

MOLECULAR SUPERFLUIDITY IN SMALL CLUSTERS OF $(p\text{H}_2)_N$ -HCN STUDIED WITH ROTATIONAL SPECTROSCOPY

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In a recent experimental and theoretical study by Li *et al.*^a, direct evidence for molecular superfluidity in small clusters of *para*-hydrogen molecules ($p\text{H}_2$) seeded with CO_2 was discovered. The authors also found that the anisotropy of the CO_2 - $p\text{H}_2$ interaction potential promotes localization of the $p\text{H}_2$ molecules at larger cluster sizes ($N \approx 17$ *para*-hydrogen molecules), with a simultaneous reduction of the superfluid $p\text{H}_2$ fraction. It has been suggested that light rotors with a more isotropic interaction potential, such as CO and HCN, are potentially more subtle probes of $p\text{H}_2$ superfluidity that would allow superfluidity to persist, especially at larger values of N . In the current study, the hyperfine structures of the end-over-end rotational transitions of $(p\text{H}_2)_N$ -HCN clusters were measured using our chirped-pulse Fourier transform microwave spectrometer. Based on tentative assignments, the evolution of effective rotational constants, B_{eff} , as a function of N shows evidence for superfluid behaviour by a clear “turn-around” point at a low N value. The trend of B_{eff} vs. N and the results from the hyperfine structure analysis will be compared to the recent studies on He_N -HCN and $(p\text{H}_2)_N$ -CO.

^aH. Li, R. J. Le Roy, P.-N. Roy, and A. R. W. McKellar, *Phys. Rev. Lett.* **105**, 133401 (2010).