PUMP-PROBE MEASUREMENTS OF ROTATIONAL ENERGY TRANSFER RATES IN HBr + HBr COLLISIONS

M. H. KABIR, I. O. ANTONOV, and M. C. HEAVEN, *Department of Chemistry, Emory University, Atlanta, GA 30322*.

Cascade lasing from molecular HBr in the 4-μm region, corresponding to several vibrational-rotational transitions within the ground state, has recently been demonstrated using Nd:YAG laser excitation. Optically pumped HBr lasers are currently being developed for high-energy laser applications. State-to-state energy transfer rate constants are needed for adequate prediction of the laser efficiency and also for calculation of the emission energy partitioned to individual rotational lines. Rotational energy transfer in HBr($v = 1$) + HBr($v = 0$) collisions has been investigated using an ionization-detected pump-probe double resonance technique. Rotationally state selective excitation of $v'' = 1$ over $J = 0 - 9$ is achieved by stimulated Raman scattering, and the evolution of population is monitored using (2+1) resonantly enhanced multiphoton ionization (REMPI) spectroscopy through the $g^3\Sigma^-(0^+)(v' = 0) \leftarrow X^1\Sigma^+(v'' = 1)$ transition. The resulting data set was analyzed by fitting to numerical solutions of the master equation. State-to-state rate constant matrices were generated using fitting law functions.