

Fluctuation Phenomena in Semi-Conductors. By A. van der Ziel. 168 pp. (Butterworths, England) Academic Press Inc., New York, 1959. \$6.50. *Reviewed by Joseph G. Hoffman, University of Buffalo.*

IN his direct and concise survey of the subject of noise in semiconductors, the author has achieved a desirable compactness by the continuous use of mathematical equations. The style provides an admirable example for technical writers: a high density of ideas per page keeps down book cost and size. Also, the words of Lord Kelvin are brought to mind: these, paraphrased, are to the effect that if you know your subject you can put it in quantitative mathematical form, which the author does to perfection here.

Conciseness of presentation is indicated by the first three chapters which give reasons for studying fluctuation phenomena, general methods of investigation, and mathematical procedures. These occupy 21 pages; the reader is assumed to be literate in fluctuation phenomena. The remaining eight chapters describe the current status of experiment and theory of noise in photoconductors, semiconductors, diodes, junction transistors, and in applications of these devices. While the topics are of a practical nature, the presentation has a broad basis in the pure physics of the phenomena which include generation-recombination noise, flicker noise, and shot noise. The author makes one aware that there are intriguing problems of a black-body nature underlying the many new kinds of noise found in semiconductors such as, for example, the Hall noise. The last section of the book describes mixing diodes, a topic which leads to phase-sensitive detectors and to parametric amplifiers, both of which are current and timely topics for physicists. Each chapter is thoroughly documented with recent literature, there are ample numbers of figures and tables, and the subject is presented swiftly and expertly. It is a highly commendable book.

Introduction to Quantum Mechanics. By Chalmers W. Sherwin. 385 pp. Henry Holt & Co., New York, 1959. \$7.50. *Reviewed by Jacques Romain, University of Elisabethville, Belgian Congo.*

VERY good introductory books to quantum mechanics do exist, but I cannot remember one that stresses so thoroughly both theoretical formalism and intuitive insight into the physics and the mathematics of that subject. The book covers the foundations of quantum mechanics, one- and three-dimensional problems, steady-state and time-dependant perturbation theory, and an introduction to Dirac's relativistic wave equation.

The author insists on the need for bringing quantum mechanics into the curriculum at an early stage to provide students with a sound basis for the study of such topics as nuclear theory and solid-state physics. The fulfillment of this assignment demands that the exposition should not involve too much advanced mathematics and here only a standard course of calculus is required. It might be thought that such a restriction

would be a great drawback, but it is astonishing to see how expertly the author succeeded in turning the difficulty into an advantage. He manages to explain the eigenfunctions and eigenvalues of the harmonic oscillator, for example, with no more sophisticated mathematics than the numerical resolution of a differential equation, and he does so in such a way that the reader grasps the physical meaning of the eigenvalues much more clearly than if he had been content with applying a mathematical theorem.

For the sake of simplicity, the author considers only bound systems and free particles and leaves more elaborate subjects to advanced books. He makes considerable use of one-dimensional systems, in which are met most of the main features of quantum mechanics. He avoids philosophical discussion and chooses to apply exact theory to simple systems rather than approximate solutions to more complex problems.

Masers. By J. R. Singer. 147 pp. John Wiley & Sons, Inc., New York, 1959. \$6.50. *Reviewed by D. J. E. Ingram, University College of North Staffordshire.*

IT would probably be fair to say that never has a subject developed so rapidly from the initial concept to the actual practical application as that of the three-level solid-state maser. The basic ideas of "Microwave Amplification by Stimulated Emission of Radiation" are of considerable intrinsic interest to all physicists because of the very subtle ways in which the normal energy-level populations of atomic and molecular states can be inverted, and hence atomic and molecular oscillators can be created. The very wide practical application of these new microwave devices has now made them of great interest to engineers as well. Unfortunately the rate at which new ideas in this field have been applied, and the large number of specialized publications, have made it increasingly difficult to follow the development of this work. A book devoted to the subject of masers is thus very welcome especially as it takes no prior knowledge of the subject for granted, and develops all the ideas and concepts in a very logical and coherent way before describing the actual construction and application of the different masers themselves.

The possibility of inverting energy-level populations was demonstrated early in the history of magnetic resonance by the experiments of Pound and Purcell on lithium fluoride, which led to the concept of "negative temperatures". The first practical application of this principle came in the work of Townes and his collaborators on the ammonia maser in which the inverted population distribution was obtained by actual spatial separation of the excited molecules. This led to a molecular oscillator of very high stability with very obvious practical applications. The very wide field of application was not fully exploited, however, until the "tunable" solid-state masers employing paramagnetic crystals were developed and microwave amplifiers with very low noise figures became a practical possibility.

