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Kinematic production and study of cold atoms and molecules KEVIN STRECKER, Sandia National Laboratories, Livermore, CA, DAVID CHANDLER, JEFFERY KAY — We have produced measurable amounts of cold molecules using a unique crossed molecular beam scattering technique, Kinematic Cooling. This technique allows for the production of cold molecules in either their absolute ro-vibrational ground state via elastic scattering with a near equal mass atom, or produced in rotationally, vibrationally or electronically exited states via inelastic collisions with an atom of a dissimilar mass. We have demonstrate this technique using inelastic collisions between NO molecules and Ar atoms, specifically $NO(^2\Pi_{1/2}$,j=0.5) + Ar $\rightarrow NO(^2\Pi_{1/2}$,j'=7.5) + Ar. We have performed new measurements on this system, utilizing vastly different experimental conditions, such that now we can report observation of samples of $NO_{7.5}$ that persist in our observation volume for over 150 microseconds. This observation time has been shown to be limited by diffusion of the unconfined molecules from our observation region. Monte-Carlo modeling of the diffusion of the molecules from the interaction volume convoluted with the detection volume yields a final average temperature for the $NO_{7.5}$ to be near 30mK. The Kinematic cooling technique has recently been extended to cooling of ND_3, NH_3 and Kr.

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