

ANALYSIS OF THE $\tilde{A} - \tilde{X}$ BANDS OF THE ETHYNYL RADICAL NEAR $1.48\mu\text{m}$ AND RE-EVALUATION OF \tilde{X} STATE ENERGIES

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We report the observation and analysis of spectra in part of the near-infrared spectrum of C_2H , originating in rotational levels in the ground and lowest two excited bending vibrational levels of the ground $\tilde{X}^2\Sigma^+$ state. In the analysis, we have combined present and previously reported high resolution spectroscopic data for the lower levels involved in the transitions to determine significantly improved molecular constants to describe the fine and hyperfine split rotational levels of the radical in the zero point, $v_2 = 1$ and the $^2\Sigma^+$ component of $v_2 = 2$. Two of the upper state vibronic levels involved, a $^2\Pi$ symmetry level at 6819.3 cm^{-1} and a $^2\Sigma^+$ one at 7527.1 cm^{-1} , had not been previously observed. The data and analysis indicate the electronic wavefunction character changes with bending vibrational excitation in the ground state and provide avenues for future measurements of reactivity of the radical as a function of vibrational excitation.

Work at Brookhaven National Laboratory was carried out under Contract No. DE-SC0012704 with the U.S. Department of Energy, Office of Science, and supported by its Division of Chemical Sciences, Geosciences and Biosciences within the Office of Basic Energy Sciences.

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