TIME-RESOLVED IR-IR DOUBLE RESONANCE FOR THE ν_4 and $2\nu_4-\nu_4$ VIBRATION-ROTATION TRANSITIONS OF CH_3F

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Time-resolved double resonance (TRDR) method has been used to study the rotational and vibrational relaxiation for a long time. However, the study of IR-IR TRDR in the 3μm region has been very limited due to the lack of powerful tunable IR lasers in this region. In the present study, we used a tunable pulsed OPO IR laser (6 mJ@6 ns, $\sim$0.2 cm^{-1} linewidth) and a tunable cw-OPO IR laser (up to 200 mW, $\sim$3 MHz linewidth) both in the 3μm region to study the IR-IR TRDR for the ν_4 and $2\nu_4 - \nu_4$ vibrational bands of CH_3F. The pulsed IR laser pumps CH_3F from the ground state to a certain rotational level (J, K) of $v_4 = 1$, and the cw IR laser probes this (J, K) level by the $2\nu_4 - \nu_4$ ladder transition. A time profile for the transition intensity of the probe line gives the T_1 relaxiation time for the (J, K) level of $v_4 = 1$. The pressure dependence of T_1 for various (J, K) levels of $v_4 = 1$ was obtained, which can be compared with the linewidth measurement[a] for the ν_4 band of CH_3F.

[a] A. G. Cartlidge and R. J. Butcher, J. Phys. B: At. Mol. Opt. Phys. 23, 2083 (1990).