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THE COMPLEX HIGH RESOLUTION SPECTRUM OF SOLID HYDROGEN: NEW TECHNIQUES AND NEW TRANSITIONS

Brenda P. Winnewisser

Physikalisch-Chemisches Institut der Justus-Liebig-Universität
Heinrich-Buff-Ring 58, D–35392 Gießen, Germany

Although the rovibrational transitions of the hydrogen molecule can only be observed due to interactions between neighboring molecules, the study of the spectrum of the solid has shown that for many transitions, the energy absorbed is localized on single molecules. This means that there are very sharp transitions. Indeed, some of them are sharper than Doppler broadened lines, since the molecules are held in position by the crystalline structure of solid hydrogen. The strongest transitions are induced by electric quadrupole interactions. Higher multipoles also lead to observable transitions. The desire to observe transitions induced by higher multipoles, and to observe weak fine structure due to electric quadrupole-quadrupole splitting, has led to the application of high sensitivity and high resolution techniques for the study of para-hydrogen with small impurities of ortho-hydrogen and isotopic impurities.

In our laboratory, two optical systems have been designed to extend the absorption path length in a cryogenic sample, in this case solid hydrogen, for measurement in a high resolution Fourier transform spectrometer. The spectra of solid, nearly pure para-hydrogen that we have recorded with these systems allowed us to observe two previously unobserved $\Delta J = 6$ transitions and one $\Delta J = 8$ transition. Improved spectra of several other transitions, including their satellite spectra due to one or two neighboring ortho-hydrogen impurity molecules, were also obtained and will be presented.

Each transition in hydrogen is unique, and the range of phenomena observed in the Fourier transform spectra will be shown.

A2

VARIOUS ASPECTS OF SPECTROSCOPY AND DYNAMICS IN THE OZONE MOLECULE. ATMOSPHERIC APPLICATIONS

J.-M. Flaud

Laboratoire de Physique Moléculaire et Applications, CNRS
Université Pierre et Marie Curie
Tour 13 - Bte 76 - 4, place Jussieu
75252 PARIS Cedes 05 (France)

The ozone molecule is of central importance in the earth atmosphere both in the stratosphere where it filters the UV solar light and in the troposphere where it appears as a pollutant. Besides, because of the radiative properties of this molecule, changes in its concentration may, as shown by some numerical models, perturb the climate. As a consequence, ozone is the subject of various laboratory studies: spectroscopy, energy transfer, ...

After a general introduction, we will present the spectroscopic and energy transfer properties of this molecule and some problems will be discussed: isotopic variants of ozone, NLTE situations...