CONSTRUCTION OF A CRYO-COOLED BUFFER GAS CELL FOR PERFORMING BROADBAND CHIRPED-PULSE FOURIER TRANSFORM MICROWAVE (CP-FTMW) SPECTROSCOPY

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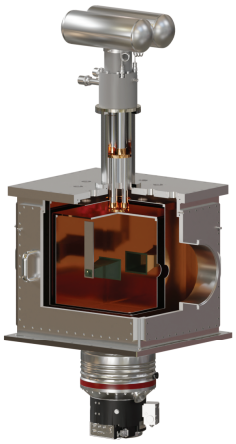

The preparation of rotationally cold molecules through the use of supersonic expansions has long been a mainstay of high-resolution gas-phase microwave spectroscopy[1]. An increasingly popular alternative to this method is to cool molecules of interest through continuous collisions with a large reservoir of cryogenic, inert buffer gas, typically helium[2]. This offers several advantages over pulsed supersonic jet methods, namely higher data acquisition rates, higher sample throughput and lower electronics noise.

We report the construction of such a cryo-cooled buffer gas cell at the Combustion Research Facility at Sandia National Laboratories in California. The instrument has been designed to perform broadband chirped-pulse Fourier transform microwave (CP-FTMW) spectroscopy across a frequency range of 6 to 18 GHz. A cooling capacity of 2.7 W at 4 K has been leveraged in order to accommodate a broad range of source assemblies and their associated heat loads, including flash pyrolysis reactors heated up to $\sim$ 1600 °C. Interleaved, perforated radiation shielding has been employed in concert with a hybrid cryopump/turbopump regime in an effort to reduce the frequency of degenerative thermal "crashes" that often plague such instruments. The performance of the instrument with respect to benchmark species will be discussed, as well as the future of the instrument and its experimental endeavours.

[1] M. McCarthy, *et. al.*, *Astrophys. J. Supp. Ser.* **2000**, *129*, 611
[2] J. P. Porterfield, *et. al.*, *Rev. Sci. Instrum.* **2019**, *90*, 053104