Triacetylene, \( \text{HC}_3\text{H} \), is the longest poly-acetylene chain found in space, and is believed to be involved in the formation of longer chain molecules and polycyclic aromatic hydrocarbons (PAHs). However, abundances are expected to be low, and observational confirmation requires knowledge of the gas-phase spectra, which up to now has been incomplete with only the weak, low lying bending modes being known. We present new infrared (IR) spectra in the C-H stretch region obtained using ultra-sensitive and highly precise IR continuous wave cavity ring-down spectroscopy (cw-CRDS), combined with supersonic plasma expansions\(^a\). The talk reviews the accurate determination of the rotational constants of the asymmetric fundamental mode, \( \nu_5 \), including discussion on the perturber state, and associated hot bands\(^b\). The determined molecular parameters are accurate enough to aid astronomical searches with such facilities as ALMA (Atacama Large Millimeter Array) or the upcoming JWST (James Webb Space Telescope), which can now probe even trace molecules (abundances of \( \sim 10^{-6} - 10^{-10} \) with respect to \( \text{H}_2 \)).


\(^{b}\text{K.D. Doney, D. Zhao, H. Linnartz, in preparation}\)