work that would let him examine the technique, its cost, limitations, and the other factors needed to determine whether or not a potential application is really feasible.

The first part of the book, covering 7 chapters and 127 pages, provides some basic material on radioisotopes, their physiological effect, etc. There is nothing particularly unique in this section, as compared to similar sections in many other books already available. Part II of the book describes 261 applications. Since only 133 pages are used to describe these 261 applications, it is clear that most of the descriptions are very brief. The book has a number of illustrations of some interest to American readers, since they show European devices. Almost all of the instruments shown are, of course, from Phillips.

For some reason not understandable to this reviewer, the author has included 12 color illustrations of an individual who suffered a fatal radiation exposure at Los Alamos during a criticality accident. The pictures are under the heading, "Physiological Effects of Ionizing Radiation." As the author mentions, the pictures don't portray the effect of an accident from misuse of radioisotopes in an industrial application, and as far as I know there have been no fatal exposures from radioisotope applications. It seems to me that the pictures are frightening and completely inappropriate.

Jerome Kohl is Manager of Marketing for Oak Ridge Technical Enterprises Corporation, Oak Ridge, Tennessee. Prior to this position, he was Coordinator of Special Products at the General Atomic Division of General Dynamics Corporation, and for 11 years was Manager of Engineering and Development for the Western Division of Tracerlab. He is the senior author of the book, Radioisotope Applications Engineering, *by Kohl, Zentner, and Lukens, and is the contributor of the Section on Radioisotope Applications to the "Handbook of Applied Instrumentation." His BS is in chemical engineering from the California Institute of Technology.*

A FAST-MOVING TARGET IS MISSED

Title The Economics of Nuclear Power

Author J. A. Hasson

Publisher Longmans, Green and Co. Ltd., 1965

Pages *viii* + 160

Price $7.00

Reviewer Charles H. Keenan

We will try to be impartial in our review, even though Dr. Hasson lists Yankee as a BWR.

The Economics of Nuclear Power by J. A. Hasson is an intellectual approach to the development of methods for the analysis of the economics of nuclear power costs. The author presents a number of computer techniques for the analysis of nuclear power costs that could be useful in governmental planning. However, from the standpoint of an American reactor operator, the book appears to have little practical value.

The rapid progress of nuclear power techniques has bypassed most of the author's assumptions and unknown factors. For example, the author states "that future nuclear power costs can not be assessed with any degree of measurable probability," and then the author uses the Shippingport Plant figures of 56 mill/kWh as the basis of his calculations. This is rather unfair, since Shippingport was built to prove pressurized-water techniques and to train personnel. It never was intended to be an economic guide post. Today, January 1966 (rather than the author's information of 1962-1964), it is known that in the United States a 500 MW(e) station can be constructed that will generate power at a cost of 5 to 6 mill/kWh. It is also clear that the trend of nuclear power cost in the United States is definitely downward with the only unknown factor being the rate of the trend.

The author spends a great deal of time on the evaluation of government subsidies of nuclear power. Currently, with the amendmant of the Atomic Energy Act permitting private ownership in the United States and the apparent end of the AEC Light-Water Reactor Development Program, the United States nuclear power industry is more on its own. Decisions on the construction of nuclear plants are now based on economic factors only, and the individual utility analyzes these factors through the use of standard time-proven procedures.

As an indication of demonstrated reliability and generation, the Dresden Reactor had produced more than 5 BkWh by November 1965, the largest amount from any reactor in the world. The Yankee plant has generated over 5 BkWh at average costs of just under 10 mill/kWh and monthly costs as low as 6.97 mill/kWh.

Nuclear power is certainly a fast-moving target in the 1960's.

Charles H. Keenan is Vice President of the Yankee Atomic Electric Company. He has been associated with the New England Power Service Company in purchasing, loaned to MIT Radiation Laboratory for administration in Project Cadillac, and later was Assistant Executive Officer for the Committee on Project Research and Inventions at Princeton University. In 1949, he joined the Brookhaven National Laboratory Staff as Administrative Officer for the Cosmotron Project and later served as Purchasing Agent. In 1958, he returned to the utility business as Assistant Vice President of Yankee. He received an AB degree (1937) from the College of the Holy Cross.

PRESTIGE, PROFIT, OR PROFESSORIAL PREDILECTION?

