

A New Method in the Theory of Superconductivity. By N. N. Bogoliubov, V. V. Tolmachev, D. V. Shirkov. Translated from Russian. 121 pp. Consultants Bureau, Inc., New York, 1959. \$5.75. *Reviewed by R. Bruce Lindsay, Brown University.*

SUPERCONDUCTIVITY has long presented a fascinating challenge to the theorist and numerous theories have come and gone. The authors of the present volume date the beginning of real success in understanding this phenomenon to the suggestion of H. Fröhlich in 1950 that the explanation must be found in a study of the interaction between the electrons and the lattice phonons. More recently Bardeen, Cooper, and Schrieffer have made considerable progress along these lines. The book under review describes in detail an even more ambitious attempt to solve the problem in the form of a generalization of a method developed in 1947 by Bogoliubov, who formulated a microscopic theory of superfluidity. The application of his ideas leads to results of which the Bardeen, Cooper, and Schrieffer theory is a first approximation.

The treatment is highly technical throughout and except for the introductory chapter will be intelligible only to the expert in quantum mechanics.

Absorption and Dispersion of Ultrasonic Waves. By Karl F. Herzfeld and Theodore A. Litovitz. 535 pp. Academic Press Inc., New York, 1959. \$14.50. *Reviewed by Stuart A. Rice, Institute for the Study of Metals, University of Chicago.*

THE diminution in intensity of the amplitude of a planar longitudinal wave traversing a liquid is, neglecting radiation losses, caused by the conversion of the organized collective motion of the sonic pulse into random thermal motion. The total attenuation may be separated into contributions arising from thermal conductivity and viscous loss. This latter contribution is itself separable into two components: that due to shear viscosity and that due to dilatational viscosity. Although for monoatomic fluids the only contribution to the dilatational viscosity arises from collisional transfer of momentum, for polyatomic fluids the dilatational viscosity can be related to intramolecular relaxation phenomena as was first demonstrated by Tisza. The major purpose of the book by Herzfeld and Litovitz is to interpret sound absorption data in terms of suitable molecular models for intramolecular relaxation. The treatment presented is admirably clear and is comprehensive from both the experimental and theoretical points of view. There are good reviews of the various model theories of viscosity as well as the theory based on autocorrelation functions, but the more detailed approach of Kirkwood is treated cursorily. Multistate models are considered in some detail. In the interpretation of absorption both multistate models and solution of the Navier-Stokes equation with frequency-independent parameters are discussed wherever appropriate. (The latter for monoatomic gases.) Of particular value

is the chapter dealing with associated liquids, the structural relaxation relevant to sound absorption, and the relationship to dielectric relaxation. In view of the increasing use of ultrasonic techniques for the investigation of condensed phases, the publication of this book is timely and important. It may be wholeheartedly recommended to all physicists and chemists interested in the structure of condensed media and will be a valued addition to any individual reference shelf.

Paris Symposium on Radio Astronomy (July-Aug. 1958). Sponsored by IAU & URSI. Edited by Ronald N. Bracewell. 612 pp. Stanford U. Press, Stanford, Calif., 1959. \$15.00. *Reviewed by E. J. Öpik, University of Maryland.*

THE young science of radio astronomy is still in the making. The Paris Symposium provides a review of the problems and progress in this field, in the form of individual contributions welded together by introductory and concluding lectures. The proceedings cover the planetary, solar, interstellar, extragalactic, and cosmological aspects of radio astronomy presented in 107 observational and theoretical invited papers. As typical of a rapidly developing science, there are more problems and questions than solutions and answers.

One reason why the interpretation of radio results is often vague or ambiguous lies in the resolving power; for radio telescopes it is by many orders of magnitude lower than for optical telescopes. This disadvantage is only partly compensated by the very much better power sensitivity of the radio. Radio techniques may discover faint signals from sources "on the edge of the universe", yet the shape, exact position, and nature of these sources may remain a mystery.

To give an idea of the contents, a few outstanding results may be mentioned. Radar observations show that the lunar surface has specular reflecting properties for wavelengths of 10 cm to 3 m, indicating a generally smooth surface except for the small-scale graininess of sand or dust responsible for the diffuse reflection of visible light. At the same time the surface is never horizontal, its average slope being about 3° . The density of the lunar atmosphere is less than 10^{-13} of the terrestrial. The unexpectedly high radiation temperature of Venus in the microwave range is confirmed. The temperature in the solar chromosphere increases from 5500°K at 5000 km to $700\,000^\circ\text{K}$ at 30 000 km above the surface, and in the lower corona at about 150 000 km it reaches $3 \times 10^6^\circ\text{K}$. Some galactic radio sources are optically identified as possible remnants of supernovae, still expanding with velocities of about 7500 km/sec. Radio diameters of galaxies are considerably greater than their optical diameters, indicating extended gaseous envelopes. There are considerable amounts of hydrogen in some galactic clusters and in high galactic latitudes. The survey of neutral hydrogen in 21-cm radiation yields new details of the spiral and disk structure of the Milky Way galaxy. Hydrogen gas is flowing out from the galactic nucleus with velocities of 150

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km/sec. Extragalactic radio sources—possibly distant galaxies in collision—seem to indicate a greater density of the universe at large distances, i.e., at an earlier time in the past; this would contradict steady-state models and agree with the concept of an expanding universe. The statistical results, however, cannot be interpreted unambiguously and are not yet conclusive.

