

port theory and the theory and practice of Fermi-surface measurements. Entries ranged far beyond material in the text (which, perhaps, should be viewed not as I have done, but as a commentary on the bibliography) extending from the late 19th century into early 1965. I can only stand in awe before such a list. Some of my favorites are on it; some are not. Each reader must judge it for himself, because only extensive personal use will reveal how valuable a tool the book can be for scholarship and research.

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N. D. Mermin is a member of the theory group of the Laboratory of Atomic and Solid State Physics at Cornell University.

Neither a gas nor a crystal

THE STATISTICAL MECHANICS OF SIMPLE LIQUIDS. By S. A. Rice and Peter Gray. 582 pp. Interscience, New York, 1965. \$19.75

AN INTRODUCTION TO THE STATISTICAL THEORY OF CLASSICAL SIMPLE DENSE FLUIDS. By G. H. A. Cole. 284 pp. Pergamon Press, New York, 1967. \$12

by JOEL L. LEBOWITZ

The two books reviewed here are among a large number of books published in the past few years on the statistical-mechanical theory of fluids (that is, dense gases and liquids).

The difficulty in studying fluids is that one has no ideal state such as the ideal gas or harmonic crystal that can be used as a reference state, or zero-order approximation, for real systems. This is particularly true of the nonequilibrium properties of fluids (For equilibrium properties the "hard-sphere" fluid serves as some sort of reference system.) The best that can be said is (to paraphrase a somewhat optimistic statement from the preface of the book by Stuart Rice and Peter Gray): The kinetic theory of liquids is at a stage of development analogous to that of the mean-free-path theory of gases: All the important qualitative features of the physical problem are incorporated, and agreement between theory and experiment is meaningful.

Given this state of the theory, both books make a useful contribution to the field. The book by Rice and Gray is the larger (by a factor of two) and more advanced of the two. It is really an advanced treatise on the

present state of the art as seen by active workers in the field. As such books are apt to do, and perhaps ought to do, it emphasizes the authors' approach and contains some previously unpublished material. It is a book for researchers and those desiring to do research in this difficult but fascinating field. An important and useful feature of the book is its emphasis on comparison between theory and experiment. A somewhat discouraging feature, to the beginner at least, is the somewhat cursory and sometimes haphazard way in which the authors review well known material (well known to experts that is), such as the definition of ensembles and the derivation of the virial expansion. The uninitiated reader might feel that he is stupid not to follow the "obvious" when it is actually not obvious at all (witness equation 2.3.27). My advice to the reader is: Don't despair, persevere and you shall be rewarded.

The book by G. H. A. Cole is briefer and in general more elementary. Many of the more mathematical parts are put in the appendixes, which are placed at the end of the book. (This brevity is somewhat violated in chapter 6 where the author could not resist giving his own work in full, and

what is essentially one formula takes up 3 1/2 pages). In some cases, I would question the author's notion of what constitutes a "derivation," for example, the statistical derivation of the Boltzmann equation in section 8.2. The book is suitable for graduate students as auxiliary reading for a course in statistical mechanics.

Both books deal only with simple classical fluids, of which argon is the principle example. The book by Rice and Gray devotes about one quarter of its space to equilibrium properties, whereas the book by Cole is divided evenly between equilibrium and nonequilibrium results. In the study of equilibrium properties both books emphasize the central part played by the radial-distribution function and discuss in some detail the various approximate integral equations in current use for this function. In the discussion of nonequilibrium phenomena the book by Rice and Gray is much more detailed than the book by Cole. Neither contains any material on the currently active research areas of critical-point phenomena or of the so-called "exact results."

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The reviewer is a professor of physics at the Belfer Graduate School of Science, Yeshiva University.

Atoms and ions: A summary of experiments

METHODS OF EXPERIMENTAL PHYSICS, VOL. 4: ATOMIC AND ELECTRON PHYSICS, PART B: FREE ATOMS. Vernon W. Hughes, Howard L. Schultz, eds. Academic Press, New York, 1967. \$15.50

by WILLIAM LICHTEN

The title of this book is somewhat of a misnomer. In contrast to its sister volume, 4A, *Atomic Sources and Detectors*, volume 4B is more devoted to a summary of experiments and results than to experimental methods. The emphasis, as the title indicates, is on free atoms, although a rather lengthy treatment is given to free ions, including electrons and positrons.

The book should be viewed as a collection of review articles; thus a more accurate title might be "Progress in Atomic Physics" or "Reviews of Recent Experiments with Atoms and Atomic Particles."

If we accept the book on these terms, we can ask how well it achieves its purpose. As is often the case, the

level of the articles is somewhat uneven.

David T. Wilkinson's article, "Properties of Free Electrons and Positrons" is a fairly complete review of the experiments that have been conducted over the past century to measure the electron charge, mass, charge-to-mass ratio, magnetic moment and electric dipole moment. In addition, discussions are given of similar measurements on the positron, electron-positron mass or charge difference.

The article by K. G. Kessler and Henry M. Crosswaite on optical spectroscopy is severely dated, with practically all of its discussion limited to pre-World-War-II research. The work with lasers is essentially completely omitted.

H. E. Radford's extensive treatment of radio frequency and microwave spectroscopy is very much an updated version of Norman F. Ramsey's *Molecular Beams* (Oxford, 1956). All the references appear to be 1963 or