Spectroscopic studies can reveal a wealth of information about the rotational and vibrational behaviour of the constituent molecules of gases and liquids. This book reviews the fundamental concepts and important models which underpin such studies, dealing in particular with the phenomenon of spectral collapse, which accompanies the transition from rare gas to dense liquid.

Following a description of the relevant basic physics, including a discussion of collisions between rotating molecules, the theory of spectral collapse is covered in terms of both quantum mechanical and classical models. A critical comparison of gas-like and solid-like models, combined with theoretical descriptions of rotational and vibrational relaxation, is interwoven with analysis of experimental results. These include data from optical, NMR, ESR, and acoustic investigations. *Ab initio* semiclassical calculations and phenomenological fitting laws are used to estimate the rotational transition rates, and the cross-section of rotational energy relaxation. The book concludes with a discussion of the latest theories describing the mechanism of rotational diffusion in liquid solutions.

This comprehensive review of theoretical models and techniques will be invaluable to theorists and experimentalists in the fields of infrared and Raman spectroscopy, nuclear magnetic resonance, electron spin resonance and flame thermometry. It will also be useful to graduate students of molecular dynamics and spectroscopy.

Spectroscopy of Molecular Rotation in Gases and Liquids

SPECTROSCOPY OF MOLECULAR ROTATION IN GASES AND LIQUIDS

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