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Using an Optical Centrifuge to Study CO_2 Super Rotor Collisions with He and Ar Buffer Gases[1] MATTHEW J. MURRAY, HANNAH M. OGDEN, MILLARD H. ALEXANDER, AMY S. MULLIN, University of Maryland, College Park, MD 20742 — Collisions of CO_2 super rotors with Ar and He buffer gases are investigated using state-resolved high resolution transient IR absorption spectroscopy. The CO_2 super rotors are generated with an optical centrifuge that captures and accelerates the molecules to extreme rotational states with oriented angular momentum. Polarization-sensitive Doppler-broadened line profiles characterize the anisotropic kinetic energy release and show that the CO_2 super rotors behave like molecular gyroscopes. Quenching of CO_2 rotational energy is more efficient with He collisions than with Ar collisions. The experimental results are compared with quantum scattering calculations performed on the He-CO_2 and Ar-CO_2 collision systems, providing insight into the J-specific collision cross sections and rates that control the relaxation. These studies reveal how mass, velocity, and rotational adiabaticity impact angular momentum relaxation and reorientation.

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