tion, and numerical calculations. An interesting comparison is given between the shell-model approach with scattering states and an $R$-matrix version of the model. Some new material appears in a discussion of the optical model, the coupled-channels approach, and the distorted-wave theory. An important application of the theory is the discussion of fine structure in nuclear resonances. Slightly less than one-third of the book is devoted to this subject. Most of the authors' important contributions have been made on this subject. These are presented in considerable detail.

The general tone of the book is rather formal. Each development is given in complete mathematical detail in a rather extended notation. Operators or matrix algebra have been eschewed so that all equations are explicit, to anyone who can keep the symbols in mind. Unfortunately this style also makes for rather tedious reading. Some refinements in notation and abbreviation of the derivation would have made the monograph more accessible without decreasing its usefulness. Some judicious pruning would also have allowed for more discussion of other important developments, such as the comprehensive theory of Lane and Robson, and of other numerical calculations. Nevertheless, this monograph will prove essential as a guide to a new approach to nuclear reactions which is still in the forefront of research.

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## Electromagnetic Scattering

**The Scattering of Light and Other Electromagnetic Radiation.** MILTON KERKER. Academic Press, New York, 1969. xviii + 670 pp., illus. $33.50.

The study of electromagnetic scattering, an old subject, has had a revival in recent years. This is partly a consequence of the availability of computers, which have permitted numerical evaluation of the formidable algebraic series arising in the rigorous scattering theory, and partly because of the motivation of application of the theory to such diverse problems as the study of particle size distributions in commercially important colloidal dispersions, radar meteorology, astrophysics, and studies of sizes and shapes of large molecules in solution. Van de Hulst's treatise *Light Scattering by Small Particles* (Wiley, 1957) was very welcome, but the need has persisted for a more comprehensive treatment including a review of recent numerical techniques and applications. Kerker has made a notable contribution toward filling this need.

The interesting historical approach to the development of scattering theory makes for good reading and places the important contributions of Rayleigh, Debye, Lorenz, and Mie in their proper perspective. The reader looking for a detailed mathematical formulation of scattering theory will be disappointed. The techniques and key equations are critically presented, and adequate references and evaluations are given so that the discerning reader will be guided to important source material.

Although the author indicates that the book reflects his bias as a physical chemist and strongly emphasizes applications to colloidal systems, the treatment is quite general and should prove valuable to workers in many areas. Treatment of multiple and inelastic scattering is excluded, the latter omission representing a major gap in consideration of the exciting studies of Brillouin scattering, Doppler shifts, and Raman scattering that have been stimulated by the availability of laser sources. In order to keep the length of the book reasonable, the author wisely omits extensive discussion of experimental procedures.

About two-thirds of the book is devoted to the rigorous treatment of the scattering by uniform and stratified spheres, cylinders, and discs, with emphasis on the interpretation of theory and numerical procedures. Good tabular summaries of available calculations of scattering functions are given, with excellent documentation. Especially valuable in this interdisciplinary subject are the tables comparing notation used by various workers. The chapter on particle size distribution has a good evaluation of the "inverse problem" of calculating the distribution from experimental data.

The chapter on "Rayleigh-Debye scattering" (more commonly called Rayleigh-Gans scattering) presents a compact but comprehensive summary of the limitations of this approach and its applications to macromolecular solutions, colloidal suspensions having small refractive-index ratio, and heterogeneous solids. Small-angle x-ray scattering is well integrated with light scattering here. Extensions to anisotropic systems and the correlation function approach are surveyed.

The effects of density, concentration, and orientation fluctuations in both low and high molecular-weight binary and multicomponent liquids and solutions, critical opalescence, depolarization of scattering by anisotropic objects, and the effect of orientation by shear, electric, and magnetic fields are discussed in the last two chapters.

The book is an excellent reference work both for the beginner who wishes to survey the field and for the advanced researcher who desires an up-to-date key to the literature on electromagnetic scattering.

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## Books Received

**Abiogenesis.** From Molecules to Cells. Paul D. Thompson. Helen Hale, Ed. Consultant. Illustrated by Mary Lybarger. Lippincott, Philadelphia, 1969. 192 pp., illus. $4.95. Introducing Modern Science.

**Advances in High Pressure Research.** Vol. 2. R. S. Bradley, Ed. Academic Press, New York, 1969. x + 282 pp., illus. $12.

**Aftosa.** A Historical Survey of Foot-and-Mouth Disease and Inter-American Relations. Manuel A. Machado, Jr. State University of New York Press, Albany, 1969. xvi + 184 pp. $10.

**Air Quality Criteria for Sulfur Oxides.** National Air Pollution Control Administration, U.S. Department of Health, Education, and Welfare, Washington, D.C., 1969. xvi + 368 pp., illus. Paper, $1.50. National Air Pollution Control Administration Publication No. AP-50.

**Applied Solid State Science.** Advances in Materials and Device Research. Vol. 1. Raymond Wolfe and C. J. Kriessman, Eds. Academic Press, New York, 1969. xii + 404 pp., illus. $15.

**Australian Academy of Science Year Book, 1969.** Australian Academy of Science, Canberra, 1969. 116 pp.

**Background to Migraine.** Second Migraine Symposium, London, Nov. 1967. Robert Smith, Ed. Springer-Verlag, New York, 1969. xii + 88 pp., illus. $3.80.

**Biochemical and Clinical Aspects of Alcohol Metabolism.** A symposium, Detroit, April 1968. Vishwanath M. Sardesai, Ed. Thomas, Springfield, Ill., 1969. xiv + 322 pp., illus. $27.

**The Biologic Effects of Ultraviolet Radiation (With Emphasis on the Skin).** Proceedings of the Congress of the International Society of Biometeorology, New Brunswick, N.J., August 1966. Frederick Urbach, Ed. Pergamon, New York, 1969. xvi + 704 pp. + plates. $38.

**The Bowl of Night.** The Physical Uni-

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