Book Review

Nuclear and Particle Physics, B. Margolis and C. S. Lam, Eds. (W. A. Benjamin, Inc., New York, 1968). 547 pp., $12.50.

With the publication of this book, we are presented with yet another set of lecture notes from a summer institute in physics. This particular institute was held at McGill University during August of 1967 and covered nuclear structure and scattering theory (5 papers), elementary particle physics (2 papers), and weak interactions (2 papers). As is always the case with such a volume, the quality of the individual papers varies widely and an appraisal of the book does not properly reflect their individual merits or demerits. However, taken as a whole, it is hard to see what useful purpose has been served by its publication. Much of the material included in it is not discussed in sufficient detail to warrant publication and, in some cases, the same material is available elsewhere in a more palatable form. To compound these sins, the format of the book, which has a typewritten text and handwritten equations, is such that large portions of it are virtually unreadable without considerable eye strain. Nevertheless, there follows a brief review of its contents.

The book contains three lectures on scattering and reaction theory. The first of these, "Collision and Decay Phenomena" by K. Gottfried, treats such problems as electron-atom and neutron-nucleus scattering, atomic and K-mesonic decays, and high energy scattering of electrons and nucleons. This is a collection of rather loosely connected problems which are not treated in sufficient detail to be particularly instructive. The second lecture, "Selected Topics in Nuclear Reactions" by B. Margolis, treats such topics as the Bloch and Feshbach theories of resonance reactions, the effect of the Pauli principle on nucleon-helium scattering, the eikonal approximation, and Glauber's theory of high-energy scattering. All this is done in thirty typewritten pages and the details and motivation must be sought in other books. A very nice discussion of the then new data on high-energy proton scattering from light nuclei is given in "High Energy Scattering from Nuclei" by C. Wilkin. This paper includes a very physical description of Glauber's theory of high-energy scattering which was used to interpret the data.

These are two papers devoted to low-energy nuclear structure, the first of which, "Effective Interactions in Finite Nuclei" by S. Kahna, takes on the formidable problem of calculating a realistic effective interaction for nucleons in a nucleus starting with a "real" two-nucleon interaction. However, the author only discusses the problem of two nucleons outside a doubly magic core, treated as two interacting particles in a potential well, and he fails to discuss the validity of the many uncontrolled approximations that must be made in treating such a problem. The article, "Nuclear Deformation in the Shell Model" by D. Kurath, is a useful review of the many manifestations of nuclear deformation in light nuclei. This is treated by the generator coordinate method using a Nilsson-model wave function for the intrinsic state. The implications of such a state for nuclear reactions, electron scattering, electromagnetic transitions, and deformed excited states are then discussed.

In the area between nuclear and particle physics, there are two lectures on weak interactions, "Radiative Corrections to Weak Interactions" by G. Källén and "Muon-Capture in Nuclei and the Migdal Theory" by M. Rho. Both of these lectures suffer from having nearly illegible equations. Furthermore, since the material in the Källén article is published elsewhere in a more complete and readable form, its presence in this book contributes little to the general knowledge. The lectures by Rho are in two parts. The first part is an attempt to convince the reader that we understand muon capture well enough to be able to use it as a probe of nuclear structure and the second part uses Migdal's Fermi-liquid theory of nuclear structure to interpret observed muon capture rates.

In a field that is evolving as rapidly as elementary particle physics, the two papers on this subject, "Chiral Algebra and Dynamics" by W. A. Bardeen and B. W. Lee and "Theory of Sources" by J. Schwinger, can only be viewed with historical interest. Bardeen and Lee give a short critical discussion of current algebra, the partially conserved axial-vector current hypothesis, and chiral dynamics using a phenomenological Lagrangian. Schwinger's article gives a brief survey of his theory of sources.

In conclusion, this book's merits are far outweighted by its demerits and its purchase cannot be recommended to anyone except perhaps a library.

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About the Reviewer: Robert W. Richardson is an associate professor of physics at New York University, University Heights, where he has been a member of the staff since 1965. Prof. Richardson completed his graduate training at Michigan in 1963 and spent the following two years at the Courant Institute. His research interests lie in the general field of the many-body problem and, in particular, nuclear structure and liquid helium.