

having to wade through a thousand individual results. For the working astronomer who needs detailed information, the approach may be overly tutorial; such a user will necessarily refer to the review articles that have appeared recently on several specific aspects of pulsars. However, to obtain a good overview of what has been learned, how it was done, and why it is important, read this book.

Smith, now the Director of the Royal Greenwich Observatory at Herstmonceux, was one of the leading investigators in the halcyon days of pulsar research. He is known for his incisive criticism at international meetings, for reports of significant observations made by his group at Jodrell Bank, and for the development of the relativistic beaming theory. Now, as an optical and management astronomer in the later stage of his career, he is in a good and not excessively biased position to compose a book that is at once a worthwhile addition to a professional library and a text suitable for graduate and many undergraduate students.

There are a few mistakes, as on page 122 where Jerry Kristian seems to be misquoted, and there is an occasional typographical error, as on page 17 where "50 ms" should be "50  $\mu$ s." However, these are very small drawbacks. *Pulsars* is well produced and illustrated and has a moderately helpful index.

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## Optics

J. P. Mathieu

550 pp. Pergamon, New York, 1975.  
\$27.50

This is an unusual optics textbook, judged by American standards. Our typical textbook, written for the junior/senior college level, covers classical geometrical and physical optics and some topics in quantum and other facets of "modern" optics, and often with an *ad hoc* approach to theory. There are more advanced textbooks for use by first-year graduate students that lean more heavily on electromagnetic theory, and there are the specialized monographs written at various levels.

J. P. Mathieu is a professor at the University of Paris, and *Optics* is definitely a textbook—witness the excellent "Exercises" (problems) at chapter-end and the "Solutions and hints for the problems" following the appendices, for each of the two major parts of the book.

Part 1 is entitled Electromagnetic Optics; it contains nine chapters. It covers, rather succinctly, classical optics from the point of view of electromagnetic theory, starting with Maxwell's equations. Only physical optics is treated; there is no chapter on geometrical optics and its applications—the words "lens," "mirror," and "prism" do not appear in the index. Chapter 9 on special relativity appears out of place in this book.

Part 2, Quantum Optics, contains eleven chapters and almost half the pages in the book. It covers optically related modern-optics topics including atomic and molecular spectra, refraction and scattering, anisotropic crystal optics, thermal radiation, and quantum mechanics (not in that order). Students may well have been exposed to the principles of wave mechanics before studying the subject in this course (Chapter 13), but it is useful to have this review, and to be able to use these concepts and techniques in the following chapters.

The discussion in Part 2 develops as follows: First, what evidence is there that classical arguments are insufficient to explain observed results? Second, the foundation of quantum mechanics is laid. Third, quantum or wave mechanics is shown to explain results. Fourth, the classically defined optical processes—for example, refraction and circular dichroism—are correlated with the quantum theory. Fifth, more recent advances in optics (lasers) are discussed in quantum terms.

The author states in the preface that the material in this book "can easily be treated within one academic year." This seems like a large order, if the student is also taking two or three other demanding courses. The level of the coverage is such that this book should not serve as an introductory text; it could be used effectively at an advanced-undergraduate/beginning-graduate level, where students have already encountered classical geometrical and physical optics and the rudiments of quantum mechanics. This plan would allow an adequate concentration on the results and consequences of the theoretical foundations of phenomena described in other courses such as modern physics. The book could also be used for self-study by earnest readers who desire a sophisticated rather than *ad hoc* theoretical treatment.

We believe that the book belongs in a graduate curriculum also, because it brings together all aspects of electromagnetic radiation and assembles material generally spread among several books. The instructor of such a course would have to be selective, but should be able to use the book as the basis of a very comprehensive treatment of classical and quantum optics. An appropriate subtitle for the book would be *The Classical and Quantum Foundations of Electromagnetic Radiation, with Applications*.

Some final comments: A very broad definition of *optics* is implied by the wide spectrum of topics covered. A good compromise is struck between theory and applications. The figures—mostly line drawings—are dangerously small but in general are adequate. The problems are graded in difficulty; some introduce new material not covered in the text and hence are of considerable pedagogical value.

