BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Theory of Meson Interactions with Nuclei

Authors	Judah M. Eisenberg and Daniel S. Koltun
Publisher	John Wiley & Sons, Inc., New York (1980)
Pages	403
Price	$39.95
Reviewer	N. V. V. J. Swamy

This is a book on the theory of the interactions of mesons with nuclei, which is a matter of increasing current research. After enumerating different types of mesons and reviewing their properties, the authors go over the basics of nonrelativistic potential scattering theory—partial waves, Born approximation, Lippman-Schwinger theory, and the Optical theorem. A prerequisite for examining the methods developed for studying meson-nucleus scattering is to know how one treats meson-nucleon scattering. There is thus a presentation of the Chew-Low Theory of πN scattering inclusive of pion interactions and resonant intermediate states, and a criticism of some of its relevant limitations and inadequacies. Throughout the book, one finds the theories interspersed with diagrammatic representations and experimental data.

As mentioned in the Preface to the book, more than half of it is devoted to the treatment of multiple scattering methods and their applications. First the meson-deuteron scattering, a three-body system, is treated in the impulse approximation assuming fixed nucleons and, after that, the nonrelativistic Faddeev integral equations are set up. The low energy (S wave) πd and Kd elastic scattering cross sections are chosen as applications of the Faddeev formalism and these are followed by a brief excursion into relativistic three body theories. There is then a systematic exposition of the Watson approach to multiple scattering accompanied by a discussion of convergence of the series and corrections to the lowest order approximation. The Distorted Wave Impulse Approximation is used to study inelastic scattering. The Glauber method for calculating high-energy cross sections is heuristically derived and compared with the Watson series. Since one is dealing with matter waves and their scattering or absorption by media, the analogy with optics underlies most of the derivations. Dispersion relations are touched on as one of the specialized techniques for analyzing forward pion-nucleus scattering. Meson degrees of freedom are important to deal with effects like meson absorption and to take these into account a quantized meson field is necessary. A chapter is devoted to this in which the "doorway state" approach of Feshbach et al., introduced in the context of intermediate structure resonances of the compound nucleus, is taken to develop a coupled channel method. The various consequences of the existence of virtual mesons to nuclear structure, for example, pion condensation, form the subject matter of the concluding chapter.

Since it covers the waterfront, so to speak, this book will be found useful by researchers in the area of meson-nucleus interactions. As for reaching students, it falls just short of being, in the authors' words, a "pedagogic treatment" comparable to Wick's review of the Chew-Low theory or Glauber's introduction to his method. In this respect it would have been helpful if they included here and there "mundane details" that could help the student to make the transition from heavy (though clear) formalism to the calculation of a cross section using appropriate basis states and explicit interactions. This, however, is not to be taken as a serious shortcoming of the book. Mention is made in the text of quarks, strangeness, and the like, and as such the table listing meson properties could be expanded to include other quantum numbers and the quark composition of mesons just for completeness. The annotated references at the end of each chapter are a welcome feature. Recent work on a relativistic generalization of the Chew-Low model is a typical example of how vigorous the current research is in this field and because of this it becomes necessary to reiterate the usefulness of this book to anyone who has anything to do with meson-nuclear physics.

Dr. N. V. V. J. Swamy is a professor of physics at Oklahoma State University in Stillwater, Oklahoma. He is the author of a book and several publications relating to nuclear structure, nuclear fission, relativistic quantum mechanics, symmetry and group theory, astrophysics, and plasma wave dispersion relations. In 1975, he spent his sabbatical at the Plasma Physics Institute of Kernforschungsanlage in Germany, where the dominant theoretical activity was the study of radiofrequency heating of tokamak plasmas, and later at Cambridge University in England. Because of the levitation experiments that seem to establish the existence of fractionally charged particles (quarks) and the contention of particle physicists that the existence of quantized charges implies the existence of magnetic charges, his current research interests include the investigation of consequences in plasma physics of the existence of such charges, besides nuclear fusion.