

advantage of such a partnership, the authors place a salutary emphasis on physical principles. Technicalities, both theoretical and experimental, they invoke only when necessary to bring out those principles. Many interesting historical references have been included, and the early development of the subject is treated exhaustively, starting from quite an elementary level. The basic concepts necessary in the discussion of nuclear and elementary-particle physics are discussed quite thoroughly and expertly from what this reviewer, who belongs to a later generation, would describe as a somewhat old-fashioned viewpoint.

The authors indicate in their dedication that the book has been a long time in preparation, and the text shows it. Although SU (3) is indirectly alluded to in the first chapter, and there appears also some mention of unified gauge theories, one finds no further discussion of these important developments in particle physics. The book must be regarded as a treatise that codifies the basic principles of nuclear and particle physics from the viewpoint of physicists who gradually made the transition from nuclear to particle physics. The exercises at the end of each chapter contain an interesting mixture of theoretical and experimental problems, not often seen in such textbooks, and there are many interesting comments on the earlier development of the subject. A rather complete set of supplementary references at the end of each chapter provides excellent guidance to the student searching for further enlightenment.

I welcome this book as a useful and interesting addition to the textbook literature, but I would hesitate to recommend it as the sole text for a graduate course on this subject. The matters treated are very well done, but the book's special merit resides in its excellent treatment of developments in the subject up to the last decade.

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Introduction to Plasma Physics

F. F. Chen

329 pp. Plenum, New York, 1974. \$18.00

Introduction to Plasma Physics is a well written, clear and concise introduction to this rather broad subject area. Chen has selected a balanced set of examples from several areas within the field to illustrate its basic principles.

He begins with an exposition of the motion of individual charged particles in various electric- and magnetic-field configurations common to laboratory and natural plasma situations. The various

adiabatic invariants and constants of motion for charged particles in such arrangements provide the background necessary to understand plasma behavior in complex field configurations.

Although plasmas are composed of charged particles, much of their behavior can be explained in terms of a simple fluid model. Chen presents an easily followed development of the macroscopic fluid equations for plasmas, together with examples of their application.

Plasma oscillations and waves in the fluid plasma are treated in some depth. Many problems of good textbook quality appear, as do numerous examples of plasma and electromagnetic wave propagation in simple plasma configurations.

On time scales of the inverse plasma frequency, plasmas generally behave as collective fluids. However, one must also consider longer time scales. This means



The magnetic field produced by a "baseball seam" coil for plasma containment. (Model, Lawrence Radiation Laboratory.)

that binary collisions have time to rearrange the particles in configuration space, and that applied electric fields will cause currents to flow subject to the limitations caused by the plasma resistivity. Chen gives a good introduction to this subject area of diffusion and resistivity in both weakly and fully ionized plasmas.

From the controlled-thermonuclear-fusion point of view, the most important problem in plasma physics is the identification of magnetic field configurations in which a high-temperature plasma has a nonthermodynamic equilibrium allowed by the fluid equations. The next question is, given such a configuration, is it stable against being jostled a bit? Such jostling can occur either in configuration space or velocity space. Here Chen goes through several simple examples to illustrate the essential features of plasma equilibrium and stability.

Macroscopic fluid theory is the most reduced description of a plasma. A less reduced microscopic fluid theory, usually called kinetic theory, is based on the use of the distribution function of particles that satisfies the Vlasov equation. Even though the course upon which Chen bases his book is for undergraduates, I believe that more material on kinetic theory should have been included. Chapter 7, unlike the earlier chapters, would have to be expanded by the lecturer to develop some of the ideas needed by those students planning graduate work in the field. The material Chen has included is good, but there should be more.

The study of nonlinear phenomena in plasmas is a fascinating theoretical and experimental adventure. Chen has a good background in this area and has taken advantage of it to write an excellent introduction to this area.

The last chapter contains a survey of some of the major plasma-confinement devices used in controlled-fusion research. This represents one of the most important applications of plasma physics, and it should be included. Even so, the unsophisticated reader should be cautioned that both specific devices and their utilizations change on a time scale comparable to the publication of books. Therefore, this material does not have the enduring quality of the rest of the book.

I have used this book for occasional lectures to physics undergraduates on various topics in plasma physics. It's a good book for this purpose, and I recommend it highly to those wishing to include an undergraduate course in plasma physics in their curriculum.

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book notes

When Values Conflict: Essays on Environmental Analysis, Discourse, and Decision. L. H. Tribe, C. S. Schelling, J. Voss, eds. 178 pp. Ballinger (J. B. Lippincott), Cambridge, Mass., 1976. \$15.00

Does there exist a rational, definable process by which reasonable people can resolve among themselves value conflicts as such? Lewis Carroll's account of the diverse crew that hunted the snark may be apropos in describing the efforts of the heterogeneous group—a physicist, a philosopher, two economists, a lawyer and others—that met at the request of the American Academy of Arts and Sciences to examine this question in the context of environmental disputes: "They sought

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it with thimbles, they sought it with care;/They pursued it with forks and hope;/They threatened its life with a railway share;/They charmed it with smiles and soap." Did they succeed? The editors tell us that "the essays collected here can be understood only as interim statements . . . with respect to an elusive and enormously complex set of questions."

