

oriented." "On the night side" should be eliminated from the sentence "sudden pulses and sudden commencements are worldwide phenomena occurring nearly simultaneously on the day side and on the night side."

Some readers will be disappointed that this book fails to give adequate attention to interactions between electrical phenomena occurring in the troposphere and the regions above it. For example, no indication is given of the possible effects on the electrification in thunderclouds when solar flares cause increases in the atmospheric electrical conductivity that extend down to levels as low as 15 km. Similarly, little attention is devoted to the effects that radiation from lightning can produce on processes occurring in the upper atmosphere.

Despite these minor limitations, the book should prove a valuable resource for those already working in any of these very active fields of research, or who may be thinking of tackling any of the many fascinating and important problems in atmospheric and magnetospheric physics that remain unsolved.

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Quantum Field Theory

F. Mandl, G. Shaw

Wiley, New York, 1985. \$34.95

Quantum field theory has, in the last two decades, become the natural tool for describing systems with large numbers of degrees of freedom, and it is at this time the only language in which relativistic quantum mechanics can be formulated. Thus some knowledge of field theory is increasingly viewed as part of the general graduate curriculum. This carefully written and, for its length, surprisingly comprehensive book is an excellent candidate for becoming the standard text for a one-semester introductory course in relativistic quantum field theory.

The first part of the book contains a brief, but quite complete, introduction to the quantization of free fields. The discussion of the Dirac equation is perhaps too brief, even though an appendix attempts to remedy an almost complete absence of details in the main text. The problems with the covariant quantization of the radiation field are treated with great efficiency. The quantization of the massive vector-boson field is postponed till the last part of the book, where the topic comes up in a discussion of the weak interactions.

The scattering matrix is introduced in the second part of the book. Feynman-graph rules for electrodynamics are derived and some tree-graph exam-

ples are worked out. I was again impressed with the care the authors have taken to combine brevity with completeness. Thus the reader's attention is drawn to the need for some sort of asymptotic hypothesis; the infrared divergence is discussed in connection with the soft-photon limit of *bremsstrahlung*, and the examples chosen for explicit calculation are compared with experiment. Further, useful examples of tree-graph calculations occur in the last part of the book in connection with

the weak interactions.

The discussion of renormalization is conventional: The various divergent parts are identified, and renormalized. The authors make good use of dimensional regularization. As usual, the discussion of the external line renormalization is awkward in the absence of Lehmann-Symanzik-Zimmermann reduction formulas, but aside from that, everything is clear; and the Schwinger correction to $g - 2$ and the Lamb shift are worked out to order e^2 .

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The book concludes with a brief discussion of the more modern topics in quantum field theory, namely Yang-Mills theories, spontaneous symmetry breaking and the standard electroweak theory. Goldstone bosons and the Higgs mechanism are discussed at the classical level. Also, the Weinberg-Salam-Glashow model for leptons is discussed, and the main predictions are worked out.

Quantum Field Theory has the advantage over J. J. Sakurai's *Advanced Quantum Mechanics* (Addison Wesley, Reading, Mass., 1967)—another book aimed at the same audience—in that it has been written 17 years later, so that technical improvements such as dimensional regularization; fundamental advances such as electroweak interactions; and the topic of spontaneous symmetry breaking can be included. Sakurai's book is more discursive: There is much more on the Dirac equation, more playing around with the results of calculations in various limits, and more use of invariance principles in the interpretation of physical results. The book under review is more directed. Both books have good problems. An excellent course could be constructed with either book, using supplementary sections from the other one.

Since recent technological advances have led to the publication of many books that look as if they have come straight off the word processor, I feel that it is important to compliment the publishers on turning out an extremely attractive book.

STEPHEN GASIOROWICZ
University of Minnesota in Minneapolis

book note

Niels Bohr: The Man, His Science and the World They Changed Ruth Moore

MIT Press, Cambridge, Mass., 1985. 436 pp.
\$9.95 paper

Ruth Moore's biography of Niels Bohr, originally published in 1966 (Knopf, New York), is still the only full, book-length biography of the physicist published in the English language. Therefore we have to welcome this new paperback edition of the biography as a valuable addition to the existing literature on Bohr.

Throughout the book, Moore discusses the most important concepts of atomic and quantum physics necessary for understanding Bohr's work, making the book accessible to the nonscientist. The book also covers Bohr's political life, his participation in the anti-Nazi movement, his efforts to avert a nuclear arms race and his work towards the peaceful use of atomic energy.

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