theoretic probability is most helpful in those sections dealing with populations depending on a continuous parameter, but the reviewer can attest that even without such knowledge, while some of the proofs may be obscure, the main results seem quite intelligible. Indeed Dr. Harris often accompanies such results by non-rigorous arguments which would convince most physicists. His presentation is generally quite lucid and, for a mathematical work, relatively informal. Conjecture and speculation about unproved results is even included.

For any serious student of the stochastic theory of neutron multiplication, this book should be of great value.

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About the Reviewer: George Bell received his doctorate in theoretical physics at Cornell University in 1951. Since then he has been a staff member in the theoretical division of the Los Alamos Scientific Laboratory. In 1962-63 he was a lecturer on applied physics at Harvard.

Power Reactor Experiments. Proc. Symposium, Vienna, (October 23-27, 1961). International Publications, Inc., New York City. Vol. I, 402 pages, $6.00. Vol. II, 285 pages, $4.00.

The symposium that was held in Vienna in 1961, under the auspices of the International Atomic Energy Agency, included the 32 papers that are published with discussions in this two-volume set. Reviewing the set of papers must be done in the context of the time of the symposium, which was nearly three years ago. All of the reactor systems discussed were developmental in nature, ranging from conceptual design studies to operating experimental reactors such as SRE and the Dounreay fast reactor. If the number of papers presented represented the interests of the industry, it would appear that the greatest activity was in the fields of high temperature gas cooled reactors, fast breeder reactors, and in nuclear superheat.

The collection of papers makes an interesting status report of advanced reactor development in 1961. Unfortunately, as in all collections of this type, the papers vary considerably in the effectiveness of their presentation. In many cases the discussion following the paper proves to be more enlightening than the paper itself.

Among the better papers on developmental reactors are those on Dragon, SRE, Dounreay, BORAX V and the ESADA program. The paper on the Molten Salt program at ORNL is of particular interest because it is the updating of a novel concept with a background of operating experience and discusses the design problems and the engineering details.

The most serious omission was that of the group of papers on Rapsodie, which were not included because of their length. The abstracts that were included are not very informative and the discussion that follows suffers because of the omission of the papers.

This reviewer would like to see experimenters give more details on their experiments and techniques. Under the pressure of space restrictions they tend to dismiss the experimental procedures in a paragraph or two and devote much of the space of the results. Often the results are strongly affected by the experimental method. This is particularly true in studies of fission product releases such as those presented by Brown Boveri/Krupp where a diagram of the loop would have been of considerable interest.

These proceedings are a worthwhile addition to any library collection of reactor engineering information.

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About the Reviewer: Arthur W. Flynn is with Ebasco Services, Inc., where he is Engineer-in-Charge for test loops and applied research and development for the 250 000 kWt Advanced Test Reactor. He has worked on a plant design using the freezing process for desalination, and has consulted and done engineering on various nuclear power projects.

Applications of Neutron Diffraction in Chemistry. By G. E. Bacon. Vol. 1 of Topic 11, "The Ideal Crystalline State," *The International Encyclopedia of Physical Chemistry and Chemical Physics.* Edited by E. A. Guggenheim, J. E. Mayer, and F. C. Tompkins. The Macmillan Company, New York, (1963). 141 pp; $6.50.

This small book contains a valuable review of the contributions which have been made by neutron-diffraction methods to the solution of chemical problems. The author, a principal contributor in the field, writes lucidly and authoritatively.

Chapter 1, "Principles and Methods," provides the absolute minimum discussion of the crystallography, neutron-scattering theory, and experimental techniques needed for appreciation of the

special advantages of neutron diffraction. Here, and throughout the rest of the book, appropriate comparisons are made between neutron and x-ray methods.

Chapters 2-5, comprising slightly more than half of the book, show how the facility of neutron diffraction for determining the parameters of light atoms, especially hydrogen atoms, in the presence of heavy atoms has been exploited. The chapter headings are: "Hydrogen Bonds in Inorganic Compounds"; "Hydrogen Atoms in Organic Compounds and Determinations of Molecular Structure"; "Heavy Element Compounds of Carbon, Nitrogen, and Oxygen"; and "Metal Hydrides and Ammonium Compounds".

Chapter 6, "Compounds Which Include Neighboring Elements," discusses research in which differences of scattering amplitudes among elements with nearly the same atomic numbers have been used to study chemical ordering in alloys of the transition elements and in spinels.

Chapter 7, "Magnetic Materials: An Outline," is extremely brief, because the author regards this application "not primarily of chemical interest;" but it serves to outline the principal application of neutron diffraction in physics. It shows the use that has been made of magnetic scattering of neutrons to study the locations, orientations and magnitudes of the magnetic moments in ferro-, antiferro-, and ferrimagnetic materials.

"The Study of Liquids and Gases" is the title of Chapter 8. The isotropic character of the neutron-scattering amplitudes and the low-absorption coefficients of most materials for neutrons are stressed as advantages.

Generally, the relative degrees of emphasis on the various topics discussed seem appropriate. The very brief treatment of principles in Chapter 1 and in other sections where theory is discussed does appear inconsistent with the statement in the publisher's introduction that "particular importance has been given to the exposition of the fundamental bases of each topic and to the development of the theoretical aspects;" but it is more consistent with the statement in the author's own Preface that his "main aim is to describe the new knowledge which has been obtained." The decision to limit sharply discussion of the nature of crystal structure analysis has led to some oversimplification and lack of clarity. For example, the term "thermal motion ellipsoid" is used in the book without any explanation of its meaning. Again, the single paragraph devoted to the phase problem (p. 28) implies, incorrectly, that 'trial-and-error' methods of solution are the only ones available. The reviewer feels that the author has missed an opportunity to be helpfully informative by electing not to discuss the phase problem in more detail, particularly for neutron analysis when the approximate structure is not already known. Such a discussion would have relevance to the matter of the choice of subjects for study by neutron diffraction, specifically to the fact that nearly always one chooses crystals whose structures are already approximately or partly known from previous x-ray work.

Unfortunately, the author could not include the results of recent neutron analyses based on three-dimensional data. The book discusses only a single study of this type. To this reviewer's certain knowledge, twelve structures have been refined from three-dimensional data, and at least three sets of data have been collected for other structures. The development of automatic methods of data collection, predicted in the book, is now a fact, and one of the greatest significance for applications of neutron diffraction.

The author is in error when he states (p. 42) that there are hydrogen bonds in the crystal structure of lithium hydroxide. A typographical error results in the representation of two different quantities in Equation 1, 4, 1 by the same character.

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About the Reviewer: George M. Brown is in the neutron-diffraction group of the Oak Ridge National Laboratory's Chemistry Division. He was on the staff of the Chemistry Department of the University of Maryland from 1947 to 1959, when he moved to his present position. He has also been a visiting research fellow at the California Institute of Technology. His research interests are in the field of determination of crystal and molecular structures by x-ray and neutron-diffraction methods.

Advances in Nuclear Science and Technology, Vols. 1 and 2. Edited by Ernest J. Henley and Herbert Kouts. Academic Press. Volume 1 (1962) 355 pp. $12.00, Volume 2 (1964), 378 pp. $14.00.

The volumes are the first of an annual series, each volume containing several separate articles on selected fields of nuclear science and technology. The editors' stated objective is to provide 'authoritative, coherent, complete, and critical review articles covering every phase of the nuclear industry other than pure mathematics, theoretical physics, and radiation biology and medicine.'

Volume 1 contains seven articles. "Thermo-