

to identify a solenoid as a *magnetized filament* won't hurt anyone.

I am more bothered by the chapter on flying saucers. That the material referred to has anything to do with space travel is merely assumption or conjecture. When people were concerned with the transcendent importance of great men and events, with survival after death, and with the powers of darkness, those who felt called upon to interpret the unexplained part of their experience did so in terms of portents, ghosts, and witchcraft. Nowadays those who can't rest until all reports and experiences are ticketed give us space craft.

Still, if the reader can take the author's concern with Charles Fort and unidentified flying objects as lightly as the author takes space flight in general, he can't help being entertained as well as instructed by everything in this excellent book.

Modern Physics. By John C. Slater. 322 pp. McGraw-Hill Book Co., Inc., New York, 1955. \$5.50. *Reviewed by E. Richard Cohen, North American Aviation, Inc.*

In comparison with the rate at which knowledge and understanding of the physical universe has developed from the beginnings of history up to the end of the nineteenth century, the rate in the last sixty years has been explosive. The combined impact of relativity and quantum mechanics (ushered in by Einstein and Planck) has so altered our concepts of nature that modern theories are often presented as an almost magical recipe which will miraculously give the right answer. Professor Slater's book is intended to serve as a nonmagical introduction to the so-called "mysteries" of modern physics.

Beginning with the thermodynamic paradox of black body radiation and the Maxwell-Boltzmann distribution law, Slater presents quantum mechanics as a logical and inevitable consequence of experimental facts. With a minimum of mathematics, and with the emphasis instead on the logical development of ideas, the book follows the step by step evolution of the present day theory of the structure of the atom. It is intended for an introductory course in modern physics or for a survey course for engineers, chemists, and physicists who will not continue into the study of the mathematical details.

The title, "Modern Physics", implies a wider range, however, than it is the purpose of the book to cover; relativity is treated only as it is needed to explain atomic structure while the entire field of nuclear physics, mesons, and cosmic rays is covered in a single chapter. A more descriptive title for the book would be "Atomic Structure", since it restricts itself for the most part to what may be defined as "classical quantum mechanics"—those problems which are completely specified by Schrödinger's equation with a well defined potential function and which are best exemplified by the electronic energy states in atoms and perfect crystals.

Within the limits which Professor Slater has set for

the book, it provides a good survey of the field. There are indications, however, that parts of the book were hastily written, and the omission of any mention of the center of mass correction in the Balmer formula was disturbing. On the other hand, an excellent selection of problems at the end of each chapter supplements the text and should provide the student with additional insight.

Carl Friedrich Gauss: Titan of Science. By G. Waldo Dunnington. 479 pp. Exposition Press, New York, 1955. \$6.00. *Reviewed by T. Teichmann, Lockheed Aircraft Corporation.*

Gauss' scientific work encompasses many of the most significant contributions to both pure mathematics and physics, and an account of these accomplishments would presumably be fraught with interest to any scientifically oriented reader. On the other hand, Gauss' personal life was singularly devoid of unusual incident or the romance of many other great figures of mathematics. One might, therefore, expect that any interesting biography would accent Gauss the scientist, and that Gauss the man would simply provide the continuity and background for his scientific work.

It is clear that Professor Dunnington has done a tremendous amount of meticulous research on the minutiae of Gauss' life, but it is unfortunate, at least in this reviewer's opinion, that he has not cared to put less emphasis on the less significant incidents. As a result, Gauss' achievements are often buried amid the day to day trivia with which Professor Dunnington regales his readers. It is perhaps unfair to suggest that Gauss' daily life was completely uninteresting; Gauss maintained close relationships with famous scientific figures such as Weber and Bolayi, and it is certainly not without interest that Bolayi, for example, did not regard Gauss as a genius. It is, however, a pity that this fact and others of similar nature are submerged in a welter of insignificance.

In view of the fact that Professor Dunnington has done such a painstaking and dedicated job, this reviewer hopes that he will also write a book which is more palatable to the scientifically interested layman, if not so impressive to the historical scholar.

Classical Electricity and Magnetism. By W. K. H. Panofsky and Melba Phillips. 400 pp. Addison-Wesley Publishing Co., Inc., Cambridge, Mass., 1955. \$8.50. *Reviewed by P. M. Morse, Massachusetts Institute of Technology.*

It is perhaps instructive to observe the changes in fashion in texts on various fields of physical theory. In the case of electromagnetic theory, Starling's *Electricity and Magnetism*, a popular college text in the twenties, might represent the first phase. A concentration on techniques of measurement, on the peculiarities of measuring equipment, and finally an apologetic statement of the general Maxwell equations with a few



Dr. T. Teichmann (center), head of the Nuclear Research and Engineering Department, discusses neutron flux in nuclear reactors with Dr. Lewis Larmore (right) and Dr. J. W. Rosengren, head of the reactor section.

