HIGH RESOLUTION ROVIBRATIONAL SPECTROSCOPY OF LARGE MOLECULES USING INFRARED FREQUENCY COMBS AND BUFFER GAS COOLING

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We have recently demonstrated the integration of cavity-enhanced direct frequency comb spectroscopy with buffer gas cooling to acquire high resolution infrared spectra of translationally and rotationally cold (~ 10 K) gas-phase molecules.[a] Here, we extend this method to significantly larger systems, including naphthalene ($C_{10}H_8$), a prototypical polyaromatic hydrocarbon, and adamantane ($C_{10}H_{16}$), the fundamental building block of diamonoids. To the authors' knowledge, the latter molecule represents the largest system for which rotationally resolved spectra in the CH stretch region (3 μm) have been obtained. In addition to the measured spectra, we present several details of our experimental methods. These include introducing non-volatile species into the cold buffer gas cell and obtaining broadband spectra with single comb mode resolution. We also discuss recent modifications to the apparatus to improve its absorption sensitivity and time resolution, which facilitate the study of both larger molecular systems and cold chemical dynamics.

[a] B. Spaun, et al. *Probing buffer-gas cooled molecules with direct frequency comb spectroscopy in the mid-infrared*, WF02, 70^{th} International Symposium on Molecular Spectroscopy, Champaign-Urbana, IL, 2015.