ROTATIONAL SPECTROSCOPIC STUDY OF CYANOACETYLENE-DOPED $ortho$-HYDROGEN AND $para$-HYDROGEN CLUSTERS ($(H_2)_N$ - HCCCN; N = 2 AND GREATER)

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A high-resolution Fourier transform microwave spectrometer was used to measure rotational transitions of $(ortho H_2)_N$ - HCCCN and $(para H_2)_N$ - HCCCN (N = 2 and greater) van der Waals clusters. The clusters are prepared using a gas sample containing low concentrations of HCCCN and H_2 (normal or enriched $para H_2$ gas) in helium up to pressures of 40 atm. The helium supersonic jet into the spectrometer cavity produces a collision free environment where the clusters are stabilized and can be studied. Varying the backing pressures and sample concentrations controls the size distribution of the clusters. The measurement of rotational transitions corresponding to minor isotopomers of HCCCN (DCCCN, $HCCC^{15}N$, ...) aids in the assignment of the N number. The N number assignment also benefits from the measurement of mixed $para H_2$ and $ortho H_2$ clusters such as $(para H_2)(ortho H_2)$ - HCCCN. The $para H_2$ containing clusters are of particular interest since $para H_2$ is suspected to exhibit the bulk property of superfluidity, similar to ^4He.