A SLOW SOURCE OF MOLECULES FOR HIGH RESOLUTION SPECTROSCOPY

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We present experiments on decelerating and trapping ammonia molecules using a combination of a Stark decelerator and a traveling wave decelerator. In the traveling wave decelerator a moving potential is created by a series of ring-shaped electrodes to which oscillating high voltages are applied. By lowering the frequency of the applied voltages, the molecules confined in the moving trap are decelerated and brought to a standstill. As the molecules are confined in a true 3D well, this new kind of deceleration has practically no losses, resulting in a great improvement on the traditional Stark deceleration techniques. The necessary voltages are generated by amplifying the output of an arbitrary wave generator using fast HV-amplifiers, giving us great control over the trapped molecules. We illustrate this by experiments in which we adiabatically cool trapped NH_3 and ND_3 molecules and resonantly excite their motion. Our main motivation for this research is the possibility to use the traveling wave decelerator as a source of cold molecules for a molecular fountain. Previous attempts to create a fountain using a Stark decelerator were unsuccessful due to losses at low velocities and a complex lens-system for cooling and collimating the slow beam. A traveling wave decelerator should solve both of these issues.