

# BOOK REVIEWS

**Regge Poles and S-Matrix Theory.** By Steven C. Frautschi. 200 pp. Benjamin, New York, 1963. Cloth \$7.50, paper \$3.95. Reviewed by J. C. Polkinghorne, University of Cambridge.

Professor Gold used to liken cosmologists to a drunk looking for his lost key under a lamp post—it may not be the right lamp post but it is the best one he can find. Strong-interaction physics is an equally mysterious subject and, apart from symmetry principles, the two most used lamp posts have been potential theory and relativistic perturbation theory. In his introduction to the subject, Professor Frautschi has leaned most heavily on the former. The reviewer slightly regrets this, partly because he has spent more time encircling the other one, and partly because perturbation theory can represent the vital effects of crossing clearly.

However, since Regge poles were first found under the potential lamp post, it is ungenerous to complain—particularly of a book which presents so readable and useful an introduction to modern ideas. It falls into two halves, the one concerned with the Mandelstam representation and such notions as the strip approximation, the other dealing with Regge poles and high-energy behavior. Professor Frautschi is particularly successful in seeing that the reader understands what is going on and does not get lost in a welter of formalism. The book takes the subject up to the summer of 1962 and is an excellent addition to the "Frontiers in Physics" series.

**Cosmical Electrodynamics.** Fundamental Principles, (2nd ed). By Hannes Alfvén and Carl-Gunne Fälthammar. 221 pp. Oxford, New York, 1963. \$9.60. Reviewed by S. Fred Singer, University of Maryland.

Hannes Alfvén's *Cosmical Electrodynamics* was first published in 1950. It became a classic overnight. Nearly a generation of physicists has been brought up on it. It appeared at a crucial time in the development of physics. The fundamental ideas which

were discussed in this first edition of 1950 have found application in two very important and growing areas: thermonuclear research and space research; one, the development and exploration of magnetohydrodynamics in the laboratory, the other, the investigation of magnetohydrodynamic conditions in the vicinity of the earth and in interplanetary space. We will probably never be able to estimate precisely to what extent Alfvén's book contributed to the rapid growth of these two fields, but there is no doubt that its influence was great. It is easy to show that the pioneer workers in these research areas, and the many students who were attracted into these fields, all used Alfvén's book as a primary reference.

The new edition of *Cosmical Electrodynamics* has been awaited with great interest, and it proves to be well worth the wait. Alfvén and his co-author have made a very wise decision by concentrating this volume on fundamental principles only, and by not attempting to cover the vast areas of applications which now exist and are constantly developing. In essence, therefore, this book will not be outdated very soon. It serves as an excellent exposition of the phenomena which underlie laboratory and cosmic magnetohydrodynamics. Furthermore, the exposition is extremely direct and easy to follow. Therefore, the volume should also serve as an excellent textbook, in addition to its obvious purpose as a technical monograph.

The first four chapters of Alfvén's first edition have now been expanded into the thorough exposition of four general areas: (1) the motion of a single charged particle in a magnetic field; (2) magnetohydrodynamics; (3) plasmas without magnetic fields; and (4) the final long chapter on plasmas with magnetic fields. The selection of topics turns out to be complementary to the well-known monograph of Spitzer's. For example, Alfvén does not treat such topics as Landau damping, two-stream instabilities, etc.

It may be helpful to highlight those

topics which are greatly expanded in this second edition as compared to the first edition: the connection between Störmer theory and the adiabatic methods; adiabatic invariants; acceleration in varying magnetic fields; expanded treatment of MHD waves, including dispersion relations; many applications of MHD, including isorotation, forcefree fields, stability problems, magnetic field generation mechanisms, runaway electrons in plasmas; expanded discussions of plasmas in magnetic fields, particularly the topics of conductivity and diffusion.

One of the attractive features of the volume is its close adherence to experiments and experimental results wherever possible. Indeed this close relation between theory and experiments has characterized much of Alfvén's personal philosophy. In his laboratory were conducted some of the earliest magnetohydrodynamic experiments dealing with simulation of cosmic rays in the earth's magnetic field and with aurora. In the present second edition one sees results of experiments with plasma rings, with model experiments on magnetohydrodynamic instabilities, and with experiments on hydromagnetic waves (better known as Alfvén waves, although not referred to as such in this book).

**The Moon, Meteorites, and Comets.** Barbara M. Middlehurst and Gerard P. Kuiper, eds. Vol. 4 of The Solar System. 810 pp. Univ. of Chicago Press, Chicago, 1963. \$15.00.

Reviewed by E. J. Opik, Armagh Observatory and University of Maryland.

The volume links with Vol. 3 of the same series in that it has the moon in common. In 22 chapters, each of which is a separate monograph written by experts of world-wide reputation, an exhaustive account is given of the structure of the moon's surface as obtained with optical, radio, and radar means; of meteorite falls; of meteorite craters from observed falls, recent falls, or fossils; of the empirical and theoretical aspects of impact cratering which has become an independent branch of mechanics bordering on astrophysics and engineering; of the physical, chemical, and mineralogical properties of meteorites; of the isotopic and dynamic evaluation of me-



teorite ages, with links toward cosmogony; of cometary orbits; of the physics and structure of comets and their parts, and their probable origin; of "ordinary" meteors as observed by optical and radio methods, the physics of their interaction with the terrestrial atmosphere, their origin and links with comets. Abundant plates, figures, and tables illustrate the text. Undoubtedly, the opinions of different experts on the same subject would not always agree, and there are many points which could have been given a different presentation. It is therefore gratifying to note the high percentage of the text which can be marked as commonly accepted by the leading authorities. At the same time, it contains material which is unusual and unorthodox, yet not in contradiction with the laws of nature.

