently confine these molecules in a trap. We will report on various experiments that have been performed with these samples of trapped molecules. Stark decelerated molecular beams also hold great promise in molecular beam scattering experiments. In a crossed-beam configuration, these beams offer the revolutionary capability to study elastic or inelastic and reactive scattering as a function of the continuously variable collision energy with a high intrinsic energy resolution. We will report on the first scattering experiment using a Stark decelerated beam of OH radicals [2], and our progress on a new crossed beam machine containing two Stark decelerators under 90 degrees crossing angle.

[1] S.Y.T. van de Meerakker et al., Nature Physics 4, 595 (2008).

[2] J.J. Gilijamse et al., Science 313, 1617 (2006).