dissolved, ionic, and interfacial states are covered in six chapters in a highly systematized fashion. The last part of the text discusses chemical equilibria and reaction kinetics of both homogeneous and heterogeneous systems. The book ends with several brief appendices which include a short list of the more important physicochemical constants, and derivations of some mathematical relationships pertinent to earlier parts of the text.

In this reviewer's opinion, this treatise is an excellent example to the next generation of textbook authors who, in an age of almost-overwhelming rate of expansion of knowledge, will find that the tedium and discipline of learning mathematics is really worth the effort after all.

An Introduction to Discharge and Plasma Physics. Summer School (U. of New England, Armidale, Australia, Jan.-Feb., 1963) S. C. Haydon, ed. 509 pp. Department of University Extension, The U. of New England, Armidale, Australia, 1964. £A3 10s.

Reviewed by L. Talbot, University of California, Berkeley.

Summer institutes have become increasingly popular as a means for providing a concentrated exposé of a topical subject. One of the obvious virtues of a summer course (apparently, even if it is held in January and February, the summer months down under) is that it makes possible the assembling together of a number of authorities whose combined expertise far exceeds that of any single individual who might be available to teach a regular university or industry course. Of course, having a group of experts deliver a series of lectures is no guarantee that the program taken as a whole will be well-organized, coherent, or even particularly informative. In the present instance, I am pleased to report that the effort met with conspicuous success.

The intent of this summer course was, quoting from Editor Haydon's preface, ". . . to outline in a systematic manner the fundamental properties of ionized gases and to provide the basic physics required for a discussion of engineering problems which involve discharge and plasma phenomena." The thirty-five chapters of the volume represent the formal lectures of fourteen participants, plus one post-course contribution. The subject matter of these lectures encompasses a wide range of topics, including kinetic theory and collision processes, surface phenomena, electrical breakdown in gases and liquids, plasma properties and interactions with fields, and glow, arc, and spark discharges. The emphasis, as Haydon indicates, is on engineering, and almost without exception, the contributions contain good physical descriptions of the phenomena under discussion and examples of technical application. Although in some cases the presentations are brief, they are not superficial. Each chapter is followed by a list of general references in addition to the particular sources referred to in the text, which should easily enable the reader to dig deeper, if he so chooses. Editor Haydon has done a most commendable job of unifying notation and maintaining a consistent set of units (mks). There is good cross-referencing between chapters, which gives continuity to the book, and an adequate subject index is provided.

Taken as a whole, these lectures provide an excellent survey of the broad and complex field of discharge physics, and I would recommend them highly to anyone wishing to begin study in this area.

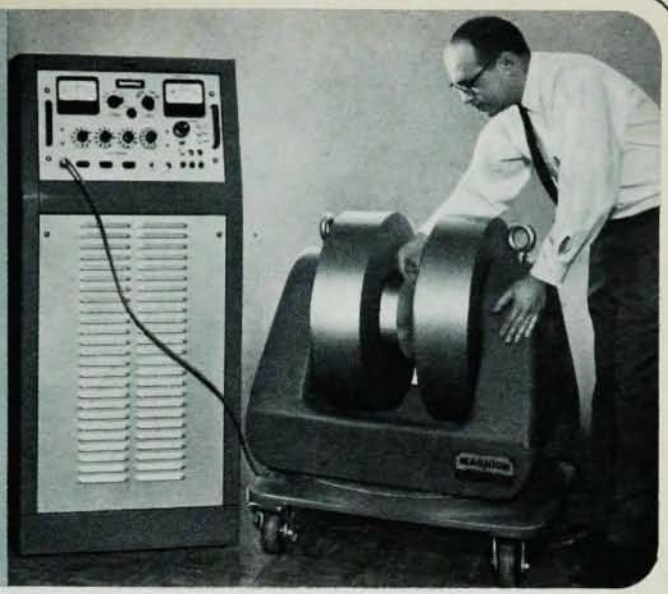
Nuclear Energy in Space. By Erik S. Pedersen. 516 pp. Prentice-Hall, Englewood Cliffs, N. J., 1964. $19.95.

