TIME RESOLVED MMW/MMW DOUBLE RESONANCE SPECTROSCOPY ON METHYL FLOURIDE: OBSERVATION OF A K-CHANGING COLLISION PROCESS

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We report our recent experiments to measure directly collisional relaxation rates of methyl flouride (CH_3F) in collision with Helium at low temperatures (2–20 K) using time resolved millimeter/millimeter wave double resonance spectroscopy and employing the collisional cooling technique. This system uses a BWO synthesizer and a ferrite waveguide switch to generate the pulsed pump radiation. The collisional relaxation can be monitored using a klystron based millimeter wave harmonic generator. We will discuss our current results for relaxation rates where we pump the $J = 2 \rightarrow 3$ transitions and probe the $J = 3 \rightarrow 4$ aswell as the $J = 4 \rightarrow 5$ transitions of the methyl flouride molecule within the K-states 0,1 and 2. We will emphazise the observation of probe signals in a transition with $K = 2$ upon pumping a transition in $K = 1$. Since there are no dipole allowed radiative transfer processes between states with different K, we must assume K–changing collisions of methyl flouride with Helium to explain this. We will also report theoretical studies which employ the solution of the Master equation for the population flow of a multilevel system in order to justify the analytical procedure we use to generate rate constants from the observed time dependent probe signals.

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