

flow are given in Chapter 5. A short appendix is added on numerical methods. This volume is by no means easy to read, but it contains much of interest and value to the applied mathematician.

In conclusion, it may be said that these three volumes, though somewhat uneven in their degree of mathematical sophistication, achieve their purpose of providing a good overall picture of the present state of certain fields of study. They are well produced, and few misprints appear to have crept in, though some were noticed in the third volume.

A. T. PRICE

NEBULÆ, GALAXIES AND COSMOLOGY

Rival Theories of Cosmology

A Symposium and Discussion of Modern Theories of the Structure of the Universe. By Prof. H. Bondi, Dr. W. B. Bonnor, Dr. R. A. Lyttleton and Dr. G. J. Whitrow. Pp. xii + 61 + 12 plates. (London and New York: Oxford University Press, 1960.) 9s. 6d. net.

L'Exploration des Galaxies Voisines par les Méthodes

Optiques et Radio-Électriques

Par Dr. Gérard de Vaucouleurs. (Collection "Évolution des Sciences", No. 13.) Pp. 156 + 18 planches. (Paris: Masson et Cie., 1958.) 1,600 francs.

Le Nebulose e gli Universi-isole

Da Giorgio Abetti e Margherita Hack. (Biblioteca di Cultura Scientifica, No. 62.) Pp. x + 354. (Torino: Edizioni Scientifiche Einaudi, 1959.) 3,000 lire.

IN the autumn of 1959, the B.B.C. Third Programme broadcast a series of three talks on cosmology followed by a discussion at which the rival theories were debated. The short book *Rival Theories of Cosmology* is a direct outcome of these, the content being substantially the same as that of the talks.

Relativistic theories of the universe are discussed by W. Bonnor in the first chapter. This is followed by an account of the steady-state theory, the case being put by H. Bondi, one of the originators of the theory. Finally, R. Lyttleton explains his idea that the expansion of the distant galaxies may be due to the proton having a slightly greater numerical charge than the electron. The volume contains some good illustrations of galaxies, but the book would have been improved by the insertion of a short chapter on some of the observational aspects relevant to cosmology. The text does not presuppose any detailed knowledge of astronomy or cosmology, and within the limitations which are of necessity imposed by this restriction the ideas are put forward very clearly. The book is recommended to anyone who wishes to be introduced to some of the problems of cosmology.

L'Exploration des Galaxies Voisines has been written by an astronomer who has himself worked extensively in the field concerned. After a brief introduction to the nature and classification of galaxies, the problems of estimating extra-galactic distances are considered in some detail. Subsequent chapters deal with the luminosities, diameters, spectra, colours, rotation and masses of galaxies. In addition, there is a chapter devoted to the information about galaxies which has been obtained by means of radio astronomy. The text is well written in a logical sequence; the plentiful illustrations and diagrams are of a high standard. The author intends to write a

second volume in which more general topics such as clusters of galaxies will be treated. There is a dearth of up-to-date books about galaxies, and it is to be hoped that the second volume is of the same standard as this first one.

The work by G. Abetti and Margherita Hack discusses planetary nebulae, diffuse nebulae and interstellar absorption before describing some of the structural and kinematic properties of the galaxy. The last chapters are concerned with galaxies in general and the rival theories of cosmology. The scope of the book covers a wide range of subjects which are in some cases rather indirectly connected with each other, and the planning of the volume leaves much to be desired. Despite this criticism, some of the individual description is quite good. The book contains some useful material which is not often found in accounts written for the non-specialist.

J. B. ALEXANDER

VERSATILITY OF VACUUM

Progress in Vacuum Science and Technology

Edited by A. S. D. Barrett. Pp. iii + 160. (London and New York: Pergamon Press, 1959.) 70s.

IN recent years vacuum techniques have been introduced into a number of different industrial fields and this book will give the reader a good idea of some of them. The book contains six chapters, each dealing with a particular application and written by an expert in that field. There is also an introductory survey of education in vacuum practice at colleges in the United Kingdom. The contributions have been published as separate articles in the journal *Vacuum*.

Although the book-title includes "Science and Technology", the majority of the chapters are written from a technological rather than a scientific point of view, and are largely descriptive. That on problems in the valve industry does, however, touch on the basic theory more than most. The chapter on the gettering process in receiving valves includes a historical survey of developments leading to the modern type of barium getter. The gas clean-up performance of the latter is given, but the physics of the process is barely mentioned.

The applications of vacuum to metallurgy, fumigation and drying of medical and food products are in complete contrast to valve techniques. These chapters deal with the use of not-so-high vacua on a heavy engineering scale and make interesting and informative reading to those whose knowledge of vacuum is derived mainly from the standard textbooks. The final chapter, on molecular distillation, describes a number of vacuum stills, particularly those of Hickman, who has been largely responsible for recent developments in this field.

A book of this nature is unlikely to be exhaustive, and the most notable omissions are the recent work on ion-pumps and the production and use of ultra-high vacua, which get only passing mention. The book is well produced and fairly free from misprints. Most chapters have an adequate bibliography; that on molecular stills in particular. Thus this book provides a useful survey of the industrial applications of vacuum, in a form suitable for a busy technologist to read.

R. O. JENKINS