

particular group theory, the remarkable recent developments in the study of the fundamental symmetries of elementary particles would have been seriously retarded.

The volume under review is the first of a treatise written by Théo Kahan and several eminent collaborators which is devoted mainly to the group structure. It was originally written in French and published in 1960 by Dunod, of Paris, under the title *Théorie des Groupes en Physique Classique et Quantique*. The translation into English by H. Ingram is good. The main objectives of the treatise are, first, to provide an account of axiomatized mathematics and the theory of abstract groups directed specifically towards the theoretical physicist, and secondly, to investigate with considerable thoroughness the different applications of group theory to the various branches of physics.

The book is divided into seven parts. The first of these is entitled "Theory of Groups and Axiomatized Mathematics for the Use of Physicists" and was written by P. Cayllès and T. Kahan following the axiomatic method of the team of French mathematicians calling themselves Nicolas Bourbaki. The first part concludes with an appendix by G. Lochak on integration over the topological groups. The next part of the book is concerned with the "Inhomogeneous Lorentz Group" and was written by T. D. Newton. This is followed by a part on the "Theory of Abstract Groups", written by R. Gouarné. Inevitably, a certain degree of overlap with the contents of the first part of the book occurs here. Some repetition is, of course, quite helpful to the reader although it would have been advantageous if the authors had used the same notation. Parts IV and V, written by G. Rideau, deal with the "Theory of Representations" and the "Permutation Group", respectively. Then comes a part written by T. Kahan concerned with the "Theory of Groups and Axiomatics of Quantum Mechanics". It is quite short and develops the elements of quantum theory from five axioms, the Dirac approach being followed fairly closely and the connexion with group theory discussed. Lastly, there is a part on the "Group of Rotations", written by R. Nataf.

The general aim which motivated the preparation of this treatise is certainly a good one and, on the whole, the first volume has turned out very well, although it could have been written in a more unified manner by a single author. However, the translation of the first volume is very welcome particularly when taken together with the second volume, so far unpublished, which deals with the applications of group theory to the various branches of physics. B. L. MOISEWITSCH

SURFACE IMPACT

Atomic and Ionic Impact Phenomena on Metal Surfaces

By Manfred Kaminsky. (Struktur und Eigenschaften der Materie, Band 25.) Pp. xii + 402. (Berlin and New York: Springer-Verlag, 1965.) 58 D.M.

A MONOGRAPH on a large subject imposes rigid limits on an author. Dr. Kaminsky decided to restrict *Atomic and Ionic Impact Phenomena on Metal Surfaces* strictly to metal surfaces and even within this framework he had to be selective. He states plainly in the preface that his selection of topics reflects principally his own interests in the various activities in the field and is not intended to reflect their relative importance.

In five introductory chapters Dr. Kaminsky gives brief descriptions of the structure of metal surfaces, forces which can act on an atom or molecule impinging on the surface and the energetics of surface reactions. Each of these topics could easily become a subject of a separate monograph, and readers familiar with these fields will feel that perhaps less than justice has been done to their subjects. I was certainly disappointed to find no reference

to the work of Farnsworth, Landner and Morrison and others on the atomic structures of metal surfaces, but this was compensated by very full treatment given to some of the other topics.

The chapter on sputtering by ion bombardment is long and detailed and much information and data are also to be found in the chapters dealing with accommodation coefficients, surface ionization, ion scattering, ion neutralization and the kinetic emission of electrons by bombardment with charged and uncharged particles. There are briefer chapters which deal with the elastic collisions, formation and emission of negative ions and the de-excitation of metastable atoms and ions on metal surfaces.

There is a considerable degree of uniformity in presentation throughout the book. Each chapter starts with a clear physical picture of the phenomenon which is to be discussed and this is followed by the theoretical treatment, experimental methods and results. Whenever possible experimental data published by a large number of workers are collected into tables most convenient for easy reference and comparison. Chapters are divided under numerous sub-headings which are very useful when the reader is hunting for a specific information or reference; in consequence, however, the list of contents is difficult to read and looks monotonous. Printing main chapter titles in heavier type would help to relieve the monotony and make it easier for the reader to find his bearings.

The rate of growth of surface science is considerable and appears to be increasing. There are new graduates entering the field and older research workers established in other fields of science are developing interest in surfaces. Dr. Kaminsky's book satisfies, therefore, a real need in providing a very readable account of an important topic. The book should be of value to senior students and research workers. There are more than 800 references to papers, books and review articles published before 1963, including many classics published at the beginning of this century or earlier. J. ADAM

INTERPRETING ORGANIC SPECTRA

Interpretation of Organic Spectra

Edited by D. W. Mathieson. Pp. ix + 179. (London: Academic Press, Inc. (London), Ltd.; New York: Academic Press, Inc., 1965. Published in association with the Royal Institute of Chemistry.) 42s.

NUMEROUS text-books have been written on the interpretation of infra-red, nuclear magnetic resonance and mass spectra, in which group frequencies, chemical shifts and fragmentation patterns have been discussed and tabulated. With these to hand, the main hurdle to be faced by the novice spectroscopist is the interpretation of actual spectra.

In *Interpretation of Organic Spectra*, based on seminar sessions at one of the Summer Schools in Organic Chemistry held under the aegis of the Royal Institute of Chemistry, about ten spectra of each type are analysed in detail. For pedagogic reasons the amount of ancillary information regarding each sample is kept to a minimum, in order that both the strength and the limitations of each technique may be apparent. Additional infra-red and nuclear magnetic resonance spectra of unknown compounds are included as problems.

In each section the samples have been well chosen to show the capabilities of the particular technique, and the substances are obviously representative of those examined in a typical analytical laboratory. As such, a number of them contain impurities, which are usually indicated in the worked examples and may themselves provide useful experience. However, at least two of the unknown infra-red spectra include extraneous bands, which can only cause confusion. The novice is also liable to be confused by the three different formats used for the infra-