

that the AEC, having virtually realized its civilian power and weapons development missions, is passing through "a visible climacteric of spirit and purpose." From this assumption follow some very provocative comments on the issues involved, often supported by penetrating but unattributed quotations.

"What is the proper role of government laboratories . . . in the improvement of civilian technology . . .?" he asks. And again, "Is the time fast approaching when the Congress should define more broadly the proper function of designated agencies and of their laboratories, in the realm of civilian technology?" To accomplish an expanded role, Orleans believes the AEC requires a revised charter . . . "An accommodation under which the scope of the AEC is broadened (into, let us say, an Energy Development Agency) and, in exchange for this en-

largement of its powers, the Joint Committee on Atomic Energy is bifurcated and reconstituted to include representatives of conventional fuel areas, while the AEC, in turn, is bifurcated into a regulatory commission and an operating agency with a single administrator."

There are many other interesting suggestions in the book, including one to give over control of the Cambridge, Penn-Princeton and Stanford accelerators to the National Science Foundation. These and other comments have already been praised and condemned by Congress and scientists, depending on one's viewpoint, and make for highly stimulating reading.

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The reviewer usually edits the State and Society department of PHYSICS TODAY. A profile of him appears on page 13 of this issue.

Crystals with x rays

X-RAY DIFFRACTION METHODS. By E. W. Nuffield. 409 pp. Wiley, New York, 1966. \$12.50

by Gerald G. Johnson Jr

The author gives a nonmathematical survey of the methods and techniques used in modern x-ray-diffraction laboratories. There is little advanced mathematical derivation of equations on theory, but the analysis of the presently used methods makes the work useful to the professional crystallographer as well as the student with an interest in crystallography.

The book includes discussions of the five major methods of analysis—the powder, Laue, rotation-oscillation, Weissenberg and precession methods. Each technique is given in sufficient detail that the professor and the student both will find it of value. The instruction on the use of each technique is also quite detailed.

The methods of orienting a crystal and orientation photographs are of extreme value. Not only are aligned photographs shown, but, more importantly to the student, orientation photographs of improperly aligned crystals are given with the methods of cor-

rection. Geometries of various methods and other figures in the work make the text very useful. The author is to be congratulated on the excellent figures—a point that some authors seem to avoid!

The text is certainly unusual in the sense that the concept of the reciprocal lattice is not introduced until the second half of the book. The recent wide use of Guinier cameras for powder diffraction is mentioned, but the increased accuracy of these cameras could not be concluded from the author's description.

This book probably could not be used for a course text without an additional text for selected problems in crystallography. It is, however, an excellent reference on the many methods of modern crystallography without the depth of detail that is found in other various specialized texts on the subject. The work certainly fills a need for one small single book to cover the methods of crystallography.

* * *

The reviewer is an assistant professor at the Pennsylvania State University and a consultant to the Joint Committee on Powder Diffraction Standards.

BCS, Bogoliubov, etc.

SUPERCONDUCTIVITY OF METALS AND ALLOYS. By P. G. DeGennes. Trans. by P. A. Pincus. 274 pp. W. A. Benjamin, New York, 1966. \$12.50

by Howard Chang

A decade has elapsed since the appearance of the epochal papers of Bardeen, Cooper and Schrieffer in which the microscopic theory of superconductivity was promulgated. During this fruitful and active period, the BCS theory has been applied to explain an ever increasing range of cryogenic phenomena and found to be correct in its essential details. The number of physicists working in this exciting field and the number of papers they have published have increased exponentially with time. Happily, this has resulted in several very significant experimental discoveries and achievements such as a wide variety of tunneling effects, type-II superconducting behavior, the fabrication of loss-free, high-field electromagnets using type-II superconductors (SC) and the beautiful and precise experiments verifying flux quantization.

To be sure, there has been no dearth of monographs explaining the BCS theory, and among these the best is probably Tinkham's tutorial on superconductivity published in the 1961 Les Houches lecture notes. During the past two years, there have been six books published on superconductivity to update the pre-1957 books by London and Schoenberg in which the macroscopic theory was presented. DeGennes's book is the lecture notes of a course he gave at Orsay during 1962–63. The author is a well known expert in cryogenics and is in charge of a group that has made notable contributions to both theory and experiment. The translation from the French by P. A. Pincus is a competent and commendable job.