Kudos to J. Warren Blaker for a superb job of translating the highly technical and sometimes subtle material from French into English.

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## Potential Scattering in Atomic Physics

P. G. Burke

138 pp. Plenum, New York, 1977. \$22.50

The physics of scattering of a charged particle by other particles of a gas, vapor or plasma is of importance to scientists working on research such as fusion, fission, fossil-fuel combustion, pollution detection and control, laser development, lighting and switching. With higher efficiency being of increased importance in these areas more precise scattering knowledge directed by good theory is demanded. Atmospheric science and astronomy also involve a myriad of scattering phenomena.

Potential scattering deals with a charged body that passes through a region of *electric potential* caused by an aggregation of charged particles (for example, an ion or neutral atom or molecule). Theoretical developments rest upon the direct solution of the Schrödinger wave equation for any given form of the potential energy function.

The author, Philip G. Burke of Queen's University, Belfast, Northern Ireland, is a theorist of atomic and molecular physics. He pioneered in the application of close-coupling methods of atomic-collision physics and recently has applied the *R*-matrix method to problems in atomic physics.

This short volume is a monograph presenting the fundamental concepts and generalized forms of potential scattering theory. A number of electric-field potentials, singly and in combination, are used in the Schrödinger wave equation. No other single volume covers so wide ranging a group of potential scattering topics. But little experimental data are presented and virtually no calculated results are included.

Burke's explanation of stated theoretical results is very brief, and as such it

often does not leave the reader with an understanding as would be acquired from a textbook. An extensive mathematical background is required by the reader if he is to follow the development of theory readily and appreciate the specifics of its applicability. However, the book is well referenced and presumably it was Burke's intent to construct the skeleton and let the reader add flash to the system as needed by use of the bibliography. The intended readers (the preface is so brief they are not indicated) presumably are persons beginning theoretical studies in this field and experimentalists, each seeking a broad-brush resume of the field.

The major coverage of the book in brief is:

- ▶ presentation of working equations and definitions of scattering theory in terms of partial-wave solutions of the Schrödinger wave equation, phase shifts and scattering-amplitude functions
- ▶ applications of this to the Coulomb potential (point charge), to the spin-orbit potential, and to the potential of a one-electron atom
- ▶ the scattering phase shift, restated in terms of the "scattering length" and "effective range", applicable in low-energy scattering situations
- ▶ the relationships existing between the phase shifts and number of bound states of a system
- ▶ the Born approximation, the eikonal method, and a hybrid of the two for evaluation of cross sections in the middle and high energy ranges, and
- ▶ other topics including resonances and variational methods.

One pleasing feature of the monograph is the consecutive numbering of equations throughout with no chapter prefixes. Back reference to an earlier result is quite simple and quick. However, the monograph alone is not adequate as a course text, and its selection as a course supplement will be restrained by the high price established by the publisher.

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## Man Discovers the Galaxies

R. Berendzen, R. Hart, D. Seeley  
228 pp. Science History (Neale Watson),  
New York, 1976. \$15.95 clothbound, \$6.95  
paperbound

The authors of this book have presented Man's discovery of the galaxies in a scholarly and fascinating manner. This adventure belongs almost entirely to the present century, and was followed with excitement by those of us old enough to have watched its development from the beginning. The narrative is well organized factually and is spiced by personal

episodes in the work of the astronomers involved. Richard Berendzen, Richard Hart and Daniel Seeley gathered much of their material from scattered archival sources and provide excellent documentation. From these sources they also collected a large number of pictures, many reproduced here for the first time.

The text is in four parts, each with its own prologue and epilogue. This division provides great flexibility in the use of the book. Non-scientific readers will be well rewarded by supplementing the prologues and epilogues with the well captioned pictures, while more intent readers will be

enticed to include the entire text, in which even professional astronomers will find new material. The book's purpose as a supplementary text for college students is fulfilled in the sections of proposed problems. A series of lively biographies of the principal actors, each with a photograph, are distributed through the book, but set off for separate reading so that the text is not interrupted.

Section I, "The Scale of the Universe," begins with the early island-universe concepts of Thomas Wright and Immanuel Kant, then takes up the observations and conjectures of William Herschel. It

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