HIGH RESOLUTION INFRARED SPECTROSCOPY IN $PARA$-H_2 CRYSTALS

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Because of the weak intermolecular interactions, molecular rotations and vibrations are nearly free in $para$-H_2 crystals, and their quantum states have long relaxation times[a]. Vibration-rotation transitions appear extremely sharp with line widths that are smaller than those of gaseous lines by one to two orders of magnitude ($\Delta\nu/\nu \sim 10^{-7} - 10^{-8}$). We can thus conduct high resolution spectroscopy and study solid states with unprecedented accuracy and clarity. I will discuss pure rotational (e.g. $J = 6 \leftarrow 0$), pure vibrational ($v = 1 \leftarrow 0, J = 0 \leftarrow 0$), and vibration-rotation pair transitions with emphasis on qualitative and quantitative difference between solid and gaseous spectroscopies.

[a] T. Oka, *Ann. Rev. Phys. Chem.* **44**, 299 (1993).