experimental results to the particles of elementary particle physics is reviewed.

The experimental approach is made more difficult by the fact that the nucleons have spin. Thus the forces can depend upon the relative orientation of the spin of the two particles and upon their orientation with respect to the plane of scattering. In addition there is an isotopic spin dependence; i.e. speaking very roughly the forces between neutron and proton. A great variety of experiments are required. In addition to the usual single scattering experiments there are a number of double and triple scattering experiments in which, for example, the nucleon becomes polarized and is scattered with a consequent change in polarization which is analyzed by the third scatterer. The phenomenological potentials suffer from a similar degree of complication, their form being restricted only by invariance principle. These matters, the type of experiments needed, the types of potentials possible and finally the nature of the potentials which have been fitted to the experiment are recapitulated.

A particular result of some importance is the discovery that the long range part of the nucleon-nucleon interaction ($>1.4\ 10^{-3}$ cm) is a consequence of the possibility that the nucleons can interchange a single π meson. For shorter distances the interchange of two π mesons seems to be important while at still smaller distances the interchange of higher-mass boson systems seems to play a role. The calculation of the consequent potentials, an attempt to use a dispersion theoretic treatment instead of the usual Schröedinger equation, and finally the role of the heavy mesons form the second half of the book.

The author has labored in these vineyards for many years. Within the compass of this book he has managed to include some discussion of nearly all the topics (he does not discuss photodisintegration of the deuteron and other electromagnetic effects in any detail) which would be of interest to the theorist. The discussion, in such a small volume is, a fortiori, sometimes skimpy, and a certain level of sophistication on the part of the reader is presumed. It is a well written authoritative book but it is not for a beginner.

Herman Feshbach

Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

About the Reviewer: Herman Feshbach is Professor of Physics at Massachusetts Institute of Technology. He was a Guggenheim Fellow in 1954-55, Ford Foundation Fellow at CERN 1962-1963 and is a member of the American Physical Society.

Aqueous Reprocessing Chemistry for Irradiated Fuels. Proc. Symposium, Brussels, April 23-26, 1963. McGraw-Hill Book Company, New York, 471 pp., $8.00.

This book is an important contribution to the literature on processing nuclear fuels and is recommended for those interested in the nuclear fuel cycle. It contains 26 papers[a] and resumes of discussions from a symposium jointly sponsored by the European Nuclear Energy Agency and the Eurochemic Company in April 1963 at Brussels, Belgium. This symposium is the latest in a series of European conferences on fuel processing: Geneva 1955, Brussels 1957, and Geneva 1958. About 150 scientists from 15 countries participated. The papers are of high quality and in total present the current status of fuel processing in Europe, including research, development and production. Several survey papers included summaries of work in Europe, the U. S. and at other research and development centers. Papers presented at this type of symposium are particularly important since much of this information is not available otherwise or appears in small increments which are difficult to evaluate. Indeed, the discussions (recorded) following the papers and during the panel session are of particular interest since they represent the current thoughts of leaders in this field from 15 countries.

The objective of the symposium was to present the status of aqueous fuel processing in Europe. In addition, several excellent survey papers summarized world-wide developments in both aqueous and nonaqueous processing. Thus, the title of the symposium (Aqueous Processing) is a misnomer because three papers were given on nonaqueous (fluoride volatility) processing. Four invited papers were presented from the United States, three on solvent extraction with tributyl phosphate (TBP), amines or organophosphorous compounds, and one on economics. The latter, by F. L. Culler (Oak Ridge National Laboratory[b]), was the only formal paper at the symposium concerning the economics of fuel processing.

Areas of work covered included 1) the use of amines as a replacement for TBP in solvent extraction; 2) U(IV) as a reductant for Pu(IV); 3) fuel-processing status at Marcoule, France and at Windscale, United Kingdom, and proposed fuel-processing system at the Eurochemic plant, Mol,

[a] Eighteen papers in English and eight in French. English translations of French papers available as ORNL-tr-numbers 61, 62, 65, 73, 78, 91, and 207 and AEC-5811 from Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee.

[b] Oak Ridge National Laboratory, operated by Union Carbide Corporation under contract with USAEC.

