Wavelet theory is one of the few fields in mathematics that produces little tension between its theory and applications. Few sacrifices in rigor are needed in presenting a full theory of wavelets, and it is possible to present applied results using wavelets (on the processing of electroencephalogram data, for example) without any sacrifice of rigor. This has attracted many pure mathematicians to the field, including many talented harmonic analysts. France has traditionally been strong in harmonic analysis, and the fact that wavelets originated there has led to a large amount of high level work in that country. Books on the subject originating in France include Meyer's *Wavelets and Operators* (Cambridge U. P., 1992). Another, more standard, reference, originating in the US, is Daubechies's *Ten Lectures on Wavelets* (SIAM, 1992)

The author of *Wavelets: An Analysis Tool*, Matthias Holschneider, is a physicist at the Centre de Physique Théorique in Marseille, France, who has made a number of theoretical and applied contributions to wavelet theory; in the true spirit of wavelet theory, his book covers both applied and theoretical aspects. It is intended as a graduate text and serves this purpose very well, despite an absence of exercises (the inclusion of which would make the book much more marketable in American universities) and a somewhat terse exposition at some points.

The book starts by providing numerous examples (complete with spectral diagrams) of wavelets used in continuous wavelet transforms, together with the theory needed to understand them. Discrete wavelet expansions are then explained. Other related wavelet expansions are also considered, including nonorthogonal ones, and computational and reconstruction issues are considered, as is the occurrence of a Gibbs phenomenon in wavelet expansions.

The book includes statements of the fundamental theorems of analysis, with proofs, where needed, that a reader requires to handle the material. This should be a great help to the practicing physicist who wishes to obtain thumbnail sketches of the analysis theorems that underlie the results detailed in this book.

All in all, the book could serve well as a text, reference or tutorial on wavelets. It has a strong theoretical component and contains the foundations for most current applications of wavelet theory, and its novel approaches in some parts make it worthwhile for an expert.

Mark A. Kon
Boston University
Boston, Massachusetts

Lectures on Quantum Theory: Mathematical and Structural Foundations

Chris J. Isham
Imperial College P. (World Scientific), River Edge, N.J., 1995. 220 pp. $48.00 hc
ISBN 1-86094-001-3; $22.00 pb
ISBN 1-86094-000-5

There has been a recent increase in interest in the conceptual and mathematical foundations of quantum theory. This has been stimulated by, among other things, recent developments in relativistic cosmology and attempts at understanding quantum gravity.

The author of *Lectures on Quantum Theory*, Chris Isham, is a professor of theoretical physics at Imperial College, London. He is one of the leaders in the field of "quantum gravity." (I use quotes, since we do not yet know what this term really means.) He has made numerous contributions to the understanding of the geometrical concepts underlying attempts to formulate quantum gravity and quantized gauge theories. Recently, with Abhay Ashtekar, he has developed a line of research close to my heart: a "holonomy" approach to quantizing gauge theories and general relativity. (They are using parallel transport along loops to generate appropriate algebras of fields and observables.)

The book is based on lecture notes handed out to undergraduates at Imperial College. In the US it could serve as an excellent supplement for an introductory graduate course on quantum mechanics, one in which the students learn the "how-to's." The discursive style and clear exposition make for equally attractive reading by someone familiar with the subject or by a student who has only a rudimentary knowledge of atomic theory. The first 50 pages (after a brief review of Schrödinger wave mechanics) are devoted to a discussion of vector spaces and operators. There are no detailed proofs in the infinite-dimensional case; this is balanced by a nice supplement of solved problems at the end of the book.

As stated by the author, "One of the main goals of the book is to explore some of the deep conceptual issues that arise in quantum theory." Isham does this very skillfully in about 130 pages, without grinding any particular axe, by choosing to "focus on the notion of *physical property*, and the extent to which it is, or is not, meaningful to talk about a quantum system 'possessing' such properties."

After three review chapters, Isham begins his discussion (in chapter 4) with the ideology of classical physics, emphasizing the seamless meshing of the "realist" and "instrumentalist" views of science. The next two chapters discuss in detail the rules of quantum theory, both for pure (vector) states and mixed (density matrix) states, with a good description of the relation between the mathematics and the physical concepts. At this stage the author adopts the pragmatic approach, leaving open questions of interpretation.

The last chapter (chapter 8) is a very clear and succinct exposition of the conceptual problems of quantum theory. The chapter is organized around four main topics: the meaning of probability, the role of measurement, the reduction of the state vector and something called quantum entanglement. These four problems are dealt with in a lively and interesting way, and although some of the author's philosophical sympathies can be guessed, the exposition is as objective as one can be on the subject, emphasizing the open questions and the fact that one can be a quite successful practitioner of quantum theory even if one does not worry about the problems raised.

I would strongly recommend that anyone teaching the subject use this little book as supplementary reading. Although it is less detailed than other recent books, it gives the reader a good bird's-eye view of the problems that bother many newcomers to the field —even some experienced users of quantum theory. Getting a feel for these questions is critical if one is ever to understand the quantum theory of closed systems such as our universe.

The main text is supplemented by a substantial number of problems with solutions, which should help the beginner master the mathematics. The book is carefully typeset and, unlike other books published by major publishing houses I've reviewed recently, the number of typos I found is very small (3 or 4). An amusing one is that Karl Popper's knighthood "Sir" has become his initial in the bibliography.

Meinhard Mayer
University of California, Irvine

Relativistic Atomic Collisions

Jörg Eichler and Walter Meyerhof
Academic P., San Diego, Calif., 1995. 413 pp. $74.95 hc
ISBN 0-12-233-675-5

As a boy, I never really understood the difficulty my high school physics teacher had with the way water gets