that has been shown. The account is in a way an incidental history of the development of laboratory skills, exemplified in the progressively increasing specificity of the experiments. The latter have been notoriously difficult, for sundry reasons: the measurements of the upper end of the tritium spectrum were difficult because of the low energy of the particles and the fact that they vanish in intensity in the region of interest, and yet they have told us that the rest mass is less than a thousandth of that of an electron; the experiments on nuclear recoil from electron capture have been difficult because of the low energy of the recoils, with the consequence that "vacuum" sources have to be used, and yet they have been forced to such detail as a revelation of the recoil line shapes; the experiments on beta particle-recoil nucleus angular correlations have been difficult for similar reasons, and yet they have informed us about the nature of the basic interactions; the experiments on double beta decay have been difficult because of the tantalizing infrequency of the events; the radiochemical experiments have demanded the application of the finest of technique, sometimes almost on a chemical engineering scale; and (most of all) the experiments on the detection of the free neutrino have been difficult because they demanded the measurement of interaction cross sections about 10^{12} times smaller than those that had previously been considered small. It is therefore fitting that the emphasis be experimental, as it is also fitting that the story be told by one who has contributed substantially to it.

A summarizing account such as Dr. Allen's gives the reader the impression that, at the age of twenty-five years, the neutrino has reached its majority. A new phase of the research is now to be entered, less exploratory and more mature. One wonders at the conclusion of Dr. Allen's book: what is next? There are one or two nails yet to be driven into the lid of the packing box, such as the time-reversal experiment in neutron decay (now in progress at Chalk River and the Argonne National Laboratory), but beyond that one can see only vaguely. That terrestrial neutrino physics is possible from an experimental standpoint has been demonstrated, although at present it is difficult, slow, and costly. One can see a need for the measurement of interaction cross sections, but perhaps the more interesting questions relate to the role of neutrinos in cosmology. Challenges still exist, both theoretical and experimental, and Dr. Allen's absorbing account of past accomplishment makes one feel confident that scientific ingenuity will rise to meet them.

Corpuscles and Radiation in Matter II. Vol. 34 of Handbuch der Physik. Edited by S. Flügge. 316 pp. Springer-Verlag, Berlin, Germany, 1958. DM 78.00 (subscription price DM 62.40). *Reviewed by L. Marton, National Bureau of Standards.*

The numbering of the volumes of the new encyclopedia of physics is somewhat confusing. Volume 33 is entitled *Optics of Corpuscles,* Volume 34 is called *Corpuscles and Radiation in Matter II.* The number II implies there is somewhere a number I, but I haven't seen any evidence of it.

However, this volume will have to be judged on its own merits. It consists of six chapters. The first chapter, written by R. Kollath, is entitled "Passage of Slow Electrons and Ions through Gases". The 50 pages of this chapter contain a summary of what is known about single collisions in a field-free space. Other topics which might have been considered under this title are discussed elsewhere. Impact phenomena in accelerating fields are treated in Volume 21, whereas excitation, ionization, and similar phenomena are part of Volume 36. The present treatment is, therefore, limited to the measurement of total cross sections for the elastic scattering of slow electrons and of ions as well as the scattering and charge exchange of slow ions.

The coverage of the material gives the impression of a more or less abandoned field of physics. Just for the fun of it, I made a histogram of the references given in this paper and found that the center of gravity is on 1930. This center of gravity is so marked that, for instance, all the references (books and papers) for the post-war period are less than two-thirds of the references given for the single year 1930. I don't believe I am mistaken in stating that the post-war work in this branch of physics is considerably more than the few papers quoted in the text. Thus I am forced to conclude that the presentation, with its emphasis on very early papers, is somewhat misleading.

The second chapter is by R. D. Birkhoff. It is entitled "The Passage of Fast Electrons through Matter". The first section of this chapter considers free electron collisions where only a small amount of energy is transferred. In the next section the theory of stopping power is reviewed and a brief discussion of the Cerenkov effect is given. This section is followed by one entitled "Collisions with the Conduction Electron Plasma". This is essentially a review of the theory and of experiments of characteristic energy losses (called discrete losses by Dr. Birkhoff). The presentation reflects the point of view of the earlier version of the collective oscillation theory of the free electron gas and doesn't consider later developments where effects of nonconduction electrons can be quite important or even predominate. This section is followed with the one on the "Distribution of Energy Losses—Straggling". This is essentially a more complete study of the average rate of energy losses which was first discussed in an earlier chapter. There is also a discussion of the effect which nuclear scattering has on the shape of the distribution. In the following section the deflection caused by single scattering and multiple scattering by nuclei is considered. Ample tabular material illustrates this chapter. The last part of the Birkhoff chapter is devoted to total-range considerations. The energy distribution of electron flux is calculated for an infinitely thick absorber.

The next contribution by Lenart Simons is on "Positronium". In 23 pages he discusses the formation, sta-

bility, annihilation, and the identification of positronium in gases, as well as the fine structure and the Zeeman effect in positronium. He also considers the formation of positronium in liquids and solids. The treatment gives preponderance to the experimental viewpoint although the theory is not neglected.

Another short chapter is devoted to x-ray production by heavy charged particles written by E. Merzbacher and H. W. Lewis. Most of this chapter is devoted to consideration of inner-shell ionization.

Ward Whaling has written a very very short contribution on the energy loss of charged particles in matter. After three pages of introduction, most of the contribution consists of tabular material.

The last contribution to this volume is by Robley D. Evans and gives a very fine and thorough discussion of the Compton Effect. It starts with a historical presentation of the discovery and of early developments. This introduction is followed by a very good discussion of the conservation laws and energy and angle relationships. Two sections are devoted to Klein-Nishina cross sections. The first of these is for polarized radiation, the second for unpolarized radiation. A well-documented section is devoted to Compton attenuation coefficients followed by a short treatment of Compton absorption coefficients. The last two sections are devoted to Compton scattering by bound electrons and by magnetically oriented electrons. This whole chapter is very up to date and an exhaustive presentation of this fascinating subject.

In the introduction of this review, I considered the organization of material in the various volumes. Now we consider the organization of the material in this volume. Individually very good chapters constitute this particular volume, but their grouping them together doesn't seem to me particularly fortunate. It looks almost as if the editor in chief had difficulties in assigning these chapters to other volumes and therefore he decided to put them together in a volume called *Corpuscles and Radiation in Matter II*. This is, of course, not very important from the viewpoint of library use of the book. From the point of view of the individual buyer, who has to decide which volume he wishes to acquire for his private library, it may be very important to know how closely knit are the contents. In this particular case, the subject choice is so wide that an individual buyer might not make use of a major fraction of the contents of the book.

The Russian Literature of Satellites, Part I. 181 pp. (State Technical & Theoretical Press, Moscow, 1957) Translated by International Physical Index, Inc., New York, 1958. Paperbound $10.00. *Reviewed by S. F. Singer, University of Maryland.*

This volume contains six translated papers from *Progress in Physical Science*, Vol. 63 (*Uspekhi Fizicheskikh Nauk*) published by the USSR Academy of Sciences. The issue released in September 1957 is devoted to a series of special papers on the subject of