Belgium; 4) new "head-end" techniques; and 5) the status of fluoride volatility processing in Belgium and France.

The record of the panel question-and-answer is of particular interest. Typical questions were: Is the processing of natural uranium fuels necessary? Will improved technology reduce costs? Are one-cycle processes practical? What is the role of volatility? What is the best fuel-processing method for breeder reactors? What is the effect of the size of a processing plant on costs? What is the importance of the transportation problem? Of course, opinions were divergent. It was apparent, for example, that transportation problems have not been well defined, partly because of conflicting (or lack of) regulations in various countries.

Raymond E. Blanco

Chemical Technology Division
Oak Ridge National Laboratory

About the Reviewer: Raymond E. Blanco is Chief of the Chemical Development Section of the Chemical Technology Division, Oak Ridge National Laboratory. Since 1944 he has been active in the fields of nuclear fuel processing, waste treatment and disposal, and radiochemical and isotopic separations techniques. He presented a survey paper, "Recent Developments in Solvent Extraction with Tributyl Phosphate," at the Belgium Symposium in 1963 and also papers on fuel processing at the Belgium Symposium in 1957 and at the Geneva Conference in 1958. He received a B.S. degree in Chemistry from North Dakota State University in 1941 and has done graduate work at Brooklyn Polytechnic Institute.

Handbook of Applied Instrumentation. Editor-in-Chief: Douglas M. Considine; Associate Editor: S. D. Ross. McGraw-Hill Book Company (July 1964). Approximately 1000 pages. $32.50.

This book is a problem. In the first place, it is a problem to review and, in the second place, it is a problem, at least for this reviewer, to justify its existence. The difficulty of reviewing a handbook of over 1000 pages probably does not need explanation but, of course, my doubts about the very existence of such a beautifully produced handbook does require some further commentary.

According to the publisher's description, the *Handbook of Applied Instrumentation* is a comprehensive work presenting 'how to' information on determining instrumentation needs; selecting specific measurement and control systems; designing instruments for minimum installation and maintenance costs; and engineering instruments into diverse and numerous systems. The handbook is said to cover virtually all the major industries and fields, and in this I concur. One can find words about control of jelly and jam-making and in the same volume read about nuclear reactor instrumentation; all this in a thousand page or so, representing the work of at least 70 men of good will and impressive technical background. But the crucial question is: Does the book do what it is supposed to do?—Does it provide 'how to' information? Well, let's see.

Take the section on aerospace vehicle instrumentation (every self-respecting book has to have some space flavor these days). We find the major sub-section entitled "Satellite and Space-Vehicle Instrumentation." It is five pages long. Of the five pages, at least half is occupied by impressive looking but quite uninformative line drawings of such things as the instrument case of a sun sensor taken from a particular manufacturer's catalog. Under the heading "Sun Sensors," we look for 'how to' information. What we find in total is the following: "Sun sensors are used in determining the direction to the sun and to provide the signals necessary to point either the vehicle or a seeker toward the sun. The sensor shown in Fig. 63 can sense over a hemisphere, and by itself it contains no moving parts." This is the end of the information on sun sensors.

Nor could one really expect it to be otherwise. In a day of almost bewildering technological variety, a book five times as thick as this one could not really provide the 'how to' information so heavily stressed as its purpose. One can go on prowling through the volume and find many examples of the general sort just given. For instance, there is a very pretty outline drawing of the control panel of a research-type reactor, including the operator's chair. Then there are quite complicated-looking relay circuits illustrating a section on dimensional measurement and control, but I doubt that anyone really concerned with the problem of how to "design instruments for minimum installation and maintenance costs" or "engineering instruments into diverse and numerous systems" would get much help from the eleven pages in this book on the subject. In fact, the section concludes with a very good piece of advice "maximum control over quality and cost in. . . the gaging equipment results from the systems approach in which the gage maker is responsible for designing, building, calibrating, installing, servicing, and repairing the gaging equipment." This statement, it seems to me, applies to many, many thousands of instrumental applications discussed. The level is too general or obsolescent for anyone who really knows the subject he is interested in, and too specific for the people who have to worry