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Book Reviews

The Nuclear Properties of the Heavy Elements. By Earl K. Hyde, I. Perlman, and G. T. Seaborg. 3 volumes. Prentice-Hall, Inc., Englewood Cliffs, New Jersey (1964), Vol I, 407 pp., $15; Vol II, 1107 pp., $25; Vol III, 519 pp., $18.

In the preface to this unique set of volumes, the authors, with no discernible trace of self-consciousness, firmly place their work at the end of a parade of distinguished treatises that began with Rutherford's (1905) *Radioactivity* and included Marie Curie's *Traité de radioactivité*.

Even the 1930 edition of Rutherford's book, the one co-authored with Chadwick and Ellis, ran only 588 pages and cost something less than a pound sterling. Times, alack, have moved on, for here are well over 2000 pages with a total tab of $58 (US). Clearly such a work might easily become a recruit in the growing army of important-sounding technical publications that are normally dispatched by a note to one's library to buy and a note to one's self to browse, if one ever finds the time.

But I have something else to propose—for these volumes have been thoughtfully edited, each serves a quite distinct purpose, and there are many persons who could well use (and possibly afford) just one.

Volume I. *Systematics of Nuclear Structure and Radioactivity*, would appear to be tailormade for the shelf of any experimentalist working in nuclear physics. The insights the volume affords are not limited to the subject matter of the volume, i.e., nuclear physics above $Z = 82$. In addition, I would recommend it to any member of the American Nuclear Society who has not kept up with the evolution of modern nuclear models and who would like an eminently readable account with ample illustrations of how the models are actually used.

Nuclear models are not the only subject of Vol. I. Foreman and Seaborg's classic 1958 paper on the systematics of the heavy elements has been updated. Incidentally, the misleading term "nuclear thermodynamics" is no longer used to describe the double-entry book-keeping on nuclear masses that forms a basis for heavy-element systematics. There is also a fine chapter on alpha decay, as might be expected from the preeminence of the second author in this particular subject.

A minor disappointment for me was that Vol. I contains no reference to, let alone discussion of, the interesting (for theory) and important (for practice) problem of just how far one can go in synthesizing heavy elements. Since such prophecies are inevitably a product of and a test of any systematics, some discussion would properly seem to be a subject for Vol. I. Volume III broaches the matter in connection with predicted spontaneous fission half-lives, but the latter discussion gives the reader only the faintest feeling for the lively controversy the subject has provoked over the past years.

Volume II, *Detailed Radioactivity Properties*, seems destined for the shelf of the working nuclear chemist and every technical library, but probably for no one else. It is a monumental handbook of data and critical discussion of assignments and decay schemes for $81 < Z < 105$. The prose does not sparkle, needless to say, and often the volume becomes a "Table of the Isotopes" (such as appears periodically in *Reviews of Modern Physics*) that is written in narrative rather than tabular form.

Volume III, *Fission Phenomena*, has been in constant use by the fission physics fraternity ever since the first portion of it appeared in 1960 as a UCRL report. I heartily recommend it to anyone whose research activities include the contemplation of fission in almost any context. As a collection in one place of the disparate and bewildering array of experimental facts, it is a nonpareil—people in other fields should have it so good. This volume, incidentally, is by Hyde alone, whereas the other volumes are credited to all three authors.

Roughly half of Vol. III describes thermal neutron and spontaneous fission, while the rest is devoted to fission at medium (50 MeV) and high (up to many GeV) energies. The emphasis throughout is on experiment. Such emphasis is proper, of course, since the unhappy history of fission physics has been that experimental details are much easier to come by than theoretical insights. A relatively minor shortcoming of Vol. III has to do with the author's somewhat cavalier treatment of fission fragment energy loss. It is understandable that he would wish to emphasize fission physics to the near exclusion of the atomic physics inherent in the topic of energy loss. He mentions, however, only those theories of charged-particle energy loss that had been offered by 1953 and neglects the notable successes that Lindhard's unified range theory has had, particularly in describing the behavior of fission fragments near the ends of their tracks.

In summary, I believe that Hyde, Perlman, and Seaborg have provided an extremely valuable addition to the literature of nuclear chemistry. If the present authors are unable to deliver the lucid perspective that was possible a generation or so ago, if they concentrate more (for my taste) on what is than on what should be, perhaps the fault lies less with the authors than with the hugeness of the body of knowledge that now exists. But even if they did choose a subject that may have grown a bit too large for a single treatment, we can all be most grateful that there are still authors who want to take their places in Lord Rutherford's parade.

Robert Axtmann

Princeton University
Princeton, New Jersey

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About the Reviewer: Since 1959 Robert C. Axtmann has been Socony Mobil Professor of Nuclear Studies in Engineering and Chairman of the nuclear engineering program at Princeton University. Before going to Princeton, he was a senior research supervisor at DuPont's Savannah River Laboratory. He has recently returned from a sabbatical year as a Visiting Fellow of the Israel Atomic Energy Commission.