Intermediate-Energy Physics

Nuclear and Particle Physics at Intermediate Energies. Papers from an institute, Victoria, Canada, June 1975. J. B. WARREN, Ed. Plenum, New York, 1976. viii, 608 pp., illus. $49.50. NATO Advanced Study Institutes Series B, vol. 15.

The study of nuclei and particles at intermediate energies had its origin more than 25 years ago with the operation of meson-producing accelerators. Considering the wide variety of subjects, the complicated interrelations among them, and the enormous literature of the field, it is fortunate that there have been excellent proceedings of topical conferences and schools such as the volume under review to assist those who wish to keep in close touch with developments. With several generations of accelerators, dubbed "pion factories," in operation, an examination of the areas where developments are expected to be concentrated and of the confrontation between theory and experiment is timely.

One of the key questions addressed by the book is: Given the increased precision now possible, what can be learned about the nucleus with the pion as a probe, from π production, scattering, and energy levels of pionic bound states? Where does the experimentalist need to concentrate, what can be expected from the present theoretical models, and what needs to be done to improve both theory and experiment?

The book includes a number of short papers that cover experiments in progress (on muon capture and radiative pion capture and low-energy π nuclear scattering, for example), new experimental facilities (Omicron and the Swiss Institute for Nuclear Research universal spectrometer installation), and programs on the machines at Los Alamos Meson Physics Faculty, the Space Radiation Effects Laboratory, and the Swiss Institute for Nuclear Research. There are also several comprehensive reviews. Outstanding is the opening paper by Primakoff, which gives a meticulous account of the quantitative status of the decay and interactions of the muon. This review sets the tone of the book. Koch ably reviews research on muonic and hadronic atoms. The review by Scheck on pion-nuclear interactions presents a thorough parameterization of the fundamental interaction and scattering and adsorption phenomena. It elaborates the specific nuclear complications and presents the various models and their successes and shortcomings. There is an excellent paper by Beurtey on the magnetic spectrometry program at Saclay that is sufficiently detailed to provide the reader with an understanding of this pioneering work. The paper by Schenck on the application of positive muons in solid state physics also provides a sufficiently detailed account to appeal to those interested in understanding this new development.

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Laser Spectroscopy

Dynamic Light Scattering. With Applications to Chemistry, Biology, and Physics. BRUCE J. BERNE and ROBERT PECORA. Wiley-Interscience, New York, 1976. viii, 376 pp., illus. $24.95.

Aside from proceedings volumes, *Dynamic Light Scattering* is the fourth book on modern light-scattering spectroscopy to appear in recent years. Fabelinskii's *Molecular Scattering of Light* (Plenum, 1965) mainly summarized contributions of prelaser times. Two volumes in the Quantum Electronics series (Academic Press) deal with experimental methods, practical applications, and elementary principles of the high-resolution spectroscopic techniques, known as Fabry-Perot interferometry and light-beating, intensity-fluctuation, optical-mixing, or photon-correlation spectroscopy. The first volume concentrates on basic light-scattering theory, methods, and practical applications related to macromolecules in solution, laser Doppler velocimetry, and critical opalescence (Benjamin Chu, *Laser Light Scattering*, 1974); the second is concerned almost exclusively with statistical properties of scattered light (B. Crosignani, P. Diporto, and M. Bertolotti, *Statistical Properties of Scattered Light*, 1975). The book under review provides a comprehensive introduction to the theoretical foundations of light-scattering spectroscopy and is thus complementary to the earlier volumes.

Berne and Pecora are experts in the field of statistical mechanics. They have made valuable and important contributions to the elucidation of the principles of light-scattering spectroscopy, and their book covers the topics that interest them and in which they have had considerable experience. Consequently, many important topics, such as nonlinear light scattering and dynamic scattering from liquid crystals and turbulent fluids, are not treated at all, and others, such as critical opalescence, especially critical dynamics, are barely touched. Furthermore, details of the experimental methods are missing. The book does deal, however, with many theoretical aspects of Rayleigh scattering. With the aid of time-dependent statistical mechanics, the authors endeavor to explain how information about the structure and dynamics of the system of interest can be obtained from light-scattering characteristics, but they provide only a summary of schemes for performing those measurements.

The presentation in chapters 1 through 8 of the basic theories pertaining to the dynamics of macromolecules and colloids in fluids is in general extremely well done. The authors provide detailed derivations and discussions of scattering from model systems of spherical molecules, optical anisotropic molecules, and very large macromolecules. The format is excellent because the authors have presented the less pertinent but nevertheless important derivations in an appendix and provided short notes as hints for those who wish to achieve a deeper understanding of the more subtle points in their theoretical development. On numerous occasions, helpful intermediate steps are presented.

Chapters 9 through 14 treat systems composed of interacting molecules and collective modes. The authors correctly say that chapter 11, which deals with projection operators and relaxation equations, "is mathematically involved and should be skipped, at least on the first reading, by those not conversant with the mathematics of quantum mechanics." In fact, the book as a whole will be tough reading for those who do not have advanced training in the physical sciences, such as a semester of statistical mechanics at the graduate level. Let biologists and medical scientists be forewarned of the mathematical sophistication that permeates the book.

It is unfortunate that such a first-rate piece of work should contain a number of typographical errors, which are especially annoying in figures and equations. The references are neither numerous nor entirely up to date. In dealing with motile microorganisms, the authors fail to point out that the scaling represented by their figure 5.7.1.b is coincidental because the structure factor of large particles cannot be ignored.

This is an impressive, carefully written book that should be useful as a source of information on many theoretical aspects of light-scattering spectroscopy. It provides a broad perspective on the field and contains much that is of value for those who want a rigorous understanding