The task of the editors was not easy, and slips are inevitable, especially in translations. As an example, on p. 216, in Krinov's article it is stated that the Tunguska meteorite could have been *overtaking the earth*; to be observable, in such a case this object should have passed right through the earth to emerge in Siberia at the moment of observation, and would then be moving in the wrong direction. In Krinov's original Russian text (*Meteoritika*, Moscow 1955; cf. p. 105) it is correctly said that the object could have been *overtaken by the earth*.

The volume is a fundamental contribution to our knowledge of the minor members of the solar system, of lasting value to serve as a handbook for years to come.

**Précis d'Electromagnétisme théorique.** By Paul Poincelot. 456 pp. Dunod, Paris, 1963. Paper 76 F.  
Reviewed by Howard H. C. Chang, Stanford Research Institute.

In the preface of his celebrated opus, *Dictionary of the English Language*, the irascible Dr. Samuel Johnson noted with trepidation that "Every other author may aspire to praise; the lexicographer can only hope to escape reproach." This melancholy observation applies equally well to writers of handbooks and Baedekers. To escape censure the author must satisfy three stringent requirements: (a)

the handbook must be accurate, exhaustive and modern. (b) The material must be imaginatively arranged and readily accessible. (c) The price must be reasonable. In all three scores, the present volume, which is best described as *A Handbook of Classical Electricity and Magnetism* (circa 1940), is woefully unsatisfactory and not worth the serious attention of engineers and physicists.

To be sure, the grave sins of this work are not sins of commission but sins of omission. The most damaging statement that can be made against it is that it could have been written in 1940 by Jeans. Thus the following important modern topics are not treated at all or treated very superficially: waves in anisotropic and inhomogeneous media, electromagnetic fluctuations, magnetohydrodynamics, radiation by moving charges, collisions between charged particles, energy loss, bremsstrahlung, method of virtual quanta, radiative beta processes, radiation damping, self-fields of a particle, scattering and radiation by bound systems, dispersion, obstacles in wave guides, variational methods for waveguide discontinuities, surface wave guides, artificial dielectrics, integral transform and function-theoretic techniques, and the powerful and elegant Green's-function techniques. It would, of course, be unreasonable to expect that he would treat all these topics in depth, but to omit them entirely opens this handbook to the serious charge of being obsolete. Instead, the author dissipates his energy on elementary and standard material found in such venerable classics as *Classical Electricity and Magnetism* by Abraham and Becker. Like most French works in electromagnetic theory, an inordinate amount of space is devoted to tensor calculus. Surely, such topics as tensor densities and Christoffel symbols should be eschewed in a book on electromagnetic theory.

Poincelot's references are principally to French books, which is well and good. Apparently he has not bothered to read the English books in this field except Stratton, which appeared in 1941! Thus, he makes no mention of the two fine books in EM theory in the Landau-Lifshitz series (*Physics Today*, Oct. 1961, p. 48), *Classical*

*Electricity and Magnetism* by Panofsky and Phillips, *Classical Electrodynamics* by Jackson (*Physics Today*, Nov. 1962, p. 62), and *Field Theory of Guided Waves* by Collins (*Physics Today*, Sept. 1961, p. 50). If he has not read these fine books, he is guilty of an inexcusable laxity, and if he has, it is difficult to understand why he failed to cull material from them.

While it is a truism that "An author never finishes a book, he merely abandons it", the conscientious author will not abandon his book before he has prepared a detailed and useful index. The fact that this handbook has no index is enough to deter anybody considering its purchase from doing so.

Finally, \$15.25 is an exorbitant price for this potboiler. The same material and much more is available in Jackson for \$11.25 and in Panofsky and Phillips for \$12.50.

**The Natural Philosopher, Vol. I.** A Series of Volumes Containing Papers Devoted to the History of Physics and to the Influence of Physics on Human Thought and Affairs through the Ages. 155 pp. Blaisdell, New York, 1963. Cloth \$2.95, paper \$1.95.

Reviewed by L. Marton, National Bureau of Standards.

My curiosity was aroused when I saw a new publication entitled *The Natural Philosopher*. It is easy to cover a multitude of sins under that title, but it is less easy to do justice to a fine, old, and time-honored concept. I am happy to report that the attempt is reasonably successful.

The relatively slim volume purports to be first of a series and contains four articles. The first and longest part is by Robert E. Beardsley on "Radiation Control" and is, in my opinion, the weakest part of the volume. Although it is a well-documented and exhaustive treatment of its subject, it does not fit too well the announced purpose of the series ("a series of volumes containing papers devoted to the history of physics and to the influence of physics on human thought and affairs through the ages"), and it does not match too well with the remaining three contributions, which are fine illustrations of what can be done in "natural philosophy".

The second paper, by Martin J.