DIRECT MEASUREMENT OF WEAK COLLISIONS AND COLLISION RATES USING HIGH RESOLUTION TRANSIENT IR ABSORPTION SPECTROSCOPY

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We report a new experimental method for measuring the dynamics of weak collisions between highly vibrationally excited donor molecules (pyrazine, pyridine, picoline and lutidine) and HOD. Excited donor molecules with E_{vib} near 38000 cm^{-1} are prepared by the pulsed 266 nm output of a Nd:YAG laser. Time-dependent populations of scattered HOD molecules in low rotational states are probed at 2.7 micrometers from a single mode tunable F-center laser. Results include transient absorption traces, rotational distributions, and measurements of Doppler broadened linewidths. Contributions from reactive pathways are quantified. Data for weak and strong collisions are used to describe the entire energy transfer distribution from which the total collision rate is determined.