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 Inevitably some of the experiments quoted have been superseded, some of the most active lines of present investigation merit only a footnote or a paragraph, and some of the quite fascinating features of coherence,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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Herbert Malamud, vice-president of Plasma Physics Corp, is studying the application of high-temperature thermal plasmas to problems of chemical and metallurgical processing.

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

deluge continues unabated and is touching nearly every specialized area of electrical and physical science, providing new tools of great flexibility and high precision wherever a high-radiance optical beam of well defined frequency and phase can be used to advantage. Certain portions of the field show signs of approaching maturity, and the time for review and appraisal of progress is at hand.

The five articles in this volume deal with nonlinear optics, frequency stabilization of gas lasers, and three commonly available species of laser sources: gas, glass and injection lasers. The book provides sufficient background knowledge and working information to facilitate development and widened application of these marvelous devices to diverse fields. Review articles in technical fields undergoing rapid expansion sometimes suffer unfairly when the growth rate is faster than an author can write. The strongest constructive criticism that can be made of the present series of articles is that they are about two years behind current developments. It would help if the closing date of review were indicated at the head of each article. The reviews are intended to be a critical assessment of progress in their respective fields, but it is clearly impractical to have the last word in a critical sense in an area undergoing explosive expansion. Consequently the authors have for the most part confined themselves to careful reporting.

Albert Levine edited Volume 1 of this series, and the excellent standards of scholarship evident in that work have been repeated in Volume 2.

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The reviewer is a physicist with the Naval Electronics Laboratory and is concerned with laser applications.

Semiconductors made simple

ENERGY BANDS IN SEMICONDUCTORS. By Donald Long. 212 pp. Interscience, New York, 1968. $9.95

by DANIEL C. MATTIS

This book is enthusiastically recommended as an introductory monograph dealing with theoretical and experimental aspects of homogeneous semiconductors. The author, who is actively involved in semiconductor materials research at Honeywell Corporation, has a felicitous style and brevity of exposition that make the book suitable either as an undergraduate or graduate textbook. Although it is probably somewhat too abbreviated to serve either as a reference book or for self-study, references to the literature, following each chapter of this book, will lead the reader to relevant supplementary sources. With little mathematical distraction, the author leads the reader, in part I, through energy-band theory, group theory and perturbation theory, followed by experimental methods (electrical, magnetic and optical). Application to Group IV elements (germanium and silicon), III–V compounds, II–VI compounds, IV–VI compounds and various alloys form part II; a helpful appendix explains some devices (transistors, tunnel diodes and so forth). Basically the only flaws are those inherent in oversimplification. This is not a serious objection as conscientious students will soon fill in the gaps, and others will not need to. This book will be useful to electronics engineers (as well as solid-state physicists) and to all others who wish to learn a little about a lot of aspects of the energy-band structure of solids from a small book easily scanned in a few hours.

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The reviewer is professor of solid-state physics at the Belfer Graduate School of Science, Yeshiva University, where he occasionally works in semiconductor physics.

Application of graphs

GRAPH THEORY AND THEORETICAL PHYSICS. Frank Haray, ed. 358 pp. Academic Press, London, 1967. 84s

by GARRISON SPOSITO

A glance at the book title suggests that it deals with the relationship between a small part of mathematics and a large part of physics. In a rather subtle way this is true, although what one finds are polished versions of eight very mathematical lectures on graph theory along with four first-rate expositions on the uses of graphs in classical statistical physics and in electrical engineering. In this sense, the word *and* in the title is not to be taken lightly.

The three articles on theoretical physics are written by P. W. Kasteleyn, J. Groeneveld and George Stell, respectively, and first appeared along with their companion pieces as lectures in a NATO-sponsored institute. Kasteleyn's paper is an immensely readable assessment of the impact of graph theory upon some aspects of crystal physics, that is, the random and self-avoiding walk problems, the dimer problem and the Ising problem. The discussion is self-contained and complete, beginning with the very definition of "graph" and including descriptions of the use generating functions and Pfaffians. The two and one-half pages of references at the end of the article should contain sufficient starting material for anyone who is serious about lattice statistics.

The articles by Groeneveld and Stell may be regarded as distinguished supplements to George E. Uhlenbeck and Gerald W. Ford's fundamental paper on graph theory and the statistics of classical gases, published a few years ago in *Studies in Statistical Mechanics*. Groeneveld's paper indicates in a systematic way how one arrives at the ideal-gas approximation, the Mayer theorems and the celebrated Percus-Yevick and Hypernetted Chain approximations. In addition he presents his own (previous) derivations of rigorous thermodynamic inequalities that are consonant with the ideal-gas approximation and the Mayer theorems. Stell's paper deals with generating functionals as they are used in many-body perturbation theory and includes a lengthy list of references.

Graph Theory and Theoretical Physics is recommended highly to anyone interested in statistical physics and, in particular, to those who wish current findings in a nutshell as a guide to their own research.

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Garrison Sposito is an associate professor of physics at Sonoma State College, Rohnert Park, California.

Orbital mechanics

ASTRODYNAMICS, ROCKETS, SATELLITES AND SPACE TRAVEL: AN INTRODUCTION TO SPACE SCIENCE. By John A. Eisele. 545 pp. National Book Co. of America, Washington, D. C., 1967. $10.00

by ROBERT L. WEBER

The author, a staff member of the U.S. Naval Research Laboratory, states