dynamics of rotating fluids. Because the book is issued by Cambridge University Press, it is in the best of company and deserves this place.

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Superconductivity for everyman

AN INTRODUCTION TO THE THEORY OF SUPERCONDUCTIVITY. By Charles G. Kuper. 301 pp. Clarendon Press, Oxford, 1968. $9.60

by JOEL A. SNOW

Two types of monograph are needed to summarize and unify the present state of an advanced scientific field. Inward-looking monographs are expert's books, intended for the small corps of professional specialists whose research is actively extending the frontiers. As the body of knowledge expands and specialities grow within specialities, the inward-looking books must necessarily become evermore esoteric, and the potential audience perforce remains limited. Outward-looking monographs are nonexpert's books, intended for the broad range of scientists and students whose major interest is in related fields, who have an interest in applications, or who are drawn to the subject out of curiosity. Such books must eschew elegance in deference to clarity and avoid jargon in favor of language that is understandable to a heterogeneous audience. Charles Kuper's book on superconductivity theory falls into the latter class. It is designed for, and deserves the attention of, the many engineers, chemists, experimentalists, and nonspecialist theorists who wish to use or appreciate the theory without mastering it.

In recent years superconductivity has moved from the status of a laboratory curiosity and perplexing theoretical puzzle to the threshold of major technological importance. Superconducting switching circuits, high-field magnets and superconducting linear accelerators all either exist or are under development, and the prospect of the associated development of large-scale cryogenic techniques hints at such applications as high-power long-distance transmission of electricity. Thus many people have a need to learn the essentials of the underlying theory, and Kuper has undertaken a task that is well worth the effort. The theory took its great leap forward 12 years ago, with the development of the BCS (John Bardeen, Leon Cooper, Robert Schrieffer) theory and, contrary to the occasional situation in which a new, comprehensive theory is so overwhelming that it stifles further development, the original BCS paper led quickly to further applications, elaborations and refinements. The experimental and theoretical literature have both grown very rapidly, and most of the remaining experimental disagreements and conceptual perplexities have now been resolved.

Though the original BCS paper may properly one day be known as a masterpiece of scientific exposition, it was originally thought to be quite obscure, and the subsequent theoretical literature has tended to be relatively opaque to nonspecialists. Much of this difficulty arises because the full apparatus of the quantum many-body formalism is generally required.

The present comprehensive version of the theory, due to G. M. Eliashberg, L. P. Gor'kov, Yoichiro Nambu, Philip W. Anderson and others, uses the formalism of many-body Green's functions, an elegant technique with its own lore and language, and an unfortunate proliferation of notations. Kuper approaches this high plateau assuming only that the reader knows some classical physics and elementary quantum mechanics.

The chosen approach is historical and phenomenological, with more than half of the book devoted to material that is dismissed in the first chapter of Schrieffer's well known advanced monograph. Basic experimental results are sketched in where appropriate, with particular attention given to various models that describe the observed thermodynamic and electromagnetic properties. Though most of the arguments are familiar, they are put forward clearly and with painstaking detail. A very few forward references, for example, using the BCS density of states while discussing two fluid models with an energy gap, make it possible to present many of the most useful relationships and much of the intuitive content of the subject without any direct reliance on quantum me-

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chanics. Normal–superconductor interfaces, the intermediate state and the phenomenology of type-II superconductors are treated particularly well.

The later sections of the book, devoted to the microscopic theory, are relatively more telegraphic. Kuper develops, in simplified form, much of the quantum theory of metals, starting with an introduction to second quantization and a simple introduction to the electron–photon interaction. The Bogoliubov–Valatin version of BCS theory, as modified by Anderson, is discussed in some detail. Many well known sticky points, and justifications for steps that otherwise would seem a bit arbitrary, are pointed out or at least referred to in footnotes without interrupting the smooth flow of the argument. A subsequent introduction to Green's functions, in which some of the basic results of the Gor'kov version of the theory are set out, is probably too brief to be useful although it does provide a modest bridge to the literature. The full theory of Eliashberg *et al*, including the retarded interaction, is not discussed.

