length, usually denoted by a, gives the scattering cross section $4\pi a^2$ of the pair involved at very low energy, or would give it if only nuclear forces were involved. The range r determines the energy derivative of the cross section. If the three nuclear interactions, proton-proton, neutron-neutron, and proton-neutron, were equal—thus eliminating one of the reasons for the breaking of the isospin symmetry—both a and r would be identical for all three pairs. The article discusses the determinations of the three a's and three r's from the experimental point of view and the surprisingly many and intricate corrections that must be applied on the raw data. It also discusses the cross-section dependence at somewhat higher energies, several MeV, and the Cini-Fubini-Stanghellini formula which should account for these. It reaffirms the generally accepted conclusion that the ranges of the three interactions, close to $r = 2.8 \times 10^{-3}$ cm, are very nearly equal, but the scattering length of the proton-proton interaction, $a = 17.8 \times 10^{-3}$ cm, is considerably lower than that for proton-neutron interaction, $a = 23.7 \times 10^{-13}$ cm. The neutron-neutron interaction is very difficult to determine directly—the problem is discussed on a rather sophisticated level—and it may be best to assume that it is equal to the proton-proton interaction.

As was mentioned before, the book appears to be a useful contribution to the literature; the articles one can understand are rewarding reading.

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About the Reviewer: Professor E. P. Wigner, a revered member of the nuclear community, actively continues his contributions to nuclear physics following his retirement from the Thomas D. Jones Professorship of Mathematical Physics at Princeton. Dr. Wigner, a Nobel laureate in physics, was one of the principal strategists of the Manhattan Project. Interestingly, his early academic training was as a chemical engineer.

Fundamental Interactions and the Nucleus. By R. J. Blin-Stoyle. American Elsevier Publishing Company, Inc. (1973). 345 pp. $19.50

The phrase "fundamental interactions of the elementary particles" is usually associated with the experimental programs of the large accelerators and not with what we currently call nuclear physics. However, much of what is known about the strong and weak interactions has been learned from experiments with nuclei at relatively low energies. This is the subject of *Fundamental Interactions and the Nucleus* by R. J. Blin-Stoyle.

The subject matter is actually considerably less general than the title indicates. The emphasis is overwhelmingly on weak interactions. This focus reflects the interests of the author, who is well qualified to write such a book. He and his collaborators and students have made numerous contributions to the field, in addition to significant contributions to other areas of nuclear theory and several lucid review articles.

The theory of weak interactions is reviewed in Chap. I. This theory is very similar to the quantum electrodynamics in that the interaction of particles is taken to be proportional to the scalar product of their (four-dimensional) currents. The electromagnetic current of nucleons has a polar vector part plus a rank-2 tensor part arising from the anomalous magnetic moments. The weak interaction currents contain additional terms of axial-vector, scalar, and pseudo-scalar form. Associated with each is a coupling constant analogous to electric charge. The form of the interaction manifests itself through the properties of radiations emitted in various nuclear processes. These are reviewed exhaustively in Chaps. II through X. Five chapters are devoted to nuclear beta decay. Chapter VII treats muon capture; muon capture provides information on components of the interaction which manifest themselves strongly only in processes in which there is large energy-momentum transfer to the nucleus. Chapters VIII, IX, and X are concerned with the consequences of weak interactions on processes, such as alpha and gamma decays and nuclear reactions. The interacting current theory predicts a weak force which results in the violation of parity selection rules in gamma and alpha decay. Time reversal invariance may be violated in nuclear reactions. Chapter XI treats the meson-exchange corrections to electromagnetic moments and the charge dependence of strong nucleon-nucleon interactions. Chapter XII is a brief, almost perfunctory discussion of what we can learn about strong interactions from complex nuclei. Most of what is known about the strong interactions has resulted from studies of nucleon-nucleon scattering; this topic is not treated.

This book is written for readers with a serious interest in the subject matter. According to the Preface, "The book is pitched at a level which should enable a physicist who has been through, say, a first year postgraduate course in basic nuclear and elementary particles physics to understand virtually all sections." An absolute prerequisite, in my opinion, is a full-year course in quantum mechanics, including relativistic quantum mechanics, at the level of a text such as those of Schiff, Dirac, or Messiah. The book has five excellent appendixes on notation and conventions and quantum mechanics background material. I was delighted to find the notation and conventions for gamma matrices and the like to be quite conventional. Many readers may find, as I did, that the book is easier to read if these appendixes are studied first. For the somewhat limited audience for which it was intended, the book is highly recommended. A physicist who has never worked in this field would find it an excellent introduction. In addition to being very complete in coverage, the book gives approximately 1100 references to original papers.

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About the Reviewer: Tom Pinkston is currently professor of physics and chairman of the Department of Physics at Vanderbilt University, where he has been a member of the faculty since 1959. Following completion of his graduate studies at Catholic University of America in 1957, Dr. Pinkston was at the Naval Ordnance Laboratory and at Princeton University. His research has been in theoretical nuclear physics with interest in nuclear-shell model calculations and the effects of nuclear internal structure on cross sections for direct reactions. His present interests are in heavy-ion reactions.