Most of the book's writers concentrate more on environmental concerns than on abstractions about conflict resolution, however, and there is an attempt to include "fragile" values (such as the preservation of natural wilderness beauty) in the analyses. Robert Socolow of Princeton University discusses "failures of discourse," and Harvard's Harvey Brooks analyzes environmental decision-making. Others take up such subjects as "Ways Not to Think about Plastic Trees" (Laurence Tribe). Environmentalist readers may be interested in a companion volume, *Boundaries of Analysis: An Inquiry into the Tocks Island Dam Controversy*.

Turbulence (Topics in Applied Physics, Vol. 12). P. Bradshaw, ed. 335 pp. Springer-Verlag, New York, 1976.

This volume, Peter Bradshaw proclaims in his preface, "is not a Markovian sequence of unrelated essays," nor has he "simply assembled specialized accounts of turbulence problems . . . this book is a unified treatment. . . ." *Turbulence*, he says, might serve as a graduate-level text or as a guide for research workers who need to predict turbulence in real life. Bradshaw and seven other contributors have written on internal, external, buoyant, two-phase and non-Newtonian flows, as well as on geophysical turbulence, the calculation of turbulent flows, and heat and mass transport. The emphasis is on the *breadth* of the topic, its applicability in various branches of science.

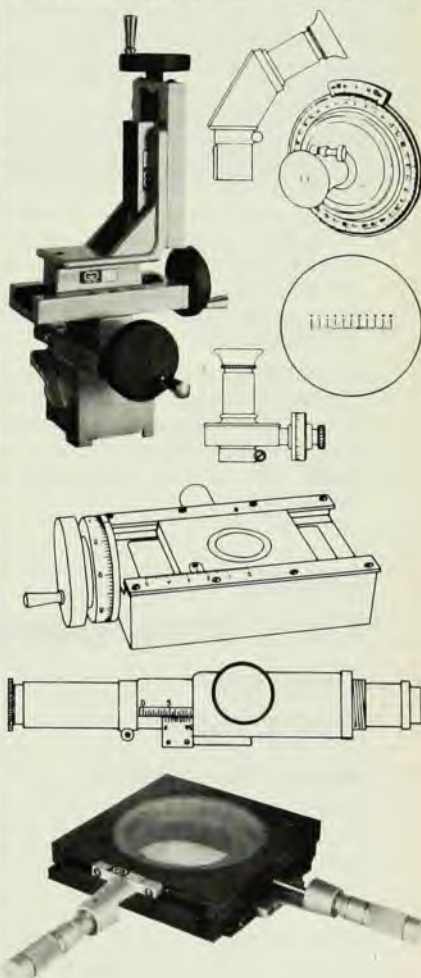
Introduction to Tribology (Wykeham Engineering and Technology Series, Vol. 5). J. Halling. 157 pp. Springer-Verlag, New York, 1976. \$8.60 (paper)

Tribology has naught to do with tribes or trilobites—rather, as the author tells us, the word "was specifically created to bring together the interests of chemists, engineers, materials scientists, physicists and others in . . . contact mechanics, friction, lubrication, wear . . ." and so on. Like the others in the Wykeham series, this British text aims at young graduates or apprentices just embarking on industrial careers; a school teacher has worked with the author to make the book palatable to beginners while retaining some physical formalism. Thus, for example, one finds the coefficient of friction relevant for a sled-borne Egyptian statue expressed in terms of the product of the number of slaves pulling it and the force per slave, divided by the statue's weight. Hydrodynamic lubrication and externally

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With the publication in 1918 of the treatise "On the Quantum Theory of Line Spectra", Bohr initiated a new

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This is the fourth of eight books on the works of Niels Bohr, and covers the years from 1920 to 1923. The bulk of material resulting from his work

during this period was so great that it was necessary to publish it in two separate volumes. Whilst the previous book - Volume 3 - deals primarily with the development of quantum theory this volume contains the papers and manuscripts treating the application of the theory to the problem of atomic structure, and the explanation of the periodic system of the chemical elements.

CONTENTS: Part I. Atomic Structure. Part II. Selected Correspondence (1920-1924).

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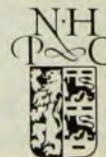
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pressurized bearings are two of the topics considered.

Physics and Our World: A Symposium in Honor of Victor F. Weisskopf (AIP Conf. Proceedings, Vol. 28). K. Huang, ed. 164 pp. American Institute of Physics, New York, 1976. \$15.00

The superstars who spoke at the 1974 symposium at MIT, held to honor "Viki" Weisskopf, were told to select their topics on the basis of what would interest him: the result is a potpourri of social comment, hard physics and novel, if whimsical, scholarship. Wolfgang Panofsky expounds on arms control, Hans Bethe on the energy problem. Edward M. Purcell considers life at low Reynolds number ("At low Reynolds number you can't shake off your environment. If you move, you take it along..."), and Max Delbrück recounts "How Aristotle Discovered DNA." Ben. R. Mottelson and others present no-nonsense scientific work. Generalists and interdisciplinarians may find the book's variety engaging.

