HIGHER VIBRATIONAL LEVELS OF THE $\tilde{A}^1\Pi_u$ STATE OF C_3 OBSERVED BY LASER-INDUCED FLUORESCENCE

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The vibrational structure of the $\tilde{A}^1\Pi_u$ electronic state of C_3 in the region 26000-31000 cm^{-1} has been re-examined, using laser excitation spectra of jet-cooled molecules. Rotational constants and vibrational energies have been determined for over 60 previously unreported vibronic levels; a number of other levels have been re-assigned. The vibrational structure is complicated by interactions between levels of the upper and lower Born-Oppenheimer components of the $\tilde{A}^1\Pi_u$ state, and by the effects of the double minimum potential in the Q_3 coordinate, recognized by Izuha and Yamanouchi. [a] The present work shows that there is also strong anharmonic resonance between the overtones of the ν_1 and ν_3 vibrations. For instance, the Σ_u^+ vibronic levels 2 1^+1 and 0 1^+3 are nearly degenerate in zero order, but as a result of the resonance they give rise to two levels 139 cm^{-1} apart, centered about the expected position of the 2 1^+1 level. Similarly, the 202 level lies 60 cm^{-1} lower than expected because of interaction with the 400 and 004 levels. With these irregularities recognized, every observed vibrational level up to 29550 cm^{-1} (a vibrational energy of nearly 5000 cm^{-1}) can now be assigned.

[a] M. Izuha and K. Yamanouchi, J. Chem. Phys. 109, 1818 (1998).