The volume contains a wealth of material in current research, illustrated by tables, figures, and theoretical formulas, and is a valuable contribution to the various fields of astrophysics.

Great Experiments in Physics. Edited by Morris H. Shamos. 370 pp. Henry Holt & Co., New York, 1959. \$4.40. *Reviewed by M. W. Friedlander, Washington University.*

TWENTY-FOUR great experiments have been chosen for discussion. After an introductory chapter which sketches the development of the scientific method and of physics in particular, the remaining chapters are each devoted to an experiment of major importance. First comes a brief historical note which sets the scene for the experiment to be discussed; then follows the text of the experiment copied from its original publication (translated where necessary). In the margins, alongside the text, the editor has added many illuminating comments which deal with both the scientific aspects of the experiment and, where necessary, with the altered meaning of words used. There are many references—to the original works, to papers, and to books.

The book was developed "mainly for use by liberal arts students in the new laboratory physics course . . . designed on the 'great experiments' idea". While the content and aim of a general introductory physics course can be debated at length (but not here), there can be no gainsaying the fascination of this book. Well produced, well annotated, well selected, the procession from Galileo to Chadwick's experiment on the neutron encompasses an impressive demonstration of the growth of our physical knowledge through painstaking experiment and inspired interpretations. Those more advanced than freshmen will better appreciate this, and will gain much from perusal of these pages.

The Physics of Electricity and Magnetism. By William Taussig Scott. 635 pp. John Wiley & Sons, Inc., New York, 1959. \$8.75. *Reviewed by Jacques Romain, University of Elisabethville, Belgian Congo.*

MORE is contained in this book than its title claims. Not only is the physics of electricity and magnetism explained in detail, but also a good deal of mathematical reasoning is included. Although not written on an advanced theoretical level, it does offer a sound theoretical and experimental basis for understanding, and as such it can be used either as a reference book or as a textbook, especially since the contents are up to date and include many topics not currently

found in introductory textbooks. Since the book covers more territory than is likely to be condensed into a one-year course, the instructor must be selective in choosing the material he deems most appropriate. A standard grounding in differential and integral calculus is assumed.

The main topics are: charges, fields, and potential; conductors; dielectric and magnetic materials; steady and alternating currents; an introduction to semiconductors, thermoelectric and electrochemical effects; signal propagation in coaxial conductors and lines; electromagnetic radiation; and an introduction to the special theory of relativity in the four-dimensional formulation.

A full list of abbreviations and symbols is welcome, as are the carefully prepared index and a detailed table of electromagnetic quantities, units, and physical constants. The bibliographical references are unfortunately given only in footnotes, and authors are not indexed or otherwise listed.

Care in the writing is apparent throughout the book and definitions and explanations are neat and precise. Numerous worked out examples of direct physical interest clarify each new concept step by step, and many problems (without answers) are included at the end of sections.

The main unit system used is the rationalized mks system, according to the modern trend, but the important equations, as well as the table of units, are written both in the mks and the cgs Gaussian systems.

High-resolution Nuclear Magnetic Resonance. By J. A. Pople, W. G. Schneider, H. J. Bernstein. 501 pp. McGraw-Hill Book Co., Inc., New York, 1959. \$13.50. *Reviewed by D. J. E. Ingram, University College of North Staffordshire.*

NUCLEAR magnetic resonance has now become recognized as a standard research technique in most physics and chemistry laboratories of any size. Its development has followed the trend of all the earlier branches of spectroscopy, the original ideas and concepts having arisen in physics departments where the basic experimental techniques and theory were established. It was then rapidly taken over by the chemists, however, and it would probably be fair to say that the major applications of nuclear magnetic resonance are now in the fields of physical and organic chemistry. The techniques and possibilities of this new form of spectroscopy have been outlined in several reviews and books of general character, and one or two elementary texts on its chemical applications have recently appeared. An authoritative treatment of "high-resolution nmr" has so far been lacking, however, and the present volume by three well-known workers in the field should go a long way to meet the growing demand for just such a book.

The contents are divided into two major groups: "principles" and "applications". In the first section, the general magnetic properties of nuclei are considered