Variational Methods in Theoretical Mechanics. J. T. Oden, J. N. Reddy. 302 pp. Springer-Verlag, New York, 1976. \$14.80 (paper)

Interest in variational theory in historic times began at least as early as Jean Bernoulli's proposal in 1696 of the now-familiar "brachistochrone" problem, and those who have contributed to the subject's development include Isaac Newton, Gottfried Leibniz, Leonhard Euler and Joseph Lagrange. The authors summarize the calculus of operators on Banach spaces and review the principles of continuum mechanics, then set forth 14 basic variational principles for treating the large class of linear boundary- and initial-value problems. There follows a general method for developing functionals and a description of the theory relevant to variational boundary-value problems. Methods of approximation are also introduced. The book is meant to serve as a text for graduate mechanics and engineering students with some knowledge of continuum mechanics and functional analysis.

new books

Elementary Particles and Fields

Particle Searches and Discoveries—1976: Vanderbilt Conference (AIP Conference Proc., Vol. 30: Particles and Fields Subseries, No. 11). R. S. Panvini, ed. 338 pp. American Institute of Physics, New York, 1976. \$18.50

Gauge Theories and Modern Field Theory (Proc. of a Conf. held at Northeastern Uni-

versity, Boston, September 1975). R. Arnowitt, P. Nath, eds. 428 pp. MIT, Cambridge, Mass., 1976. \$15.00

Gravitation and Spacetime. H. C. Ohanian. 461 pp. W. W. Norton, New York, 1976. \$18.95

Gravitation and Relativity. M. G. Bowler. 172 pp. Pergamon, Oxford, 1976. \$14.50 clothbound, \$8.50 paperbound

Atoms and Molecules

The Theory of Auger Transitions. D. Chattarji. 265 pp. Academic, London, 1976. \$29.00

Negative Ions, 3rd edition (Cambridge Monographs on Physics). H. S. W. Massey. 741 pp. Cambridge U.P., New York, 1976. \$69.50

Spectroscopy, 2nd edition: Vols. 1, 2, 3. B. P. Straughan, S. Walker, eds. 304, 362, 324 pp., respectively. Halsted, New York, 1976. \$22.50 each volume

Chemical Physics

The Determination and Interpretation of Molecular Wave Functions (Cambridge Monographs in Physical Chemistry, Vol. 3). E. Steiner. 205 pp. Cambridge U.P., New York, 1976. \$27.00

Electron-Solvent and Anion-Solvent Interactions. L. Kevan, B. C. Webster, eds. 360 pp. Elsevier, Amsterdam, 1976. \$57.50

Advances in Chemical Physics, Vols. 34 and 35. I. Prigogine, S. A. Rice, eds. 324 and 358 pp., respectively. Wiley, New York, 1976. \$28.95 and \$29.75, respectively

Optics

Contemporary Optics for Scientists and Engineers. A. Nussbaum, R. A. Phillips. 511 pp. Prentice-Hall, Englewood Cliffs, N.J., 1976. \$19.95

Fluids and Plasmas

High Temperature Vapors: Science and Technology. J. W. Hastie. 480 pp. Academic, New York, 1975. \$35.00

Handbook on Plasma Instabilities, Vol. 1. F. F. Cap. 458 pp. Academic, New York, 1976. \$19.50

Electricity and Magnetism

Magnetofluid Dynamics. L. Dragos. 478 pp. Abacus, Tunbridge Wells, Kent, England (US distributor: ISBS Inc, Beaverton, Oregon), 1976. \$43.00

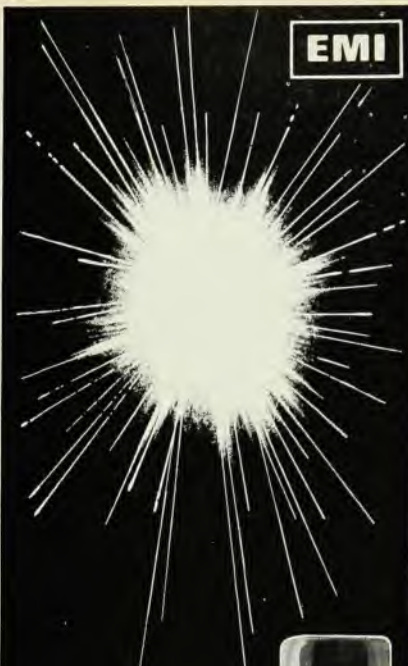
Theory and Applications of Molecular Paramagnetism. E. A. Boudreaux, L. N. Mulay, eds. 510 pp. Wiley, New York, 1976. \$35.00

Magnetism and Magnetic Materials—1975 (AIP Conf. Proc., Vol. 29: 21st Annual Conf., Philadelphia, December 1975). J. J. Becker, G. H. Lander, J. J. Rhyne, eds. 687 pp. American Institute of Physics, New York, 1976. \$30.00

Materials and Solid State

Stability of Microstructure in Metallic Systems. J. W. Martin, R. D. Doherty. 298 pp. Cambridge U.P., New York, 1976. \$32.50

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