Book Review

Annual Review of Nuclear Science, Vol. 19, 1969. Edited by E. Segre, Annual Reviews, Inc. (1969). $8.50.

This volume keeps up the high standards established by the previous volumes of the same series. It contains 11 chapters concerning topics in nuclear techniques, experimental and theoretical nuclear and particle physics, and one article on radiation biology. There are no articles directly related to nuclear engineering in the present volume.

The two chapters, "Rapid Chemical Separations" by Herrman and Denschlag, and "Mass Separation for Nuclear Reaction Studies" by Klapisch, are, at least, of some interest for nuclear engineering. The first technique might help in the search for new nuclei, particularly for those far off the stability line. It might also help in the exciting search for bridges to possible islands of superheavy nuclei. Altogether, the number of new nuclei might be equal to the number of nuclei observed so far. The second technique is of interest, of course, for high-energy nuclear reactions in general, fissions and spallations in particular. Applications include the distribution of high-energy reaction products, new isotopes (again far from the stability line), and the problem of the scarcity in the universe of Li, Be, and B.

Six chapters deal with theoretical and experimental nuclear physics. Amado, on the "Three-Nucleon Problem" emphasizes the broad qualitative understanding reached. Quantitative understanding, I feel, will have to await a better knowledge of the two-nucleon interaction. Tamura, on "Coupled-Channel Approach to Nuclear Reactions," emphasizes its better status for high-energy reactions, because of the better knowledge of the relevant effective interaction. For low energy reactions he is, in my opinion, rightly critical of some past work, because of the lack of a really good microscopic foundation. Henley, on "Parity and Time—Reversal Invariance in Nuclear Physics," emphasizes that the small violations of parity invariance observed in electromagnetic transitions need further verification, and that no time-reversal violation has been found yet in nuclear reactions. While the discovery of parity non-invariance led to a great clarification of weak interaction in general, the discovery of the *CP* violation for the K_1^0 and K_2^0 systems remained an isolated phenomenon until now. Garvey, on "Nuclear Mass Relations," discusses the present state of the relations proposed for the energy differences between ground states of nuclei or between the levels of an isospin multiplet. The relations are presented in terms of mass differences, rather than masses, because of the present uncertainties in finite many-body nuclear calculations, due to the ambiguities in the choice of the nucleon-nucleon interaction. Nolen and Schiffer on "Coulomb Energies," after discussing past work, present a method for extracting Coulomb energies from experimental data, which is nearly model independent. Wu and Wilets present a comprehensive picture of what has been learned about "Muonic Atoms and Nuclear Structure," since the high-resolution Ge(Li) detector replaced the NaI spectrometer for the study of muonic x-ray spectra in 1964. Such an authoritative summary of today is timely, since tomorrow muon factories or "factorettes," with a hundred- or tenthousand-fold increase in muon intensity, are expected to lead to a new exciting chapter of muon physics.

Two chapters on particle physics cover in detail "Boson Resonances" by Butterworth and "Pion-Nucleon Interactions" by Moorhouse. The former is the longest (121 pp.) chapter in the book and together with the latter seems far away from nuclear physics. However, it is well to remember that bosons should mediate the nucleon-nucleon forces, though a comprehensive theory might be a music of the, hopefully not too far away, future.

The radiation-biological chapter by Bridges, on "Mutagenesis in Cellular and Subcellular Systems" emphasizes that mutations are hardly caused by direct action of radiation on genetic material. The initial damage might be contained in the DNA. Mutagenesis might imply recombination between two DNA molecules, but future experiments are needed to show this more directly. This whole topic is closely related to carcinogenesis and aging (implying mutation of somatic cells) and is a significant factor for mutations in humans due to environmental radiations and chemicals, and also in genetic engineering.

For nuclear scientists in general, nuclear engineers in particular, it would be welcome if the chapters could be bought individually, as is already possible for four other "Annual Reviews."

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