HIGH-RESOLUTION INFRARED SPECTRA OF THE ν_1 FUNDAMENTAL BANDS OF ^{13}C MONO-SUBSTITUTED PROPYNE IN A SUPERSONIC SLIT JET

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In the past few decades, many high-resolution spectroscopic studies have been dedicated to the C-H stretch vibrations in propyne (CH_3-C≡CH), aiming to understand the intramolecular vibrational redistribution in isolated small hydrocarbons. In this talk, we present the sensitive detection of the ν_1 (acetylenic C-H stretch) fundamental bands of the three ^{13}C mono-substituted isotopologues of propyne. The infrared absorption spectra are recorded using continuous-wave cavity ring-down spectroscopy (CRDS) in combination with a supersonic jet expansion of propyne/argon gas mixtures. A 0.05x30 mm slit nozzle is used in the present experiment to realize an effective rotational cooling to ≈14 K and a reduced Doppler width of ≈90 MHz. The high sensitivity of CRDS allows us to detect the three ^{13}C isotopologues in their 1.1% natural abundance. Different infrared band intensities of ν_1 are found for the three isotopologues. Detailed rotational analyses of the experimental spectra are performed to derive effective spectroscopic constants for the upper ν_1 vibrational state. The ^{13}C-substitution effect of the near/non-resonant perturbations to ν_1 of propyne is discussed. In addition, more accurate infrared data of ^{12}C-propyne, including the ν_1 fundamental band, are also obtained from our experimental spectra.