ROTATIONAL AND RENNER-TELLER ANALYSES OF THE GROUND AND EXCITED STATE LEVELS OF THE JET-COOLED CS_2^+ ION

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The $\tilde{A}^2\Pi_u - \tilde{X}^2\Pi_g$ spectrum of the jet-cooled carbon disulfide cation (CS_2^+) has been studied by laser-induced fluorescence and single vibronic level emission spectroscopic techniques. The ions were produced in a pulsed discharge jet using a precursor mixture of CS_2 vapor in argon. Analysis of the high-resolution spectrum of the $^2\Pi_{3/2}$ vibronic component of the 0-0 band has provided reliable ground and excited state molecular structures. A total of 33 LIF bands have been observed including a variety of hot bands from the $\mu^2\Sigma$ and $^2\Delta_{5/2}$ vibronic components of the first bending level in the ground state. In emission, 34 ground state levels were observed, including all four components of $v_2 = 1$. The ground and excited state vibronic energy levels were fitted using a Renner-Teller model that included spin-orbit, vibrational anharmonicity, and Fermi resonance interactions. The spin-orbit splittings are much larger in the ground that in the excited state, although the Renner-Teller constants ϵ are comparable. The $\nu_1 - 2\nu_2$ Fermi resonance interaction is very strong in both states and causes a nearly 50:50 mixing of the basis functions in each case.