In a book of this sort very much attention must be given to deciding what to leave out and where to place the emphasis, and Kuper has, by and large, chosen very well, although, of course, the book is far from exhaustive. Inevitably some of the experiments quoted have been superseded, some of the most active lines of present investigation merit only a footnote or a paragraph, and some of the quite fascinating features of coherence, long-range order and connections with the general theory of phase transitions and with the properties of liquid helium simply go unmentioned. A whole class of situations are ignored in which mechanisms exist (such as the presence of magnetic impurities) that tend to break Cooper pairs and lead to the suppression of the energy gap without destroying long-range coherence. Type-II superconductors are not discussed from the standpoint of microscopic theory, strong-coupling superconductors are barely mentioned, and nothing is said about the remarkable class of alloys, such as Nb_3Sn, which have unusually high transition temperatures. Many of the practical questions related to materials that are of particular importance in possible technological applications, such as metallurgical problems, hysteresis effects and so forth are also not discussed. Kuper also does not enter into Bernd Matthias' intriguing speculations relating electronic band structure to superconducting properties, and the book was published just too soon to record Matthias' recent success in producing an alloy with a transition temperature of 20.7 K.

But the book is well produced and edited, with a good index, helpful appendixes and a not unreasonable price. As a well planned primer to the basic theory and a compact guide to the literature this book will serve its readers well.

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Joel A. Snow has published on transport properties of superconductors and recently moved from the University of Illinois to the National Science Foundation where he is concerned with the theoretical-physics program.

Advanced infrared

THE DETECTION AND MEASUREMENT OF INFRA-RED RADIATION. (2nd Edition) By R. A. Smith, F. E. Jones, R. P. Chasmar. 489 pp. Oxford Univ. Press, 1968. $13.45

by HERBERT MALAMUD

If one can define a monograph as an advanced-level textbook for which there is no course, this book is a monograph. It is also a good monograph.

The authors emphasize new methods of detection of infrared energy and infrared spectroscopy. The discussion of each subject begins with its early history and describes details of development up to the most recent. For example the development of the thermocouple is described from Leopoldo Nobili's first model, made in 1830, up to the present. Detailed theory is given for operation of both cw types and those fed with chopped ir beams. The same type of description is given for bolometers and Golay detectors. A similarly complete discussion is given for photodetectors, ir sources and optical materials and components.

The theoretical discussions include effects of fluctuations and other limitations on ultimate sensitivity. A chapter is devoted to amplifiers of various types. Another discusses atmospheric transmission of ir. Still another describes various ir spectrometers, including the Fourier-transform spectrometer developed during the last two decades. The book is well written, the theoretical development clear and easy to understand, and the notation not at all

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ponderous. Footnotes contain the many references, convenient to their citation higher on the page, but tedious to count, if any one should want to.

I noted only two criticisms of this book. Firstly, although lasers, many of which operate in the ir, are described in a short section of about four pages, there is no discussion of the detection of effects peculiarly associated with lasers, such as coherence measurements. Secondly, the book contains a number of tables and graphs giving various properties of materials and components of interest (such as thermoelectric power of various metals, for example). However, to workers in the field, a great expansion of information of this type would have been useful. Such people will still need a handbook to work effectively. For workers in the field of ir, either newly arrived or old hands, the book is very apt. Necessary, we might say in mathematical language, but not sufficient.

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Light reading for lasermen

LASERS, VOL. 2. By Albert K. Levine. 440 pp. Marcel Dekker, New York, 1968. $19.75

by DAVID F. HOTZ

Ten years have passed since the original article of Charles Townes and Arthur Schawlow proposing an optical maser appeared, setting loose a flood of incredibly fruitful activity. The