MAR15-2014-020052

Abstract for an Invited Paper
for the MAR15 Meeting of
the American Physical Society

Dynamics of Molecular Gyroscopes Created by Strong Optical Fields[1]

AMY MULLIN, University of Maryland

We explore the behavior of molecules in ultra-high angular momentum states prepared in an optical centrifuge and detected with transient IR absorption spectroscopy. In the optical centrifuge, the polarizable electron cloud of molecules interacts with the electric field of linearly polarized light that angularly accelerates over the time of the optical pulse. The centrifuge pulse is generated by combining oppositely chirped pulsed of light. Trapped molecules are driven into high angular momentum states that are spatially oriented with the optical field and have energies far above the average at 300 K. High resolution transient IR spectroscopy reveals the dynamics of collisional energy transfer for the super-rotors. Polarization-dependent studies show that the initial angular momentum orientation persists for many collisions, indicating that molecules in an optical centrifuge behave as quantum gyroscopes. Time-dependent population and energy profiles for individual J- states give information about the dynamics of super-rotors.

[1]Research support provided by NSF and the University of Maryland