Abstract Submitted
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Collision cooling of molecules KEVIN E. STRECKER, JAMIE RAMIREZ, DAVE W. CHANDLER, Sandia National Laboratories — We report a new technique using single collisions to cool molecules from supersonic speeds down into the milliKelvin regime. Geometrically orientated collision between partners with equal or near equal masses results in a small fraction (of atoms or molecules) coming to rest in the laboratory frame. When one collision partner is a molecule, excess collision energy can be funneled into the rotational modes of that molecule, forming cold ground vibrational but rotationally excited molecules. Using this technique, we have cooled nitric oxide (NO J= 7.5) to below 200 mK, the current resolution of our system [1]. This technique has recently been expanded to cool ammonia (NH_3 J = 2), via collisions with neon and hydrogen bromide (HBr J = 1) via collisions with Kryton. The cooling limit of this technique is only limited by the mass defect between the molecule and colliding atom. We are currently attempting to improve or ability to measure the final temperature of the molecules, as our measured final velocities are a factor of four greater then theoretically predicted. [1] D.W. Chandler, J. Valentini, M. Ellioff, Science v.302, 1940 (2003)

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