any way. The author states that for K_P and K_R to be nearly equal, the frequency-dependence must be very slight " . . . as a consequence of the strong frequency-dependence of $dB_\nu(T)/dt$ and $B_\nu(T)$, and the fact that in one case . . . K_ν occurs in the denominator of the (defining) integrand, while in the other case . . . it occurs in the numerator." This is all true except for the remarks concerning the frequency-dependence of $B_\nu(T)$ and $dB_\nu(T)/dT$ which is of almost no importance to the argument (its scale of variation is usually much slower than the scale of variation of the absorption coefficient). This can be demonstrated as follows: The theorem mentioned above is based on the Schwartz inequality; dropping the Planckian weighting functions entirely causes it to become almost trivial. One can state that

$$(\Delta x)^{-2} \left[\int_0^{\Delta x} (k)^{-1/2}(k)^{1/2}\, dx\right]^2$$

$$\leq \left[(\Delta x)^{-1} \int_0^{\Delta x} \frac{dx}{k}\right] \left[(\Delta x)^{-1} \int_0^{\Delta x} k\, dx\right].$$

Since the left-hand side is obviously just unity, one obtains $k_H \leq k_D$, where the harmonic average

$$k_H^{-1} \equiv (\Delta x)^{-1} \int_0^{\Delta x} dx/k$$

corresponds to the Rosseland mean without its weighting function, and the direct average

$$k_D \equiv (\Delta x)^{-1} \int_0^{\Delta x} k dx$$

corresponds to the Planck mean without its weighting function (or in either case, to means defined locally, i.e., for small regions of frequency over which $B_\nu(T)$ and $dB_\nu(T)/dT$ do not change appreciably). From this and the aforementioned difference in the scales of variation of $B_\nu(T)$ and K_ν, one sees that the frequency-dependence of the Planck function and its derivative does not have much effect on the relative values of K_P and K_R. It does, however, prevent them from ever being closer than five percent to equality *even when the absorption coefficient is constant.*

Chapter 9 is a brief and not very useful discussion of nonequilibrium radiation. [See the review of this book by R. Landshoff, *Phys. Today*, **19**, 81 (1966).] The last chapter is a considerably more useful and practical discussion of the conditions required for the existence of local thermodynamic equilibrium. The overly formal tone of some of the previous chapters is not evident here.

The Appendixes appear to be excellent; I have no quarrel with them whatsoever in the light of what one considers an appendix should be. As Dr. Sampson surmised in his preface, some readers will find the Appendixes more useful than the book. They would, for example, provide a sound starting point for the answering of the questions and filling in of the omissions I have noted above.

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REFRESHING REMINDER

Title Beta Decay

Authors C. S. Wu and S. A. Moszkowski

Publisher John Wiley & Sons, Inc., 1966

Pages xiv + 393

Price $16.00

Reviewer Theodore B. Novey

This combination of authors who are well known for the clarity of their experimental and theoretical work has provided a very clear, concise, and valuable contribution to the literature on the weak interactions. As the reviewer has lived through a number of the recent historical stages in beta decay and the weak interactions, it is very fascinating to see the book put together with an emphasis on the historical development simultaneously blending in a large amount of useful reference data.

The book begins with a historical summary giving an insight into the strands of research which branched out and were picked up at various points of time with a series of startling discoveries, and which have brought our knowledge of the weak interactions to its present-day state. A quite comprehensive review of the early theory and development of measurements in beta decay follows, including beta-ray spectra, beta-gamma angular correlation, and all of the various other topics in nuclear spectroscopy which have been active for many years. The exciting experiments of 1957 and subsequent years on parity nonconservation are described, and a very clear summary is given of each of the major experiments of that period. Each experiment is discussed in sufficient detail so that one gets a clear picture of what was done and why.

There follow sections on electron capture, double beta decay, low-energy neutrino and antineutrino physics, leptonic decay of muons, pions, and strange particles. The transition and the interchange of people and ideas and experiments between low energy and high energy physics is made with no difficulty. It is refreshing to be reminded that in this field the barriers between high- and low-energy physics have not been very obvious and that experiments have been done in a way which has brought new developments from both fields. The book ends with some of the recent developments of the treatment of the weak interactions under the conserved vector current hypothesis, the experiments made in the expectation (so far unfulfilled) of discovering the intermediate vector boson, and the high-energy physics experiments leading to the discovery of the existence of two neutrinos, and an indication of the paths which may next be explored.

The main section of the book is followed by a very excellent set of appendixes which will serve as a very useful reference for both novices and specialists in the field. The appendixes summarize relativistic and nonrelativistic transformations involved in beta-decay theory, the Dirac equations, some simple derivations for allowed transitions, calculation of matrix elements based on a single particle model, beta decay of polarized nuclei, and muon decay.

