BOOK REVIEWS

Selection of books for review is based on the editors' opinions regarding possible reader interest and on the availability of the book to the editors. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

Elements of Neutron Interaction Theory

Author	Anthony Foderaro
Publisher	The MIT Press (1971)
Pages	585
Price	$19.95
Reviewer	Rex Fluharty

The style of this book is direct and fluid, readily carrying the reader from simple point, two particle, classical neutron kinematics through quantum mechanical scattering to the generality of U and R matrix theory. The pedagogy is excellent, and a consistent and fairly complete theoretical framework for the description of neutron cross sections is provided for energies below 20 MeV. The first six chapters are devoted to development of the formalisms and the last to their application, including elastic scattering, inelastic scattering, radiative capture, charged particle emission, fission, and the effects of target structure and atomic motion. Several people actively engaged in cross-section evaluation for the generation of constants for neutron computations have stated their desire for reference copies.

Because of a diversity of backgrounds, the text fills a real need for many nuclear engineering students entering graduate school. Because of the depth and breadth of material covered, the student must be diligent and have good aptitude to assimilate the many new ideas. Background depth in physics and mathematics will assist materially in comprehending the material. Problems designed to illuminate the learning process are included.

Some indication of its completeness is shown by the classical treatment of square well and inverse radius potentials, by a survey of classical mechanics to provide the basis for establishing quantum mechanical equations, by a brief discussion of Clebsch-Gordon coefficients, by the discussion of the reciprocity theorem, etc. In this respect, it resembles a verbal outline of pertinent reactor cross-section physics. The outline is adequately supplemented by enough references to expand subjects of specific need and interest. If the book can be faulted, the area most probably open to attack would be the adequacy of the discussion of experimental cross-section data and the associated nuclear and atomic models, which are only covered in an introductory fashion. However, the text does provide background for reading the literature in these very extensive areas.

Because of the slack market for highly trained specialists in neutron cross sections, perhaps the course could be broadened to include higher energies (accelerator engineering), light charged particle cross sections (fusion), and gamma-ray cross sections. It is also unfortunate that the author chooses to define a cascade reaction as one emitting several heavy particles (neutrons, protons, alphas, etc.). This definition confuses the more usual usage of cascades in terms of the cascade chains of cosmic rays and high-energy particles. These high-energy cascade chains are directly correlated particles cascading inside a nucleus, as well as outside, as a direct reaction sequence of individual photon or nucleon knock-ons. Multiple particle emission can also result from evaporation processes where the correlation is weak (anticorrelated even because of competition), and to include them under the cascade definition blurs an otherwise sharper meaning.

Rex G. Fluharty (PhD, nuclear physics, Massachusetts Institute of Technology) worked during World War II at the MIT Radiation Lab on Modulator R&D, specializing in tracer research while working on his PhD. After moving to the MTR in Idaho (1952), he worked in reactor neutron beam spectroscopy and resonance cross sections until his recent move to Los Alamos. During the past ten years he has been extensively interested in pulsed neutron sources.