Reviewed by Herbert Malamud, Sperry Gyroscope Company, Division of Sperry Rand Corporation.

During the 1930's, science fiction stories were common which dealt with the "attic genius" type of scientist, who built an atomic-powered space ship in his back yard and flew off to battle. Such a scientist would have found this book invaluable: it covers, in sufficient detail to be a good introduction, just about every part of the subject to which the title lays claim, and a few related fields outside this direct claim area.

Today's "space ship" builders are, however, teams of specialists, and clearly the men who design nuclear power sources will not also have responsibility for fluid-flow analysis in

A SIGNIFICANT STATE-OF-THE-ART ADVANCE IN MAGNETIC FIELD CONTROL



Magnion's new FFC-4
provides 5 parts in 10^5 field set accuracy, PLUS . . .

5 parts in 10^7 field stability

5 parts in 10^7 or 1 milligauss (short term)
1 part in 10^6 of *operating* field (long term)

field sweep linear to 0.01%

Sweep range continuously adjustable from 1 to 20,000 gauss
Sweep rate continuously adjustable from 0.1 to 10,000 gauss per minute

repetitive field sweep

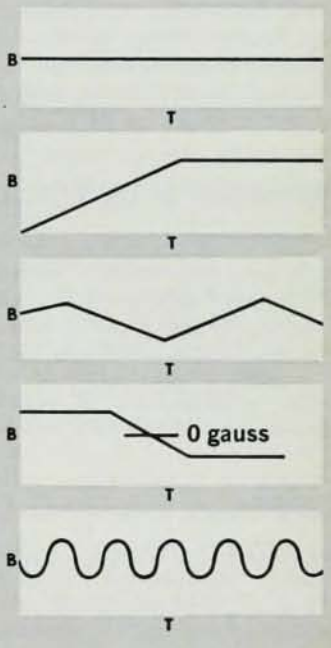
An output jack and meter provide indications of deviation from mean field accurate to 0.1% of field sweep range

zero field capabilities

Field set to *zero field*
Field sweeps through *zero field* to —100 gauss

external field control

Two input jacks for external field control and sweep



Magnion's new FFC-4 is the finest magnetic field control system available. It provides field set accuracy, sweep linearity and temperature stability which are orders of magnitude above competitive systems.

The FFC-4, which is based on Faraday's Law, is thermally stable to 5×10^{-7} per degree Fahrenheit at any operating field. This far exceeds the temperature stability of Hall Effect field regulators in which thermal compensation is field dependent. Typical Hall Effect regulators may drift 2×10^{-5} per degree Fahrenheit when operated only 5 kilogauss from the level at which compensation is optimized.

Write today for complete details and performance specifications on the new FFC-4 to **Magnion, Inc.,** 144 Middlesex Turnpike, Burlington, Massachusetts.

MAGNION®
INC.
HARVEY-WELLS

the heat exchanger. Since both are interested in the same vehicle, one may assume that each would want to know at least the basics of the other's field.

Pedersen here performs the valuable service of providing the means for this cross-education of specialists. *Nuclear Energy in Space* will not teach a specialist too much in his own specialty, but it gathers together the basics of all specialties within or bordering on the field of providing energy in space (with emphasis on nuclear energy) and presents them in one place for study.

Chapters are presented, not only on the primary nuclear energy supply, but on auxiliary supplies, on electrical power generation from heat and light energy, on advanced propulsion methods (including electrical propulsion), on materials to be used in construction, and even on the space environment itself.

The book is also appropriate for an introductory course on energy sources in a curriculum on space sciences or on nuclear engineering.

Plasma Kinetic Theory. By D. C. Montgomery and D. A. Tidman. 293 pp. McGraw-Hill, New York, 1964. $11.50.
Reviewed by Howard Chang, Stanford Research Institute.

