Quantum mechanics for librarians

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Simple Quantum Physics. By P. Landshoff and A. Metherell. Pp.177. (Cambridge University Press: 1980.) Hbk £12, $29.95; pbk £4.25, $9.95. *An Introduction to Quantum Physics.* By A. P. French and E. F. Taylor. Pp.670. (W.W. Norton/Nelson: 1979.) Hbk $17.95, £15.95; pbk $11.75, £8.95. *Principles of Quantum Mechanics.* By R. Shankar. Pp.612. (Plenum: 1980.) $29.50, £18.59.

AT THE end of any introductory quantum mechanics course, the lecturer sadly concludes that there is not yet a satisfactory textbook while the bemused undergraduate inscribes on the desk top "Schrodinger waives the rules — probably". The three books considered here do not solve the lecturer's problem although each has its merits. They are well produced with a few misprints and each is well provided with problems for which solutions are given at the end of the text. Apart from this they have little in common.

Simple Quantum Physics is based on lectures given at Cambridge University to mathematicians and physicists, and is suitable for a one-term introductory course. I enjoyed reading the book for its brevity and clarity. There is a very brief account of the basic ideas of wave mechanics in which the standard problems are treated up to the hydrogen atom without spin. The mathematical treatment is clear but so concise that only able students will follow what is going on. A short treatment of perturbation theory leads to the most distinctive feature of the book, an excellent introductory account of atomic absorption and stimulated emission and how these can be used to understand a laser. The final three chapters introduce solid-state quantum physics by way of band theory and the physics of real transistor devices. I will recommend this book to our college library and urge my students to read it; however I will use a more detailed text as the required reading in my own course of introductory quantum mechanics.

Out of the MIT Introductory Physics Series comes French and Taylor's *An Introduction to Quantum Physics.* Here the emphasis is on the experimental basis of quantum physics, the coverage ranging from the great historical experiments to modern laser spectroscopy. The basic approach is wave mechanical, although two chapters on photon polarization experiments point the way to the abstract notion of a state vector. All the basic problems up to the hydrogen atom are treated, and both spin and hydrogen fine structure are mentioned. Atomic radiation is discussed although no systematic perturbation theory is included. The mathematical treatment is unfortunately sparse. The student who uses this book will enjoy it, but he will have to do it all again. For that reason I cannot recommend it as a set text in British universities; however, in North America, where there is more time for an undergraduate degree, I would commend it highly for a one-term or one-semester course. Even in Britain many lecturers will want this book for its outstanding illustrations and examples, and libraries should have a copy for students.

Principles of Quantum Mechanics by Shankar is intended for a year-long first course in quantum mechanics. In contrast to the previous authors, Shankar introduces the subject in a loose axiomatic way using abstract linear spaces and the Dirac notation. The attempt to explain the subject at this level means that the book is very long, and even long-winded at times, without covering as much physics as one should expect in 600 pages or so. There are some compensations, however. There is a clear introduction to the Feynman path integral formalism and special attention is paid to the role of symmetries in quantum mechanics. All standard perturbation theory is covered, including fine structure effects in hydrogen. Angular momentum addition is treated and the concept of an irreducible tensor operator is introduced. Scattering theory, electromagnetic field quantization and even the Dirac equation are briefly discussed. This book has merits as a reference book, but I think its place is not in the lecture room. □

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Approaches to nuclear reactions

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Introduction to Nuclear Reactions. By G.R. Satchler. Pp.316. (Macmillan, London/Wiley, New York: 1980.) £23, $59.95. *The Physics of Nuclear Reactions.* By W.M. Gibson. Pp.338. (Pergamon: 1980.) Hbk £19.50, $45; pbk £6.95, $16.75.

BOTH of the authors of these two volumes set out to provide a textbook on nuclear reactions, as opposed to static nuclear properties, for the undergraduate student. Usually, a single book covering the whole of nuclear physics provides adequate detail for an undergraduate course, and several such books are available. There are, in fact, some advantages in having the entire subject in one book — the unity of the subject renders the division into static properties and reactions arbitrary and sometimes confusing. However, the extra detail covered in a specialist book may well be useful to the more inquisitive student, especially if he intends to pursue the study of nuclear physics beyond undergraduate level.

Two books apparently aiming to teach much the same general topic at the same level could hardly be more different in their content and approach. Satchler's book, after an excellent introductory chapter, and an extensive section on basic scattering theory, covers in detail all the theories and models which have formed the basis of our understanding of nuclear reactions over the past 20 years. The treatment is authoritative; many of these models have been developed by Satchler himself. However, the approach is by no means historically orientated — topics of current interest, such as heavy-ion scattering and multi-step processes, are discussed and the book contains plenty of examples of the application of the methods described to "real live" data. The descriptive material is excellent, although curiously the only point at which it is a little misleading is the discussion of the concept of cross-sections, which is sometimes difficult to get across to students. The scope of the book is broad, both in the depth of treatment and in the wide range of topics covered. For example, even Glauber theory, which is useful at energies much higher than those usually encountered in nuclear reaction studies, is described briefly.

By contrast, Gibson's book, which is a new edition of his book *Nuclear Reactions,* provides a much more concise account of the basics of nuclear reaction theories. Unfortunately, several topics which are an essential part of most undergraduate courses are omitted; for example, there is no quantitative treatment of direct reactions. The discussion is clear throughout, and Gibson seems sometimes to assume a more elementary starting point for his readers than does Satchler. Gibson provides an excellent discussion of particle accelerators (though not of any other aspect of techniques — a curious selection), and also gives an account of the physical principles of fission and fusion reactors. His final chapters on nuclear forces and nuclear spin give good accounts of these topics, with a breadth of treatment beyond that directly relevant to nuclear reactions.

The choice between these books for the student must be based on their content. The student who intends to concentrate on pure nuclear physics will find Satchler's treatment valuable, and the content of this