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**Polarization Studies of Highly Oriented Carbon Dioxide Super Rotors** MATTHEW J. MURRAY, Department of Chemical Physics, University of Maryland, College Park, HANNAH M. OGDEN, CARLOS TORO, QINGNAN LIU, AMY S. MULLIN, Department of Chemistry and Biochemistry, University of Maryland, College Park — Controlling molecular motion could enable manipulation of energy flow between molecules. We have used a high power optical centrifuge IR spectrometer to investigate energy transfer between molecular super rotors with oriented angular momenta. The polarizable electron cloud of the molecules interacts with the electric field of linearly polarized light that angularly accelerates over the time of the optical pulse. This process drives molecules into high angular momentum states that are oriented with the optical field and have energies far from equilibrium. High resolution transient IR spectroscopy reveals the dynamics of collisional energy transfer for these super excited rotors. We make time-dependent measurements of individual rotational states of carbon dioxide ranging from J=0 to J=100. Polarization-dependent studies show that the initial angular momentum orientation persists even after thousands of collisions, indicating that molecules in an optical centrifuge behave as quantum gyroscopes.

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