LABORATORY SPECTROSCOPY FOR PLANETARY REMOTE SENSING

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Spectroscopic remote sensing of planets, comets and the Sun requires extensive knowledge of molecular spectra at various wavelengths and under a wide range of conditions of pressure and temperature. In this presentation, an overview of the requirements for monitoring the Solar system with current technology will be summarized. The progress of some infrared laboratory studies that support these applications will be described. The measurement and analysis of intensities and line shapes of relatively abundant molecules (such as ammonia and methane) will be emphasized. Finally, recommendations for some future laboratory investigations to support planetary and cometary applications will be given. [a]

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MULTIPLE FITTING OF 'PERTURBATION ALLOWED' SPECTRA OF SYMMETRIC TOP MOLECULES

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'Perturbation allowed' spectra of symmetric top molecules are observable due to off-diagonal rovibrational interactions and higher order terms of the dipole-moment operator. The observation generally needs spectroscopic tools of high sensitivity. Fourier transform microwave spectroscopy is a powerful tool for the investigation of Q-branch 'perturbation allowed' rotational spectra due to the linear dependence of the observed signal on the dipole matrix element.

For symmetric top molecules of C_{3v} symmetry 'perturbation allowed' transitions follow the Δk-Δl=$\pm$3n (n=0,1,2,3,...) selection rules. If these transitions are fitted together with transitions following normal selection rules a rather complete parameter set of the reduced effective Hamiltonian up to fifth order can be determined. The term *reduced Hamiltonian* refers to the fact that a number of parameters has to be constrained to avoid correlations in fitting the spectroscopic data. Alternative choices in constraining parameters allow the determination of parameter sets corresponding to different types of reduction which are unitary equivalent[a]. The unitary equivalence can be checked by relations which result from the theory of reduction and might be used as a test of the internal consistency of the fit. In the present talk the concept of multiple fitting will be presented for the v_t=1 and 2 vibrational states of C_{3v} symmetric tops.

[a]K. Sarka, D. Papoušek, J. Demaison, H. Mäder and H. Harder, "Vibrational-Rotational Spectroscopy and Molecular Dynamics" in "Advanced Series in Physical Chemistry", Ed. D. Papoušek, World Scientific Publishing Company, Singapore, 1997