recent heroic effort, the discovery of the quantum of action and the subsequent invention of quantum mechanics.

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Eugen Merzbacher, a professor at the University of North Carolina, is the author of a textbook of quantum mechanics.

Fission-product dynamics

PHYSICS OF NUCLEAR KINETICS. By G. Robert Keepin. 435 pp. Addison-Wesley, Reading, Mass., 1965. $12.50

by Alvin M. Weinberg

Keepin interprets the "physics of nuclear kinetics" broadly. In the first half of his book he reviews and compiles data on prompt neutrons and gamma rays from fission, as well as on the energy release and the mass and charge distribution in fission. One particularly welcome and germane chapter reviews our knowledge of delayed gamma rays from fission, and the yields of photoneutrons induced in beryllium and deuterium moderators by fission and fission-product gamma rays.

The most important chapter—the fourth—reviews in painstaking detail most of what was known about delayed neutrons up to 1964. To this task Keepin brings his own extensive experience in measuring the yields of delayed neutrons. His comprehensive review is a model of patient scholarship, and his tabulations of the yields and periods of the delayed neutrons, and particularly of the derived inhour relations giving reactor periods as a function of reactivity will be very useful to reactor physicists and engineers working on reactor kinetics.

The second half of the book is concerned largely with the theory of reactor kinetics. Most of the exposition is confined to linear theory, and includes outlines of the various static and dynamic methods for determining the reactivity of a reactor. The final two chapters cover matters directly concerned with assessing the safety of a reactor: the transfer function and nonlinear reactor dynamics.

Thus the book is in a way two books: the first half a painstaking review of our knowledge of those aspects of the fission process that affect the kinetic behavior of a reactor; and the second half a textbook of reactor dynamics. Of the two parts, I preferred the first. Here the author speaks with an impressive authority, and he has done a commendable service for the community of reactor physicists in bringing together so much data that is needed to predict the kinetics of reactors.

As for the second half of the book, though it outlines much of the theory that has been done in the American laboratories, particularly at Los Alamos, its tone is more descriptive than explanatory. For example, the most fundamental theorem in the noise analysis of a reactor—that the noise spectrum is proportional to the square of the amplitude of the reactor transfer function—is quoted rather than proved. Nor does Keepin cover many of the experiments on reactor transients—experiments described by such code words as "Borax" and "Spert," which illuminate various aspects of the theory. But here, and throughout, Keepin directs the reader to sources where details of derivations or of experiments can be found. One hopes that these sources display the same degree of scholarship and responsibility toward the reader that Keepin displays in the first half of his useful book.

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Unified field theory

LES THEORIES UNITAIRES DE L'ELECTROMAGNETISME ET DE LA GRAVITATION. By Marie-Antoinette Tonnelat. 522 pp. Gauthier-Villars, Paris, 1965. Paper $30.00

by R. B. Lindsay

One of the aims of physics as a science and indeed probably the chief one is the search for points of view that can subsume the largest possible domain of physical experience. This was exemplified, indeed, by the ancient Greek philosophers in their attempts to understand the world, though we do not consider their efforts very plausible or successful. The nineteenth century produced Faraday, who devoted many years to trying to find essential connections between apparently diverse phenomena. It also witnessed the accomplishments of the thermodynamicists who succeeded in establishing the concept of energy as a unifying principle. One of the great challenges of twentieth-century physics is the unification of the relativity theory of gravitation with electromagnetic theory and the quantum theory so as to produce a unified field theory that will encompass both gravitation and electromagnetism.

In the public mind the notion of a unified field theory is associated almost entirely with the name of Einstein, and indeed the celebrated author of the theory of relativity spent his later years in the valiant effort to produce a satisfactory synthesis of this kind. It is not generally realized that a host of other theorists have tried their hands at this problem. What may be called with considerable accuracy the whole story is set forth in the volume under review by Madame Tonnelat, professor in the University of Paris, and a well known authority in the field of which she writes.

The main part of the book is prefaced by a 13-page introduction, which provides an interesting and informative historical summary of the whole subject. This can be read with profit even by the nonspecialist, who may well find the body of the work rather formidable. The volume is divided into three parts dealing respectively with: (1) the basic theories of relativity and electromagnetism (150 pages); (2) the classical unitary theories (220 pages); and (3) attempts at quantification of gravitational fields. The first part is essentially a review of material that has been a part of the literature of physics for a long time. It is however presented with great clarity and even includes a review of the necessary mathematical background of vector and tensor analysis, the differential geometry of Riemann spaces, etc. The second part discusses in some detail the principal efforts at unified field theory in what may be called the classical or geometrical (nonquantum) domain. It is prefaced by an instructive chart relating the various theories of this kind from that of Weyl in 1919 to