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examples of simple solutions, was the typical pattern. The "apology" in Starling comes in the preface, where he says, "No apology is offered for using the methods of the differential and integral calculus whenever it appeared that an advantage was gained by so doing, since it is imperative that a student who wishes to pursue his studies in electricity must have so much (sic) mathematical equipment."

Perhaps the next stage is exemplified by Jeans' *Electricity and Magnetism*, or Smythe's *Static and Dynamic Electricity*. By now the techniques of measurement have become too well known (?) to merit much attention and the majority of the text is taken up with a detailed discussion of the various techniques of solving particular problems, special cases of the basic theory.

By the time of the third stage, these details, the calculation of specific electrostatic problems, of radiation from various kinds of antennas and of particular examples of microwave propagation, have been, for the most part, relegated to engineering texts. The mathematical notation has been streamlined so that the general equations appear simple and the emphasis is put on connecting electromagnetic theory to the broad principles underlying all physics, to the conservation laws, to thermodynamics, and to relativity, for example.

Judging from the developments in texts on classical dynamics since Mach, there may be a fourth stage, perhaps not yet reached in electromagnetic theory. In this stage, the theory enters the realm of applied mathematics and texts are written in the deductive manner, with axioms and propositions and carefully proved theorems.

The text of Panofsky and Phillips is a good example of the third stage of textual development. Techniques of solution are discussed, but the emphasis is on general principles rather than individual algorithms. There is no discussion of measurements; the first chapter is on the mathematical properties of vector fields and is followed by an excellent, though brief, discussion of the relation between E , D , and the polarization of a dielectric. After two chapters on two- and three-dimensional static problems, enough to show the general procedures, there is a clear discussion of the stress-energy tensor and its relation to volume forces and the free energy of a dielectric.

After two chapters on steady-state magnetic fields, we are already to Maxwell's equations, with two-thirds of the book yet to come. Wave solutions take up only three more chapters, however, plus a chapter on energy, force and momentum relations; the rest of the book is concerned with the connection between electromagnetic theory and special relativity. Here, interestingly enough, experimental details take up a compact and well-organized chapter, relativity still seems to need a résumé of its experimental justification.

After several chapters on the Lorentz transformation and the momentum, force and potential four-vectors, there is a clearly-written discussion of the field around a point charge, with and without acceleration, the radiation reaction on an electron and the related expres-

sions for the scattering of radiation from an electron. The final chapters discuss briefly the energy-momentum tensor in material media in its covariant form and the Hamiltonian formulation of Maxwell's equations.

This is obviously not a text to train technicians to design microwave hardware. It can, however, be used to show beginning graduate students the scope of classical electromagnetic theory and how it fits into the rest of physics. And it can prepare them for the additional intricacies of quantum field theory. As such it should be most welcome. Its choice of material and order of presentation should make it rather more satisfactory as a text than Landau and Lifshitz', *Classical Theory of Fields*, which covers somewhat the same ground.

There are a few exercises, of graduated difficulty, at the end of each chapter, an appendix on units, a number of tables of vector formulas, and a short but adequate index. The reviewer, of course, has no fault to find with the bibliographic notes at the end of each chapter.

Crystal Physics 1. Vol. 7, Part 1 of *Handbuch der Physik*. Edited by S. Flügge. 687 pp. Springer-Verlag, Berlin, Germany, 1955. \$29.15 (Subscription price if part of the series, \$23.32). Reviewed by H. P. R. Frederikse, National Bureau of Standards.

Crystal Physics I is the first volume to appear of a new *Handbuch der Physik*, successor to the well-known *Handbuch of Geiger and Scheel*, now more than 25 years old. This new work will cover the field of physics in 54 volumes, to be published in the next three or four years. The editor, S. Flügge, has realized that such an enterprise should be on an international basis; more than 200 experts in the different fields of physics from all over the world will contribute to this work. The articles will appear in German, English, and French.

The present volume includes four articles: Crystallography, by H. Jagodzinski; Theory of the Mechanical and Thermal Properties of Crystal Lattices, by G. Leibfried; Theory of Lattice Imperfections, by A. Seeger (all three in German); and Specific Heat of Solids, by M. Blackman (in English).

The authors have succeeded in giving a rather complete and up-to-date review of the present-day knowledge in these four fields of solid state physics.

The article on Crystallography treats in detail the symmetry operations, crystal classes, space groups and considers the fundamental relations between physical properties of solids and crystal symmetry. The latter part of this review article is devoted to crystal geometry and the lattice structures of elements and compounds.

Leibfried's contribution is concerned with the theory of the lattice in equilibrium (binding energy) and the mechanics of small displacements (elastic constants) and thermal vibrations (specific heat, heat conductivity). One notices that the author has deliberately limited his treatment of the specific heat and the thermal