LASER SPECTROSCOPY OF BUFFER-GAS-COOLED POLYATOMIC MOLECULES

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Buffer gas cooling has emerged as a powerful tool in the study of cold and ultracold molecules. We have demonstrated buffer gas cooling and CW laser absorption spectroscopy on two species: Calcium monohydroxide radical (CaOH) and Phthalocyanine ($C_{32}H_{18}N_8$). CaOH has gained an increasing attention from astrophysics community due to its expected presence in the atmospheres of cool stars and rocky exoplanets. 3D Magneto-Optical trapping and subsequent sub-Doppler cooling of buffer-gas-cooled CaOH has also recently been reported [1]. Phthalocyanine, on the other hand, is much larger and more complex molecule than CaOH, possessing extremely rich rotational and vibrational structure. For both species, significant rotational cooling has been observed inside the $\sim$5 K Helium buffer gas cell with estimated rotational temperature of $\sim$10 K. This is promising, especially for large molecules with spectral congestion, to move molecular population into fewer lines, enhance signals, and drastically simplify spectrum. In this talk, we will present these results and analyses, including the latest data.

[1] N. B. Vilas, C. Hallas, L. Anderegg, P. Robichaud, A. Winnicki, D. Mitra, and J. M. Doyle (2021). arXiv:2112.08349