

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 Many interesting historical references have been included, and the early development of the subject is treated exhaustively, starting from quite an elementary level.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