During the past decade the plethora of books on plasma physics, the discipline rich in theoretical concepts of dubious applicability, has been published. (About forty by the latest count in *Books in Print*.) Most of them are elementary in the sense that a highly idealized model of the plasma is used so that particle-orbit theory and a fluid description of the complex and multitudinous phenomena occurring in the plasma are adequate. Using nothing beyond material usually covered in undergraduate courses in mathematics and physics, an elegant formulation of plasma physics has been developed. This permits detailed visualization of wave propagation in plasmas, their damping, transport phenomena and what is supposedly occurring in microwave devices, controlled fusion machines, and in outer space. Unfortunately, the elaborate and beautiful edifice of elementary plasma physics is an exercise in intellectual gymnastics, or to be more charitable, applied mathematics.

Plasma Kinetic Theory represents a quantum jump in difficulty from the existing books on plasma physics. It treats a classical plasma, which is an electron gas moving through a uniform smeared-out, positive, immobile background and in which the number of electrons in a sphere of Debye radius is large compared to one. On the whole, the plasmas considered are unbounded and uniform, and quantum effects are completely neglected. The authors take the logically tenable position that the Boltzmann equation, properly modified and interpreted, contains all the answers to the questions one would ask about processes occurring in such an idealized medium. To proceed from this lofty level, the reader must have had graduate level courses in classical mechanics, statistical mechanics, electromagnetic theory, and a modern course in advanced calculus. Familiarity with the results of elementary plasma physics on the level of Spitzer's classic, *Physics of Fully Ionized Gases*, would be helpful but is not imperative.

In Part I (34 pages) a bridge between the older literature on plasmas and modern kinetic theory is established. Boltzmann's equation is derived, and it is shown why a cavalier and simple-minded use of Boltzmann's equation on a plasma will yield meaningless results. This leads naturally to a good discussion of the Fokker-Planck equation and relaxation times.

In Part II (73 pages) the so-called BBGKY hierarchy of equations for the reduced distribution functions, f_s, is developed and discussed in detail. By use of the Mayer cluster expansion, so fruitful in the study of a neutral gas, the key concept of the correlation function is introduced and used to solve the hierarchy approximately. Landau's classic discussion of the Vlasov or correlationless kinetic equation and its generalization for a many-component plasma are given.

In Chapter 6, Bogolyubov's seminal hypothesis that the f_s evolve on three distinct time scales—the initial, kinetic and hydrodynamic stage—is used to solve the chain of equations for f_s by using a powerful and elegant method due to Dupree. The excellent work of Guernsey and the Princeton Group are discussed, and a whole chapter is devoted to discussing the properties of the Balescu-Lenard Kinetic Equation, the plasma analogue of the Boltzmann equation for molecular gases at low density. Fluctuations are treated by paraphrasing a paper due to Rostoker.

In Part III (139 pages) selected applications of kinetic theory are made. It is shown how all the results of elementary plasma physics are recovered as special cases of this more general formulation. Thus, waves in cold plasmas, waves in hot plasmas in a magnetic field, nonlinear phenomena, shocks, and instabilities are treated briefly. A whole chapter is devoted to some techniques for singular integral equations of a type which recurs in plasma physics à la Muskhelishvili, followed by one on radiation. In the last chapter, the existence of the world of experimental reality is finally acknowledged by a brief consideration of ionic sound waves, incoherent scattering by the ionosphere, and computer experiments.

This is a useful and important book. Students interested in plasma kinetic theory will find it much easier to read than the original papers which are listed in the reference. Of course, they will eventually have to read the literature because the present theory is capable of treating a more complex model—ions of finite mass, plasmas in strong magnetic fields, and quantum plasmas. It will undoubtedly form the basis for advanced courses in plasma physics for sometime until a better book is written. It is definitely not for beginners, who should study Spitzer or Longmire's *Elementary Plasma Physics*.

The faults of *Plasma Kinetic Theory* are minor. It shows signs of being hastily written. The editing of the book is ramshackle and resulted in numerous stylistic errors. It would have been more readable if a glossary were provided. Its value as a textbook would have been greatly increased if problems had been provided giving examples for the text material, extending or supplementing the principles set forth, or anticipating developments to follow later.