In Chapter 1, the basic experimental situation is surveyed in a concise and lucid manner. The London theory is used to discuss the zero-dc electric resistivity of metals at the critical temperature, the destruction of superconductivity by strong magnetic fields, the Meissner effect, the energy gap and the natural division of SC into

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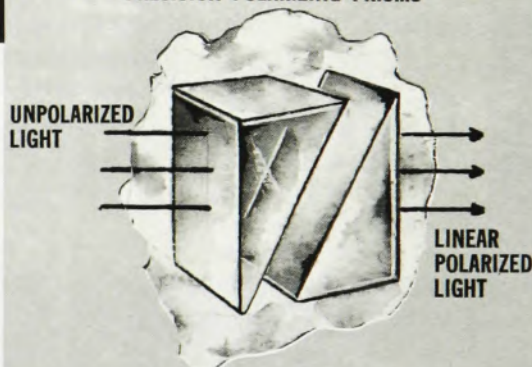
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type-I and type-II SC—formerly called soft and hard SC respectively. This is followed by a chapter devoted to type-I SC, which is similar to that found in the books by Lynton, Rickayzen, Schrieffer and Blatt. Chapter 3 is unique in its long and clear treatment of type-II SC including a discussion of the vortex state of Abrikosov. Since 1963, tutorials on type-II SC have appeared in the literature, but this is the only book that contains a detailed discussion of them. Chapters 4 and 5 may be said to be the heart of the book. There the assumed electron condensation is analyzed in detail using the microscopic viewpoint following the BCS theory and Bogoliubov's self-consistent field method. The Landau-Ginsburg equations are discussed in chapter 6 and applied to bulk material, thin films and SC junctions in chapter 7. The last chapter is devoted to the effects of strong magnetic fields, magnetic impurities and gapless SC.

The necessary background for understanding this graduate textbook is familiarity with the contents of the

third edition of Kittel's superb book on solid-state physics, a modern course in statistical physics (Reif) and quantum mechanics (Merzbacher). De Gennes eschews Feynman diagrams, Green's functions and other sophisticated techniques of the physics of the many-body problem and as the result his book will be especially attractive and intelligible to experimentalists.

The faults of this book are minor. The two-page index is practically useless and should have been expanded to at least a dozen pages to be of any value. The printing, though legible, is not a professional job. There are numerous misprints and algebraic errors, which can be rather annoying to a fastidious reader. Nevertheless, this reviewer does not hesitate to warmly recommend this book to those interested in a concise, coherent, physical and modern treatment of superconductivity.

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This reviewer is a member of the mathematical physics department of the Stanford Research Institute.

Mathematical savoir faire

MATHEMATICS FOR PHYSICISTS.
By P. Dennery, A. Krzywicki. 384 pp.
Harper & Row, New York, 1967.
\$12.95

by Garrison Sposito

A good argument can be made for the position that theoretical physics may soon be quite incomprehensible to the undergraduate scientist or engineer whose mathematical *savoir faire* does not transcend the content of traditional courses on advanced calculus and differential equations. Without at least some introductory ideas about the theory of groups and their representations, linear operators and function spaces, generalized functions, Lebesgue integration, and Green's functions, most of what has been going on recently in physical theory—in particular the numerous contributions that have been made by mathematicians—becomes an undecipherable arcanum. It follows that the mathematical content of the advanced undergraduate science curriculum, at least in the fields closely dependent upon physics,

should be updated. In *Mathematics for Physicists*, Dennery and Krzywicki have attempted, with success, to do just this.

The book is divided into four long chapters on functions of a complex variable, finite-dimensional linear space, function spaces and differential equations, respectively. The authors list as the only prerequisites to understanding the material, a knowledge of the calculus and an exposure to elementary vector analysis and the theory of algebraic equations. To this the reviewer would add introductory differential equations, functions of a complex variable, and either a smattering of mathematical sophistication or a feeling for abstract analysis.

The chapter on analytic functions is long, well written, and rather complete. In particular, it contains useful sections on conformal mapping and the evaluation of integrals, including the method of steepest descent. The chapter on linear spaces is good, but not excellent. The detracting aspects

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