Title A Textbook of Nuclear Physics

Author C. M. H. Smith

Publisher Pergamon Press, 1965

Pages *xiv* + 822

Price $15.00

Reviewer *David D. Clark*

Selecting a text for a course in nuclear physics might sound like a trivial operation. However, any teacher will tell you that it can be a discouraging chore, despite the large number of such texts on the market. It is rare for any one book to have all the desired qualities; the book with the right coverage of topics and at the right level is out of date or poorly organized, the beautifully written book is too specialized or too elementary, and so on. (I have a theorem that many a professor writes a text not for prestige or profit but simply to have a book that is just right for his course.) The appearance of each new text is therefore viewed with hopeful anticipation, and it is with regret that I must give my opinion that few professors will be likely to find the book under review to be the one they seek. I say this even in full recognition of the fact that the ultimate criterion of choice is professorial predilection.

The book covers a very broad range of topics. The first 200 pages cover x rays, electron diffraction, relativity, and quantum mechanics; the final 140 pages are on elementary particles and thermonuclear reactions in stars. The remainder of about 470 pages is devoted to nuclear physics per se, including two chapters on detectors and electronics and one on accelerators. The professor can choose which chapters to use, but inclusion of so many topics necessarily limits how much can be said on each one. For example, there are only about ten pages on the shell model and much fewer on the collective model.

The general level of the book is senior-graduate but includes both elementary and very advanced material. The student who really needs the introduction to quantum mechanics in Chapter 6 will have a hard time with the angular correlation formulas in Chapter 20. The treatment includes both theory and experiment in rather reasonable balance, and developments as recent as 1962 are discussed, but early historical developments receive rather more emphasis. There are extensive references to current journals, and detailed bibliographies are provided for each chapter. Exercises are given with each chapter, but they did not strike me as generally very good ones.

The writing is for the most part very clear, but the exposition suffers frequently from too greatly abbreviated treatment of a complex topic. In my opinion, this is the major drawback of the book as a text. The student will struggle, all too often in vain, to understand the topic on the basis of what the author is saying.

David D. Clark is Professor of Engineering Physics and Director of the Nuclear Reactor Laboratory at Cornell University. He received his AB and PhD in physics at Berkeley and was a research associate in high energy physics at Brookhaven National Laboratory before going to Cornell in 1953. He has been a guest scientist at times at Brookhaven, General Atomic, and the Euratom center in Ispra, Italy. He led the development of the Reactor Laboratory at Cornell and does his research in low energy physics and reactor physics.

INSPIRATIONAL GUIDE

Title Neutron Radiography

Author Harold Berger

Publisher American Elsevier Publishing Co. Inc. 1965

Pages *vi* + 146

Price $9.00

Reviewer L. F. Curtiss

This well-organized and well-printed little book contains much more information than its size would indicate. From the outset, Berger makes it clear that neutron radiography is not a substitute for x radiography but can achieve results unobtainable by the use of x or γ rays. Typical possibilities are the detection of hydrogenous material imbedded in heavy metal and the differentiation between such substances as carbon and boron. Neither result can be accomplished with any satisfaction by the use of x rays.

In a discussion of neutron sources suitable for neutron radiography, the author reveals that neutron sources especially adapted for this work do not exist. The investigator must modify his methods to accommodate the nature of the neutron beams available. Sources of high intensity are most desirable, which accounts for the slow development of the art. Thermal neutrons have been found preferable, in spite of the fact that thermal-neutron beams commonly contain considerable amounts of unwanted γ radiation. The strongest thermal-neutron beams are produced by nuclear reactors, and the most effective neutron radiographs have been made at reactors.

Radiography suggests photographic film, and most neutron radiography has been done with some type of x-ray film. However, such film by itself is not very sensitive to neutrons. Hence, an intensifying screen, called a converter by Berger, is introduced to form an image by radiation produced in the converter by the neutrons. Converters may be used in contact with the photographic film placed behind the test object directly in the neutron beam. A direct-exposure method of this type must be used if the converter emits prompt radiation on neutron capture but does not itself become radioactive. Examples mentioned are lithium, boron, cadmium, and gadolinium.

In the direct-exposure method, the photographic film also responds to the γ rays in the neutron beam. The γ-ray effect can be eliminated by a transfer method, in which no photographic film is used and a converter that does become radioactive is placed behind the test object. After a suitable exposure, the converter is removed from the neighborhood of the neutron beam and placed in contact with the film. The induced radioactivity then exposes the film in a pattern identical with that of neutrons emerging from the test object.

Considerable data, mostly in graphs, are given for the various converters that have been used. For the direct-exposure method, the relative photographic speed is given in comparison with a double cadmium screen arbitrarily rated 1.0. For the transfer method, graphs of relative speed versus converter thickness are plotted.

Nonphotographic detectors, such as scintillators and spark counters, which may be used in neutron radiography are described. Apparently further developments are required to make them routinely useful.