

THE BENDING OF C₃: EXPERIMENTALLY PROBING THE *l*-TYPE DOUBLING AND RESONANCE

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C₃, a pure carbon chain molecule that has been identified in different astronomical environments, is considered a good probe of kinetic temperatures through observation of transitions involving its low-lying bending mode (ν_2) in its ground electronic state. With the aim to investigate this bending mode with multiple quanta of excitation, we have undertaken high resolution optical and mid-infrared investigations on the species produced in discharge experiments.

We report here the most complete analysis of the \tilde{X} and \tilde{A} states of C₃ (literature and present study) using a single PGOPHER file. New experimental measurements, reported in the past years at ISMS, result in 36 rovibronic $\tilde{A} \ ^1\Pi_u - \tilde{X} \ ^1\Sigma_g^+$ bands (originating from $\tilde{X}(0v_20)$, $v_2 = 0 - 5$, levels) recorded by laser induced fluorescence spectroscopy at the University of Science and Technology of China and the rovibrational ν_3 band (revealing hot bands involving up to 5 quanta of excitation in ν_2) recorded by Fourier-transform infrared spectroscopy using a global source on the AILES beamline of the SOLEIL synchrotron facility.

The combined fit allows for the accurate determination of the rotational parameters and absolute energy levels of C₃, in particular for states involving the bending mode. The spectroscopic information derived from this work enables new interstellar searches for C₃, not only in the infrared and optical regions investigated here but also notably in the ν_2 band region (around 63 cm⁻¹) where vibrational satellites can now be accurately predicted. This makes C₃ a universal diagnostic tool to study very different astronomical environments, from dark and dense to translucent clouds.