BOOK REVIEWS

Introduction to the Vigier Theory of Elementary Particles. By Louis de Broglie. 138 pp. Elsevier, New York, 1963. $11.00.
Reviewed by R. B. Lindsay, Brown University.

It is well known that Louis de Broglie, one of the celebrated founders of modern quantum mechanics, has for some time been dissatisfied with the so-called probability-statistical interpretation of the theory championed by the Copenhagen school. As long ago as 1956, he published an account of an effort to construct a causal interpretation of quantum mechanics. Further trials in this direction have been made by David Bohm and by Jean-Pierre Vigier, one of de Broglie's younger French contemporaries. The general idea is that in order to account for quantum phenomena in the very small regions of the order of magnitude of the nucleus of the atom (i.e., regions of less than 10^{-13}cm in linear dimensions), and hence for the existence and properties of the many observed so-called "elementary" particles, it is necessary to assume the existence of a subquantic medium in which quantum events are described by hidden observables obeying nonlinear differential equations unlike the linear equations of ordinary quantum mechanics. It is further assumed that the wave solutions of these nonlinear equations are perturbed by interaction with the subquantic medium, and that the ψ function of ordinary quantum mechanics gets its probability status from these perturbations.

The present volume is a summary of rather recent work by Vigier and his coworkers in the attempt to construct a theory of elementary particles on the basis of the general point of view just mentioned. The development uses all the mathematical apparatus of relativistic quantum mechanics and will be followed in detail only by the experts in modern theoretical physics, but the general ideas are expounded with the clarity for which the distinguished author has long been famous. The general reader will find the first two chapters a very clear and understandable review of the basic concepts of nuclear physics and a survey of the known properties of the elementary particles, including a statement of the Gell-Mann formula for the charge of such particles.

It must be left to the experts to decide the likelihood of the success of the Vigier point of view, but it seems clear that it deserves careful examination. It is at any rate an encouraging sign that the attempt to provide a deeper meaning for quantum mechanics than that rather dogmatically insisted on by the adherents to the Copenhagen school should be in process of further development as reported by de Broglie in this book.

Introduction to Field Theory and Dispersion Relations. By R. Hagedorn. 127 pp. (Pergamon, Oxford) Macmillan, New York, 1964. $5.00.
Reviewed by J. E. Mansfield, Harvard University.

This is an interesting book—modest in scope and pedagogically direct. The author characterizes himself as an outsider to the field writing for a newcomer; hence he faces with enthusiasm certain arguments which an expert might pass over as trivial. The book developed out of the 1959 CERN lectures of Lehmann and Zimmermann; "grew out" is perhaps more correct, judging from the wealth of informative appendices.

An axiomatic S-matrix theory is developed, and causality is introduced by local commutativity and interpolating fields. This is all done for the purpose of writing dispersion relations for measurable quantities. The equivalence of dispersion relations as a statement of causality is shown in an interesting optical example.

The proof of forward and nonforward dispersion relations is carried out in the context of the Dyson representation of the Green's function. The treatment stops short of double dispersion relations and the Mandelstam representation.

Nine appendices form the second half of the book. Included are an interesting construction of orthonormal systems for the Klein-Gordon equation and a standard treatment of the integral representations of Green's functions. A very clear development of forward dispersion relations after Glaser and Joos and a physicist's proof of Titchmarsh's theorem are given.

A treatment of this type, in the context of "old-fashioned" field theory, will serve a definite purpose, especially for the student, as a good introduction to an important field.

Space Physics. Donald P. LeGalley and Alan Rosen, eds. 752 pp. Wiley, New York, 1964. $25.00.
Reviewed by R. E. Street, University of Washington.

Based upon a series of lectures given by specialists in the field of space physics as an extension course of the University of California, this volume summarizes and evaluates our present knowledge of the subject. Most of the content is experimental, obtained from the many satellites and space probes which the United States has successfully launched. However, wherever possible, theory is used to correlate and interpret the data. In addition it is clear that the editors have put a great deal of effort into coordinating and planning the whole work and with great success.

Thus we have three introductory chapters on the space programs, the design of spacecraft for experimentation and the experimental techniques used. The next five chapters summarize our knowledge of solar physics, the physics of the planets, the earth's upper atmosphere, and micrometeoroids. There are five chapters on fields and plasmas in interplanetary space, covering the geomagnetic and interplanetary magnetic fields and their interaction with solar plasma so far as they can be interpreted from current data and theory. The last five chapters on high-energy radiation in space cover what is presently known about the trapped-radiation zones, the effects of high-altitude explosions, energetic solar particles, cosmic rays, and the dosimetry rates to be expected in space. Since each chapter has a complete list of references, it