Preparation of Vibrationally Excited H\textsubscript{2} in a Coherent Superposition of M-States Using Stark Induced Adiabatic Raman Passage (SARP)\textsuperscript{1} 
NANDINI MUKHERJEE, WENRUI DONG, WILLIAM PERREAULT, RICHARD ZARE, Stanford Univ — We prepare a large ensemble of rovibrationally excited ($v =1$, $J =2$) H\textsubscript{2} molecules in a coherent superposition of $M$-states using Stark-induced adiabatic Raman passage (SARP) with linearly polarized single mode pump (532 nm) and Stokes (699 nm) laser pulses of duration 6 ns and 4 ns. A biaxial superposition state, $|\psi\rangle = 1/\sqrt{2} \ [ |v =1, J =2, M =-2\rangle - |v =1, J =2, M =+2\rangle ]$, is prepared using SARP with a sequence of a pump laser pulse partially overlapping with a cross polarized Stokes laser pulse co-propagating along the quantization $z$-axis. The degree of phase coherence is measured by recording interference fringes in the ion signal produced using the O(2) line of 2+1 resonance enhanced multiphoton ionization (REMPI) from the rovibrationally excited ($v =1,J =2$) level as a function of REMPI laser polarization angle. The ion signal is measured using a time-of-flight mass spectrometer. Nearly 60% population transfer from H\textsubscript{2} ($v =0,J =0$) ground state to the superposition state in H\textsubscript{2} ($v =1, J =2$) is measured from the depletion of Q(0) REMPI signal of the ($v =0,J =0$) ground state. The $M$-state superposition behaves much like a multi-slit interferometer where the number of slits, i.e. the number of $M$-states, and their separations, i.e. the relative phase, can be varied experimentally.

\textsuperscript{1}This work has been supported by the U.S. Army Research Office

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