INFRARED SPECTRA OF HYDROGEN CLUSTERS SEEDED WITH CARBON DIOXIDE

A.R.W. McKELLAR, *Steacie Institute for Molecular Sciences, National Research Council of Canada, Ottawa, Ontario K1A 0R6, Canada*.

It is now possible to probe cold (<0.5 K) helium clusters in the size range $N \sim 2$ to 70 by means of the vibration-rotation spectrum of an embedded infrared chromophore molecule such as CO_2,[a] often with atom-by-atom resolution. To some extent, hydrogen clusters can also be studied in this way, as shown by our previous work in which CO,[b] OCS,[c] and N_2O[d] were the chromophores.
Here we extend the study of hydrogen clusters to the case of CO_2 as the probe. The symmetry of CO_2 provides an important difference compared to the other probe molecules. This has the effect of eliminating half of the rotational levels (for the normal $C^{16}O_2$ or $C^{18}O_2$ isotopomers) and of accentuating the differences between $para H_2$ and $ortho H_2$ clusters. As in the case of $(H_2)_N$-OCS and $(H_2)_N$-N_2O, we find that $(H_2)_N$-CO_2 cluster transitions are relatively easy to identify up to about $N = 7$, but difficult to follow above this point. However, in contrast to the previous work there is intriguing evidence for a series of weak but regularly-spaced transitions which may extend to $N \sim 15$ or beyond.

[a] A.R.W. McKellar, *J. Chem. Phys.* **128**, 044308 (2008).
[b] S. Moroni, M. Botti, S. De Palo, and A.R.W. McKellar, *J. Chem. Phys.* **122**, 094314 (2005).
[c] J. Tang and A.R.W. McKellar, *J. Chem. Phys.* **121**, 3087 (2004).
[d] J. Tang and A.R.W. McKellar, *J. Chem. Phys.* **123**, 114314 (2005).