BOOK REVIEWS

Meson Physics. By ROBERT E. MARSHAK, University of Rochester. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 1952. viii + 378 pp. 16.5 × 23.5 cm. Price, $7.50.

Even those with casual acquaintanceship with progress in high energy physics are aware that there has been a bewildering succession of new particles in the past few years. These particles grouped collectively as "heavy mesons" have masses intermediate between those of π mesons and protons, while the V-particles, which may be in a special class, exceed the proton in mass. The sparsity of events in which such particles have been observed leaves a considerable amount to be known of their properties, but it is probable that the large multi-billion electron volt accelerators will remedy this deficiency. In addition, the techniques for examining such particles have been developed as a result of the intensive work on lighter mesons over the past half decade. Indeed the stage seems set for exciting events.

The next decade may well witness some entirely new concepts of the structure of matter, for it surely seems that something new is required to explain the multiplicity of "fundamental particles." In this development, the considerable body of knowledge now characterizing the light (π and μ) mesons will probably assume the distinction of being the classical work. It is with these light mesons that "Meson Physics" by R. E. Marshak is principally concerned.

The author has further restricted himself to real meson processes in contrast to theories such as those attempting to construct a picture of nuclear forces based on virtual meson transitions. Among the subjects discussed are the conditions for creating mesons, their masses, decay properties, interaction with nuclei and their intrinsic quantum mechanical properties.

The reader who has not followed this field closely may be surprised at the wealth of cohesive experimental information describing the properties of real mesons. While the book is concerned principally with the theoretical significance of these data it also serves the useful function of organizing the information for the experimentalist. References to much of the original literature accompany the text.

For complete digestion of the material in this book the reader should have some familiarity with quantum mechanics and the concepts of field theory. Nevertheless, the author has included qualitative descriptions of much of the subject matter. In addition, such experiments as those measuring meson masses and yields should be intelligible to those who will not get the full significance of the theory covering the interactions responsible for meson formation.

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Chemical Constitution—An Introduction to the Theory of the Chemical Bond. By DR. J. A. A. KETELAAR, Professor of Physical Chemistry in the University of Amsterdam. Elsevier Publishing Company, 402 Lovett Boulevard, Houston, Texas. 1953. viii + 398 pp. 16 × 23 cm. Price, $6.50.

"Chemical Constitution" presents a blend of theoretical and descriptive chemistry with many quantum mechanical and thermodynamic explanations. The subject matter is by no means restricted to a small set of topics, yet remarkably enough it was evidently not ever necessary for the author to stray far away from material he knows at first hand. The difficult matter about questionable approximations is handled with good sense in the end, though sometimes one feels in the course of reading a particular section that the author attributes more magic to crude quantum mechanical models than is sensible.

The book is divided into five chapters. In the first the periodic table is described on the basis of the building-up principle. The succeeding four chapters contain theoretical introductory material followed by applications in the divisions: ionic, atomic (covalent), metallic and Van der Waals bonding. The atomic bond chapter is perhaps too detailed, but many of the topics are after all major research interests of the author. This chapter has besides a "quantum mechanics for the layman" introduction which the reader will understand if he already knows the subject but which otherwise may be incomprehensible. The chapters on ionic and Van der Waals bonding are shorter but well organized to include reports of pertinent contemporary research. The metallic bonding chapter does not quite succeed in the attempt to make lucid and apply Brillouin Zone theory. Nevertheless the reader is reminded of a variety of topics in metal chemistry which are often neglected in a chemist's training in the United States. In fact, one of the strong points of the book is the emphasis given subjects perhaps too frequently neglected elsewhere. The subject of ionic bonding as explained by simple electrostatic considerations and the many applications comes to mind as another example.

The translation is certainly not expert, and, in addition, many errors have survived the proof-reading. With regard to possible users, it is believed the book would be particularly suitable as a summary and review in preparation for doctoral examinations; but the book would not be suitable as an introductory text, unless accompanied by much explanation. In spite of this criticism the fact is that there are a great many splendid passages written obviously with a grasp of the subject and a scientific maturity of a very high order. As an example, in commenting on some over extensions of the simple electrostatic picture in the chapter on ionic bonding the author states, "The agreement between theory and experiment may then only be put forward as a complete confirmation of the theory if it can be shown that other theories would lead to an essentially different result."

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Table of Dielectric Constants and Electric Dipole Moments of Substances in the Gaseous State. National Bureau of Standards Circular 537. By ARTHUR A. MARYOTT AND FLOYD BUCKLEY. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 1953. ii + 29 pp. 20 × 26 cm. Price, $0.20.

The number of dipole moments measured in the gaseous state is small in comparison to the number of those which have been measured in solution. Since, however, the gas values are the only ones which are independent of the molecular environment, an authoritative compilation of them is most welcome. This table of dipole moments is preceded by a brief table summarizing the more reliable dielectric constant values for seven gases which are recommended for reference purposes. Other dielectric constants may be calculated from the data given in the table of dipole moments, which, in addition to the moment values, gives the molar refraction and the total induced polarization, when it can be calculated from the variation of the total polarization with temperature. The authors have performed the arduous task of recalculating dipole moment values obtained from measurements of dielectric constant in order to put the work of different investigators on a more comparable basis. With the exception of a few less dependable results, the values obtained by different investigators are listed for each substance. The apparent uncertainties in the data are given when possible, but the differences between the results of different investigators frequently exceed the sum of the apparent errors. In addition to the dipole moment values obtained from dielectric constant measurements, the table includes moment values obtained from Stark effect in microwave and radiofrequency spectroscopy, and from the electric Stern-Gerlach experiment. The authors of this table have performed a useful service well.

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