New high-capacity optical fiber at right transmits 65% of initial laser-light intensity, versus 1% for fiber at left. From Philips Laboratories (Aachen, W. Germany).

ployed as components in intensifier tubes to transmit a digitized image), and the familiar illumination exotica where fibers provide what for some is an aesthetic distribution of illuminated points. To deal with the analysis of the electromagnetics problems associated with these applications, a book like N. S. Kapany's *Fiber Optics* (Academic, New York, 1967) provided just about everything you wanted to know.

At the same time that the lossy-fiber applications were being pursued, there was a substantial effort to explore the light-guiding potentialities of various lens and gas-filled-tube systems in order to see if a practical transmission line could be developed—one that would permit the eventual utilization of the bandwidth the laser had made available. Jacques Arnaud contributed to this effort as well as to the analysis of fiber propagation, and the present book represents, in substantial part, an expansion on his efforts in these fields. His experience parallels that of Dietrich Marcuse in many ways; this book covers much the same ground as do Marcuse's two books on the subject: *Theory of Dielectric Optical Waveguides* (Academic, New York, 1974) and *Light Transmission Optics* (Van Nostrand Reinhold, Princeton, 1972).

The book itself concentrates on analysis techniques for optical guiding systems, although other topics such as physical aspects of fiber and gas lens fabrication are also discussed in brief. Arnaud describes both ray-theoretic and wave approaches. The book sticks fairly close to the author's research, with the result that some topics are dealt with in unexpected detail (for example, several pages are devoted to the effect on loss and coupling of a layer of silver placed between dielectric slab guides), while other topics, such as the Goos–Hanchen shift near incidence at the critical angle, are given too brief dismissal.

The book fits in as a useful addition to the texts associated with optical communications. The approach is generally unorthodox, with early analogies drawn between wave mechanics and light-beam propagation and with the introduction of Maxwell's equations held off until nearly halfway through the book. This approach may have a special appeal to some readers. On the debit side, the book suffers from a parochialism in the literature citation and in a lack of clarity in the derivation of some basic concepts. On the credit side, there is a great deal of useful material concerning propagation in lens, fiber and film systems; bending losses, pulse dispersion and coupling characteristics, and ray approaches to the solution of resonator and guiding problems. The optical communications researcher will do well to add Arnaud's book to his library.

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The Elementary Language of Solid State Physics

M. H. B. Stiddard
188 pp. Academic, London, 1975. $14.00

This book presents a brief but not particularly elementary introduction to solid-state physics. For those who wish to tackle solid-state physics for the first time, its compact size may be appealing. One should note, however, that because this book was written "primarily as an aid to students of chemistry," physics students may find some of the discussions phrased in language somewhat foreign to them.

Because Melville Stiddard intended *The Elementary Language of Solid State Physics* to serve as a bridge between physical chemistry and solid-state physics, one should ask how well it does this job. Part of the answer emerges from a brief survey of the topics covered, which go beyond those in a typical physical-chemistry textbook. The treatment of crystal symmetry is quite detailed and includes an introduction to tensors and their transformational properties. Stiddard discusses the ideas of reciprocal lattice and Brillouin zones, introducing concepts that form a necessary background to the solid-state literature. The chapter on lattice dynamics includes a section on the vibrational modes of a diatomic lattice, as well as a very brief introduction to phonons. In his discussion of the free electron gas, he derives the density of electron states and uses it in conjunction with the Fermi–Dirac distribution function to calculate the electronic heat capacity, the Richardson–Dushman equation and the Pauli spin magnetization. Stiddard also gives a very condensed discussion of electron-transport properties using the Boltzmann equation. The longest chapter covers band structure and includes such topics as the nearly free electron model, the tight-binding approximation, effective mass, the Fermi surface and the temperature dependence of the conductivity of semiconductors.

From the above summary, one may see that the author covers a reasonable selection of topics but does not attempt to treat the whole field of solid-state physics. Many of the topics are clearly and interestingly presented. For instance, I was intrigued to learn that the pressure of the electron gas in a metal is about 10^4 atmospheres. However, several topics, such as phonons and the Fermi surface, Stiddard has introduced so briefly that their significance is not readily apparent. He presents very few experimental data, so the reader will have to go elsewhere to learn about properties of real materials.

