

All these authors are great experts in their respective and overlapping fields which require considerable familiarity with some highly non-trivial tools in functional analysis and generalized function theory. The lectures of Epstein, Hepp and Robinson are reasonably self-contained, whereas that of Michel requires knowledge of his older Istanbul course on group extension. Hepp's course has the strongest physical basis and can be strongly recommended as an exposition of the Haag-Ruelle scattering theory; by way of introduction non-relativistic scattering is treated in detail. There is good reason to think that the mathematics of these lecture courses will play an increasingly important part in all future physics and that it constitutes the best possible training for the younger theoreticians.

The second volume is much less coherent. There are two highly skilled introductory expositions, "Weak Interactions" and "Symmetries and Elementary Particles", by N. Cabibbo and F. Low respectively. A longish contribution by R. Cutkosky examines "Boot Strapping Models". This is an extremely readable account of a rather obscure subject, obscure because of the widely differing assumptions current in this work. A few of the other contributions have lost some topical interest, such as the review of SU(6) by B. W. Lee and the lectures by T. D. Lee on "Possible C-non-invariance in the Electromagnetic Interactions". Finally, there are lectures with strongly phenomenological flavour, by A. H. Rosenfeld, on "Mesons". This subject is in rapid flux and is constantly being reviewed again. It is of course unavoidable that some of the work presented at summer schools should be overtaken by events before the publication of the lectures. There remains enough first class material in these lectures to justify the issue in book form—that some of the proof reading is sloppy is regrettable.

There are paperback editions of each volume available at \$6.50. S. ZIENAU

SPECTRA AND SURFACES

Infrared Spectra of Adsorbed Species

By L. H. Little, with supplementary chapters by A. V. Kiselev and V. I. Lygin. Pp. xii + 428. (London: Academic Press, Inc. (London), Ltd.; New York: Academic Press, Inc., 1966.) 100s.; \$16.50.

THE study of the adsorption of molecules on surfaces is of technological importance in fields such as chemical catalysis, lubrication and adhesion. It is also a subject where scientific knowledge and understanding are still remarkably limited in relation to what is interesting import.

In many areas of chemistry much progress has been made during the past fifty years by the application of the diffraction (particularly X-ray diffraction) and spectroscopic methods of structure determination. The X-ray method depends mainly on the presence of large three-dimensional ordered arrays of molecules, and these are not to be found in monomolecular surface layers. Electron beams can usefully interact with layers a few atoms thick. The method of low energy electron diffraction (LEED) has thus recently made some useful contributions to surface studies; but there is still uncertainty about the interpretation of the results obtained by this technique, and its application appears to be limited to the relatively few cases where very high vacua can be achieved. Applications of spectroscopic methods, which can provide valuable information about the structures and environment of molecules but do not require ordered systems, are therefore of even greater importance in this field than they are elsewhere in chemistry. Most of the spectroscopic methods have made contributions to the study of adsorption. The versatility of infra-red spectro-

scopy, and in particular its ability to obtain information from small samples in all the states of matter, has led to a particularly extensive use of this method on adsorbed molecules.

This book is the first to be published specifically on the spectroscopy of adsorbed molecules. It surveys the results of infra-red studies up to the time of its completion (late 1965).

The interpretation of infra-red spectra of chemisorbed molecules is not an easy matter, partly because some surface species may not find ready analogues among isolated chemical compounds, and partly because there is no guarantee that a particular spectrum does not contain contributions from more than one species. This means that neither the literature itself, nor this comprehensive review of it, makes easy reading for the non-spectroscopist. The author has therefore wisely commenced with an introductory chapter on general principles in which he has also cited some of the typical successes of the method; this should tempt the non-spectroscopic surface chemist to explore the remainder of the book for the significant results in his field of interest. The second chapter provides a clear account of the experimental techniques used in this type of work. The next six chapters are concerned with the spectra obtained from small molecules (carbon monoxide, nitric oxide, carbon dioxide, hydrogen and nitrogen) chemisorbed on a variety of surfaces; and from hydrocarbons and other organic molecules similarly adsorbed on metals or on oxides. The final brief chapter in this section discusses a number of general spectroscopic topics concerned with chemisorption and catalysis.

The second part of the book is concerned largely with infra-red spectra from physically adsorbed molecules on oxide surfaces (particularly with respect to interactions with surface hydroxyl groups) and on related adsorbents such as clay minerals and zeolites. For physical adsorption the interpretation of the spectra is more straightforward, for this leads only to perturbations of spectra familiar in other phases. Infra-red spectroscopy has contributed greatly and directly to an understanding of the nature of physical adsorption on such surfaces. A valuable feature of this part of the book consists of contributions from two Russian authors, Professor Kiselev and Dr Lygin, in the form of separate chapters or supplements to those written by Dr Little. Much of the pioneering spectroscopic work, particularly on physical adsorption, was carried out by the late Academician Terenin and his colleagues in Leningrad and in a number of cases this work is only available in Russian language journals. It is therefore particularly valuable that these and later substantial contributions have been authoritatively reviewed by the Russian co-authors.

In summary, this book provides a welcome, comprehensive and fairly critical review of the whole field of infra-red spectroscopic investigations of adsorbed molecules; the only notable omission noticed concerned a number of publications from the Italian school under Bonino and Fabbri. It is a very valuable reference book for specialists in this field, and should be of interest and use to many other surface chemists.

N. SHEPPARD

TOPOLOGICAL TEXT

Elementary Topology

A Combinatorial and Algebraic Approach. By Donald W. Blackett. (Academic Press Textbooks in Mathematics.) Pp. ix + 224. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1967.) 76s.

THIS is one of a number of attractive textbooks beginning to appear on the market which are designed to foster the undergraduate student's interest in algebraic (that is non-point-set) topology without making heavy demands on