DECELERATION, TRAPPING AND ACCUMULATION OF NH MOLECULES

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We report on the Stark-deceleration and electrostatic trapping of metastable NH molecules. Furthermore the progress towards higher densities of cold neutral molecules by accumulation of multiple Stark-decelerated packets of NH molecules in a magnetic trap will be presented.

NH molecules in the long-lived metastable $a^1\Delta(v = 0, J = 2)$ state are ideally suited for Stark deceleration experiments because of their relatively large Stark shift and low mass. The metastable molecules $(\tau > 2.7s)$ are produced in a supersonic expansion with a velocity of ~ 450 m/s, and are decelerated to a standstill by a 108-stage decelerator. Subsequently the metastable molecules are trapped electrostatically, with a temperature of about $50 - 100$ mK, a density of $\sim 10^6$ cm^{-3} and a $1/e$ trapping lifetime of 1.4 s.

Following the deceleration and trapping, the metastable NH molecules are detected by the excitation of a spin-forbidden transition, resulting in spontaneous decay to the electronic ground state $(X^3\Sigma^-)$. The electronic ground state has a negligible Stark shift, but can be trapped magnetically. The first experiments on the accumulation of ground state NH molecules in a magnetic trap will be presented.

[1] S. Hoekstra *et al.*, Electrostatic trapping of metastable NH molecules, Phys. Rev. A. **76** 063408 (2007)