A weakness of the book is that the level of background expected of the reader varies greatly from section to section. In the chapter on the free electron gas, the author has written an introduction to quantum mechanics on a quite elementary level. In a later discussion of energy bands, however, he uses degenerate perturbation theory. This section and others would prove difficult for a reader without more extensive knowledge of quantum mechanics. Another problem the reader will encounter is a number of typographical and other errors. One particularly misleading derivation indicates that the wave vectors that label Bloch functions must be reciprocal lattice vectors.

I think *The Elementary Language of Solid State Physics* will find its most ready audience among physical-chemistry graduate students and research chemists who are initiating investigations of the solid state. For these readers the book should provide a useful background for further study of the field.

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Introduction to Liquid State Physics

C. A. Croxton
283 pp. Wiley, New York, 1975. $26.50

In his preface Clive Croxton writes "This book was written in the belief that the theory of liquids is now ready for dissemination to a wider and more general audience—to chemists, metallurgists, biophysicists and engineers, not to mention the non-specialist physicist who also needs to know something of the liquid state." He is probably correct. Over the

last decade important advances have been made in our understanding of the physics of simple (monatomic) fluids; so a well-planned and carefully written introductory text on this subject would certainly be a welcome addition to the literature and should attract a wide audience. I feel, however, that Croxton's book does not give a sufficiently well-balanced view of the subject to provide a reasonable introduction.

The major part of the present volume consists of a shortened and somewhat modified account of his earlier book *Liquid State Physics: A Statistical Mechanical Introduction*, which appeared in 1974 and is referred to as LSP. After a short introductory chapter, Croxton discusses the calculation of virial coefficients for dilute classical and quantum-mechanical systems before embarking on his longest chapter, which describes the equilibrium structure and properties of dense liquids. It is here that he introduces the formal theory of distribution functions and their use in the calculation of thermodynamic quantities. The various approximate theories of liquids, diagrammatic expansions, functional differentiation techniques, thermodynamic perturbation theories—all are described at varying levels of sophistication. This chapter is more digestible than the corresponding one in LSP, because Croxton has now included many useful sketches of the different functions that appear in the text. The two sections on numerical solutions of idealized models of liquids follow closely those in LSP and give the reader some indication of the important role played by machine calculations in the present studies of liquids.

Croxton's own work has been mainly concerned with the statistical mechanics of liquid surfaces, so it is not too surprising to find a whole chapter devoted to the surface problem. Unfortunately the author concentrates on his own contributions (whose merits are controversial, to say the least), so that the non-specialist reader would probably obtain a completely erroneous impression of the current developments in this field.

The "new" chapters in the present book form a very mixed collection. One finds a short discussion of critical-point studies and a rather idiosyncratic treatment of phase transitions, the latter again biased towards the author's own particular work. While the chapter on the structure and thermodynamics of liquid crystals is not out of place in a book of this kind, Croxton's section on liquid metals appears most inappropriate, because he deals solely with a few aspects of electronic transport in these systems. A more natural topic to include would have been a discussion of effective pairwise interatomic potentials in liquid metals; this subject is of considerable current interest. The final chapters provide a very brief, and not very illuminating, introduction to non-equilibrium properties, such as transport phenomena and the general question of irreversibility. Croxton does not give original references; the reader is frequently referred to LSP, and this naturally becomes tedious or even infuriating.

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The Solar Chromosphere and Corona: Quiet Sun

R. G. Athay
504 pp. D. Reidel, Dordrecht, Holland, 1975. $59.00

This is the second monograph on the solar chromosphere to be published in a short time; the first, by Robert J. Bray and Ralph E. Loughhead, was reviewed earlier (see PHYSICS TODAY, November 1974, page 57). Both monographs cover to a large extent the same areas, but each presents the subject as viewed by the very

SACRAMENTO PEAK OBSERVATORY

Solar chromosphere near the limb, as seen through a 1/4-Å-bandwidth filter tuned to the wing of the Balmer-α line of hydrogen. Irregular spicules appear at the limb, and the bright spot near the bottom is a small solar active region.