The authors have provided a very excellent summary and review for those interested in the weak interactions; it is reading to be well recommended.

Theodore B. Novey is a Senior Physicist in the High Energy Physics Division of Argonne National Laboratory. He was a member of the Manhattan Project (1942-1946) at the University of Chicago and Oak Ridge, an NSF Postdoctoral fellow to the Institute of Physics, Swiss Federal Institute of Technology in Zurich (1952-53), and a Guggenheim fellow to CERN (1961-62). His PhD is in Physical Chemistry, from the University of Chicago (1948).

THORIUM UTILIZATION

Title Utilization of Thorium in Power Reactors

Publisher International Atomic Energy Agency, 1966

Pages iv + 376

Price $8.00

Reviewer J. H. Kittel

This book contains the Proceedings of a Panel on the Utilization of Thorium in Power Reactors. The panel was convened by the International Atomic Energy Agency in June 1966, in Vienna. The Proceedings consist of 23 summary papers and a section entitled "Summary Report and Recommendations." The summary papers include contributions from Australia, Brazil, Canada, France, Germany, India, Italy, Japan, the Netherlands, Sweden, the UAR, the USA, and the USSR. As might be expected, the subject matter of the papers varied according to the interests of the countries represented. These interests range from extensive effort to assess thorium ore reserves, to detailed studies of both thermal and fast converter-breeder fuel cycles.

The principal US effort on thorium utilization is at ORNL. This is reflected by the fact that the six US papers given at the Conference were prepared by ORNL authors. The US papers provide a comprehensive survey of developments in thorium technology at Oak Ridge, and also include discussions of several thorium converter reactor designs. On the other hand, relatively little information appears in the US papers regarding advancements in thorium technology at sites other than ORNL. Also, this reviewer could find no discussion of mixed fuel cycles, or mention of US studies on the use of thorium in large fast reactors to maintain negative sodium void coefficients.

The "Summary Report" that appears at the beginning of the book is an excellent review of the present state of development of thorium utilization in power reactors. This section should be read by all who are interested in learning where and how thorium is being introduced into the world's power reactor economy.

J. Howard Kittel is a Senior Metallurgical Engineer at Argonne National Laboratory. For the past nine years he has been Leader of the Engineering Irradiation Group in the Metallurgy Division at Argonne. His principle involvement is in the development of materials for fast breeder reactors. Prior to joining Argonne in 1947, he was at the Lewis Research Laboratory in Cleveland in the High Temperature Materials Section. He received his BS degree in Metallurgical Engineering from Washington State University in 1943.

AN ORGANIZED, INTELLIGENT APPROACH

Title Radioactivity and Human Diet

Editor R. Scott Russell

Publisher Pergamon Press, 1966

Pages xi + 552

Price $15.00

Reviewer Stanton H. Cohn

It has become commonplace to state that the problem of the radioactive hazard currently facing mankind is new only with respect to degree, inasmuch as man has always existed in a radioactive environment. This point of view fails to emphasize that man's awareness of this aspect of his environment is only recent, and further, that concomitant with this awakening interest there is a significant potential increase in the amount of radioactivity in the environment. While current production and testing of weapons utilizing radioactive materials have added small amounts of activity to the total quantity of radiation in the earth and its atmosphere, the prospect of harnessing energy from radioactive sources for fulfilling the power requirements of future generations points to the prospect of a manyfold increase in the concentration of radioactivity about us in the near future.

Radioactivity in the environment can affect man in three ways: radiation from external sources can penetrate the body; radioactive material can be inhaled; or it can be ingested where it subjects the body to chronic radiation until eliminated. Of the three, ingestion of radioactively contaminated food represents the greatest potential radiation hazard in respect to worldwide fallout.

Radioactivity and Human Diet deals with assessing the hazard to man resulting from current levels of radioactive fallout in our environment. Specifically, the data on the transport and movement of radionuclides from the atmosphere to soil and up through plants to animals and finally to man are reviewed. Each phase of the movement of the major radionuclides through the terrestrial food chain and aquatic food chain is considered separately. While much of this material has been presented in the report of the UN Scientific Committee and reports of National committees both in the United States and the United Kingdom, this book represents an attempt to collect all the pertinent background data under one cover.

The primary emphasis of the book is on quantifying the incorporation of ^{90}Sr, ^{131}I, and ^{137}Cs into food and their subsequent uptake by man. Strontium-90 is the fission product of greatest potential hazard to man, followed by the iodine radioisotopes and ^{137}Cs. While emphasis is placed on presenting existing data on all