Terahertz Spectroscopy of Linear Triatomic CCC: High Precision Laboratory Measurement and Analysis of the Ro-Vibrational Bending Transitions

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We report concise measurements of the bending vibration transition $(0,1^1,0) \leftarrow (0,0^0,0)$ near 63.416529(40) cm^{-1} of the carbon cluster CCC in the electronic ground state $(X^1\Sigma_g^+)$. The ν_2 vibration-rotation spectrum consists of P-, Q-, and R-branch transitions. A total of ten ro-vibrational transitions have been measured with the Cologne Sideband Spectrometer for Terahertz Applications, COSSTA. It is essentially a Backward Wave Oscillator (BWO) based, and frequency stabilized sideband spectrometer. The essential feature of COSSTA is the absolute frequency accuracy of the measurements. Absolute frequency calibration is better than 5 kHz at 2 THz, i. e. COSSTA reaches microwave accuracy.

The band centre frequency was determined to be 1.901181506(162) THz: The derived molecular parameters are: $(\mathbf{0},\mathbf{0^0},\mathbf{0})$: B = 12908.242(142) MHz; D = 44.30(40) kHz; H = 4.068(184) Hz; $(\mathbf{0},\mathbf{1^1},\mathbf{0})$: B = 13262.946(109) MHz; D = 70.33(39) kHz; H = 7.71(38).

Key words: Far Infrared Spectra; Interstellar: Molecules; Laboratory Spectra; Line Identification; Rotational-Vibrational Transitions.