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any one book to have all the desired qualities; the book with the right coverage of topics and at the right level is out of date or poorly organized, the beautifully written book is too specialized or too elementary, and so on.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.

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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.

In an important chapter on methods recommended for thermal-neutron radiography, valuable guide lines for efficient procedures are presented. Choice of neutron sources, arrangement of components in the exposure assembly, and ways of securing best resolution are discussed. Comparison of direct- and transfer-exposure results shows that the direct method offers greater photographic speed and thus is often preferred.

Finally, the capabilities and limits of application of neutron radiography are examined critically. Penetrameter sensitivity may approach that obtained in x radiography. One problem encountered with neutrons, absent with x rays, is radiation induced in the test object by neutron capture, tending to obscure the image. The book contains many excellent reproductions of actual neutron radiographs that give the reader an opportunity to judge the results. Throughout, ample references to publications are included, conveniently arranged for easy access. The embryonic state in which neutron radiography exists at present is emphasized, so the book should prove an inspiration as well as a guide for persons entering this activity.

L. F. Curtiss was a National Research Council Fellow in physics in the Cavendish Laboratory at Cambridge University from 1922 to 1924. Returning to this country, he continued his fellowship for two years at the National Bureau of Standards and then accepted a position at the Bureau. His work there was concerned with radioactivity and neutron measurements. In 1946, he helped organize the Committee on Nuclear Science of the National Academy-Research Council and served as its chairman until his retirement in 1961. He is the author of Introduction to Neutron Physics *published by Van Nostrand in 1959. His PhD in physics (1922) is from Cornell University.*

MINING A RICH VEIN

Title The Impact of Science on Technology

Editor Aaron W. Warner, Dean Morse, and Alfred S. Eichner

Publisher Columbia University Press, 1965

Pages *vi* +221

Price $6.75

Reviewer Arthur F. Scott

To trace the social relations of science and technology is always a fascinating historical topic. Just as fascinating—if not more so—is the attempt by contributors to this volume to identify and delineate the important forces at play in our science-oriented society and their complex interactions.

The Impact of Science on Technology is a record of the second Columbia University Seminar on Technology and Social Change, which was attended by 68 participants. The core of the volume is the following set of papers:

"The Interaction of Science and Technology"—I. I. Rabi

"The Interaction of Science and Technology: Another View"—Harvey Brooks

"Government Education, and Civilian Technology"—Alvin M. Weinberg

"Advanced Technology and American Business: Friends or Foes"—Frederic de Hoffmann

"Science and the Civilian Technology"—J. Herbert Hollomon

"Technology and Social Change: A Congressman's View"—John Brademas

"Modern Science and Its Implications for the University"—Ralph S. Halford

The editors state that each paper was followed by a "lengthy and vigorous discussion," which the editors present in a form designed "to preserve the integrity of the dialogue" while at the same time eliminating "all repetitive or extraneous comments." The third component of the book comprises two brief essays: an "Introduction" by Christopher Wright, Executive Director, Columbia University Council for Atomic Age Studies, and a "Summation" by Aaron W. Warner, Chairman of the Seminar.

Since the speakers at the Seminar are persons who have had considerable experience in matters of policy relating to science and technology, the volume is a rich mine of keen observation and intuitive judgment. The broad scope of the Seminar can be indicated best by outlining the content of the "Summation" chapter that Professor Warner prepared with the purpose of restating "the substance of the discussion within a framework that hopefully will be more closely knit." Professor Warner's chapter is organized according to the following scheme:

Interaction Between Science and Technology
- Scientific advance as the basis for the new technology
- Scientists as innovators
- Factors conducive to technological innovation originating in science
- Science, technology, and education

Problems of Civilian Technology
- Civilian needs
- Introducing technology into backward sectors of the economy
- The importance of entrepreneurial skills

The Direction of Science and Technology
- The federal government and scientific priorities
- Industrial responsibility for the direction of science and technology
- The responsibility of scientists for social innovation

One cannot read this book without coming to the conclusion that the Columbia University Seminar on Technology and Social Change is performing an extremely valuable function in bringing about the probing and discussion of certain important and difficult problems of our contemporary society. The present volume will be of interest to all scientists, engineers, and business leaders who have concern for these problems.