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Problem-Solving Software Systems

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vices, lasers, photodetectors, optical waveguides and optical communications systems. Because of the rather broad range of subjects covered in the text, the treatments tend to be descriptive and not strongly quantitative. For example, the discussion of birefringence considers the qualitative aspects of the Huygens construction of the e-wave and o-wave surfaces, but it does not develop the usual index-ellipse formula that allows one to calculate the index of refraction as a function of direction. Two chapters of the book devoted to lasers are a bit more quantitative than the other chapters: The authors present a brief rate-equation analysis of a four-level system and calculate the population inversion required to achieve the laser threshold.

The book's greatest strength is its very clear qualitative descriptions of the principles of operation of dozens of optoelectronic devices. The authors capture the essence of each device and explain the fundamental physics in an appealing way. There are a great many illustrations in the text that contribute significantly to the clarity of the presentation. A list of questions and problems follows each chapter, and the answers to the numerical problems appear as an appendix.

The standard textbook for optoelectronics is Amnon Yariv's *Optical Electronics*, which is much more quantitative and requires a more sophisticated reader than the present book. Wilson and Hawkes intend their book to give a "first glimpse" into a growing field and to lay a conceptual foundation to be built upon by more advanced and specialized texts. All things considered, it succeeds. Even when a more quantitative exposition is needed for the principal text in a course, it would make an ideal supplementary text.

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Waves and Photons: An Introduction to Quantum Physics

E. Goldin
211 pp. Wiley, New York, 1983. \$25.95

Quantum optics, although as old as quantum mechanics itself, has been experiencing its most significant developments since the advent of the laser. To some extent, this progress has been witnessed at the five Rochester conferences on coherence and quantum optics held during the last two decades. Even though several intermediate and advanced books on quantum optics already exist, an elementary textbook on this subject, such as the present book by Edwin Goldin, is a welcome addition.

The book aims to present the wave-

like and particle-like aspects of light in a coherent pedagogic manner and to convince the reader that there is in fact no paradox in this wave-particle duality. Out of its eight chapters, the first four deal with the classical wave theory. The treatment is elementary enough that a student with some knowledge of calculus should be able to follow it. The last four chapters deal with the electromagnetic and quantum aspects of light. Here the presentation is on a different level. Because he assumes no previous knowledge of electromagnetic theory or quantum mechanics, Goldwin tries to teach some aspects of both of them in the remaining 85 pages. While it is not an easy task, he has largely succeeded in it. His presentation is clear and he has worked out the mathematical steps in sufficient detail.

Goldin has taken a daring step in introducing the Dirac formulation of quantum mechanics in an elementary undergraduate optics textbook. He thus deals with concepts that are abstract in nature and employ "strange-looking" mathematical notation. The problem here is that the intended readers may not have enough background in quantum mechanics to grasp these concepts and correlate them with their previous knowledge. In my opinion, the study of Heisenberg's matrix approach in a quantum-mechanics course would help prepare a student to follow the Dirac formulation. Goldin has, however, made ample use of analogies and illustrations, with the hope that a student will not feel completely lost.

A shortcoming of the book is that even though it is subtitled "An Introduction to Quantum Optics," recent advances in this field are not even mentioned. An overview of the possible applications of the theoretical formulation would have certainly been useful. I have also noticed a few typographical errors. These are, however, minor in nature and should not be a cause of concern.

In summary, this book provides a good introduction to the classical and quantum aspects of light and may prove useful as an elementary textbook.

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new books

Fluids and Plasmas

Introduction to Plasma Physics and Controlled Fusion. Second Edition. Volume 1: Plasma Physics. F. F. Chen. 421 pp. Plenum, New York, 1984. \$24.50. undergraduate text

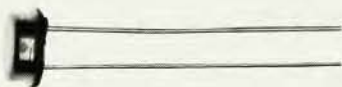
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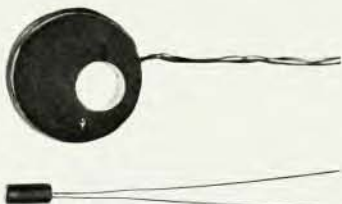
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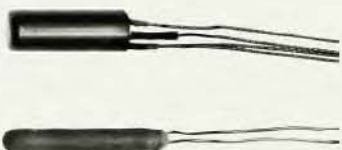
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