

PREFACE

In recent years thermal neutron scattering has become an important tool in the study of molecular structure and dynamics, and there is increasing interest in applying this technique to problems in biology and chemistry. Because the systems to be studied are invariably quite complicated, neutron scattering investigations are most fruitful when the results can be interpreted with the aid of information obtained using other techniques. The present volume has been developed from a series of lectures given at an Atomic Energy Commission Summer Institute held at the Massachusetts Institute of Technology during August, 1973. The purpose of the Institute was to discuss the use of thermal neutron diffraction and inelastic scattering, and the related techniques of X-ray diffraction, Raman and Rayleigh scattering, in investigating biological macromolecules and chemical systems. The program was designed for graduate students and faculty members in physics, chemistry, and biology, and research workers in related fields, and the lectures were presented at a pedagogical level suitable for an audience with no special background in diffraction and spectroscopy.

It is not the intent of this book to present a great deal of quantitative material, rather it is hoped that the following chapters provide a useful introduction to the various aspects of structure and molecular vibration studies. The organization of the chapters follows the same order as the Summer Institute lectures. The first two chapters are longer in length and are intended to be introductory. The principles and experimental techniques of neutron, X-ray, and laser spectroscopy are discussed in Chapter 1 while Chapter 2 treats data analysis with particular emphasis on quasielastic scattering.

Specific applications, many of them quite new and innovative, are described in the other ten chapters. Chapter 3 considers the determination of potential functions for large molecules and shows how structural and vibrational data can be effectively utilized. A group of four chapters are devoted to diffraction studies. Chapters 4 and 5 are concerned respectively with X-ray and neutron diffraction methods whereas both techniques are exploited in Chapter 6. Chapter 10 describes the recent developments of smallangle scattering in bulk polymers. Another group of three chapters are concerned with neutron inelastic scattering and related optical techniques.

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The critical review of lattice vibrations in polyethylene in Chapter 7 provides an interesting contrast with the more descriptive Chapter 8 on chemical and biophysical applications. Chapter 9 discusses molecular vibrations and presents direct comparison of neutron and optical spectra. Several very recent developments in laser spectroscopy are reported in the last two chapters, Raman scattering studies using tunable lasers in Chapter 11 and Rayleigh scattering studies by photon correlation technique in Chapter 12. All the authors have put in a great deal of effort in making their complicated subjects understandable to the non-specialists, and in our opinion they have succeeded admirably.

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