This book adopts a systematic rather than historical

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approach to the subject, however. A general introduction on absorption and emission processes is followed by a description of the ammonia maser and other gas devices. The general principles of electron resonance in the solid state are then explained and this is followed by separate chapters on the two-level and three-level masers. A final chapter on traveling-wave masers together with a brief reference to parametric amplifiers in the appendix introduce the newest developments in this field.

It is a book which is well balanced and written in a logical way which is easy to follow, and can be strongly recommended to anyone entering this field whether as a solid-state physicist or as an engineer.

College Physics (3rd Revised Ed.). By Robert L. Weber, Marsh W. White, Kenneth V. Manning. 640 pp. McGraw-Hill Book Co., Inc., New York, 1959. \$7.50. Reviewed by Grant O. Gale, Grinnell College.

THE third edition of a text as widely used as Weber, White, and Manning is almost perforce a finished piece of workmanship. The fact that the earlier editions were used in over a hundred colleges and transcribed on tape for the blind testifies to the general desirability of the text. For this reason this review will confine itself largely to the changes found or not found in the new third edition.

The size and format of the book were changed to an attractive double column page with smaller tabular arrangements and many illustrations reduced in size without loss of detail. The general appearance of the book is improved with the attractive etchings of the Nobel prize winners in physics kept at the chapter headings. The conventional compartments of mechanics, heat, etc. are maintained and each is introduced with an appropriate full-page picture with superimposed graphs, charts, etc. A rather unique feature is the treatment of the inside of the front and back covers with a series of sketches and brief statements portraying the history of physics from the Babylonians to nuclear energy.

The preface states that "this edition continues the inclusion of the topics needed for the conventional courses, together with selected material in atomic and nuclear phenomena, relativity, solid-state physics, and quantum-physics phenomena." The result of attempting to do so much has resulted in a book which is somewhat "encyclopedic in character" in spite of a disclaimer in the preface. The mathematical preparation expected from the students varies from an illustrative problem (page 207) showing how to change Fahrenheit temperatures to centigrade through to calculus used only in the appendix.

The many good features of earlier editions are kept, such as the careful use of significant figures and the algebraic manipulation of units as well as numbers. This, I found, made the students dimensionally alert and conscious. The earlier editions had a clarity of expression and an uncluttered style that the students found easy to read and understand. This has been kept

and many a student finds it "easier to learn from Weber, White, and Manning". As expected, there are very few misstatements, knowing the meticulous care with which the authors avoid these. I would take exception to the first law of motion as stated on page 34: "There is no change of motion of a body unless a resultant force is acting upon it." I think it is better stated in the summary as an "unbalanced or net force". One can have the resultant of two or more forces be zero (see bottom of p. 18) and produce no acceleration. In the treatment of the Carnot cycle (p. 229) there has been some improvement and the notation has been changed from H to Q for the heat energy received and discharged, but the student is still confused between heat energy and work all represented by areas. To the student the area between an isotherm AB and the x -axis is meaningless because it may be any value. There are, however, few examples of this kind in the text.

From its appearance I was expecting an entirely new book with completely new emphasis oriented toward modern physics. I was disappointed in this respect in the third edition. It is essentially the old book with the deficiency of modern physics compensated for by a few appended chapters. For example, the whole treatment of heat and temperature does not give the student any feeling that heat is a statistical phenomenon. The statement "Heat is a form of energy that molecules of matter possess because of their motion" (p. 200) is true, but the concept that one or two moving molecules is *not* heat is certainly *not* clear. In much the same vein, the whole of the chapter (45) on spectra may be read and the questions discussed without any inkling that spectra have something to do with atomic structure and the Bohr theory. This is rather inadequately done in a separate single paragraph (50.4). The authors apparently recognize this deficiency, for in the preface they say "Material sometimes referred to as 'modern physics' has been included with conventional topics at various places throughout this edition. The contemporary physics section at the end of the book has been enlarged." And yet the section at the end of the book is labeled Modern Physics by a full-page illustration (569) rather than "contemporary"; the two are not quite the same. The Bohr atom was contemporary in 1926.

In spite of all these remarks the text is an excellent one. The problems are good, it is very teachable and the students like it. We all agree that a satisfactory first course in college physics cannot stretch all the way from the Babylonians to Nuclear Energy.

Recent Research in Molecular Beams. Edited by Immanuel Estermann. 190 pp. Academic Press Inc., New York, 1959. \$6.50. Reviewed by R. W. Hellwarth, Hughes Aircraft Company.

FOR the purpose of commemorating the seventieth birthday of Otto Stern, his friend and collaborator Immanuel Estermann has collected a random sampling of the best of current molecular beam research into the