

interferometry to mention but a few. While the reader must look out for a few small inaccuracies (for example, the implication that the Sun is a variable star), one feels that this is a book which fills a gap in present popular literature for more advanced readers. There have been few attempts to bridge the gap between specialist works such as *Space Age Astronomy* and popular literature by professional astronomers. Chisnall and Fielder have made a worth-while attempt to build such a bridge.

D. McNALLY

A GUIDE TO COSMOLOGY

Fact and Theory in Cosmology

By Prof. G. C. McVittie. (A Survey of Astronomy, Vol. 3). Pp. 190. (London: Eyre and Spottiswoode (Publishers), Ltd., 1961.) 15s. net.

THIS book provides a very readable and sound introduction to a difficult subject. Although cosmology by its enigmatic character and generality has attracted a plethora of cranks and wishful thinkers in the past, it has also some of the greatest names in science, such as Newton, Mach, Einstein and Eddington, written on its cornerstones. Prof. McVittie, who has been active in modern cosmology since the early days when Hubble was making his dramatic discovery of the expanding universe, is a sure guide for the beginner to the difference between fact and fiction in this vast field.

In his lucid and entertaining style the author first provides a selective grounding in the astronomy of local space and time. The reader is then educated to a healthy scepticism of scientific formulæ which are established under local conditions and applied to the cosmological scene. He is shown that the challenging phenomena revealed by the great optical and radio telescopes out to distances of the order of thousands of millions of light years have no connected meaning without a cosmological theory.

Throughout the book, however, as if to warn against undisciplined flights of fancy, the point is driven home that it is the observational tests that have in their turn the last word on any such theory.

In Chapter 1 the author describes the general nature of the cosmological problem. In Chapter 2 he discusses very carefully how distance is estimated in the solar system and in the Galaxy, from there to nearby galaxies and hence to any observed galaxy in the universe. Chapter 3 introduces the systems of galaxies, clusters, and radio sources, and their distribution and motion are examined in terms of observables such as optical brightness, spectral red-shift, radio flux density and number counts. Chapter 4 contains a description of the most important cosmological theories. This is followed in Chapter 5 by an appraisal of the properties of such model universes in terms of the red-shift. How to match a model universe against all the available observational data is the subject of detailed discussion in Chapter 6. The steady-state model gets separate scrutiny in Chapter 7, and is here subjected to strong criticism of its logical basis and its ability to satisfy the observational requirements. The book ends with a summary and conclusion in Chapter 8. There is also an appendix giving the tabulated results of the latest red-shift and apparent brightness measurements up to the end of 1960. Throughout the book the mathematics used is such that any undergraduate physicist, say, would understand with ease. The references given are adequate generally although some important omissions were noted.

Highlights of the book are the valuable discussions of the red-shift apparent magnitude data and the number counts of radio sources. Here, however, the treatment invites criticism on three points. First, the author makes the assessment on somewhat slender evidence that any conceivable evolution in intrinsic brightness of galaxies

can be neglected. This is despite the fact that the periods involved are as long as 4,000 million years, and indeed Sandage has since shown that plausible evolution could significantly affect the interpretation of the red-shift apparent magnitude data. Secondly, he seems to place too much faith in an identification of the mean density of matter in the universe with that of Oort's estimated mean density of observed matter in the form of galaxies. Lastly, on the question of the number counts of radio sources the author again overlooks the possibility of significant evolution, this time in the intrinsic power of the sources.

However, these considerations are incidental in one's appreciation of the sterling qualities of a book that is of inestimable value to the student and necessary reading for the expert.

W. DAVIDSON

ILLUSTRATED OCEANOGRAPHY

Oceans

An Atlas-History of Man's Exploration of the Deep. General Editor: Dr. G. E. R. Deacon. Pp. 297. (London: Paul Hamlyn, 1962.) 50s.

THIS popular work on the sea consists of a scientific libretto set in colour as by a composer and requires review rather like an opera. The libretto is completely successful and opens with a history of the ocean from earliest times by T. F. Gaskell. It is of interest that a geophysicist should build his story around the concept of continental drift.

Edward Shackleton then tells the history of maritime exploration in terms of six explorers from the Greek, Pytheas, to Anderson, who reached the North Pole using inertial navigation in the atomic-powered submarine *Nautilus*. Present-day research on the submarine archaeology of the Mediterranean, revealing so much about maritime endeavour in the cradle of Western civilization, is then excitingly told by N. C. Flemming. Maurice Burton, in presenting marine biology, has had the most difficult task since so many good popular accounts have gone before. His script is wide-ranging and necessarily highly selective, but in his hands even the bare bones of taxonomy come alive. The whole book is forward-looking and specialists describe vividly the organization of marine research (G. E. R. Deacon), the floor of the sea (A. S. Laughton), currents (John Swallow), the power of the tides (K. F. Bowden) and the coasts (C. E. M. King). The direct writing in Ronald Currie's account of the future of the sea disguises a brilliant presentation of where the science of oceanography is going.

A final section on facts about the sea gives, in the manner of an illustrated pocket encyclopædia, an account of instruments, techniques and data to which reference has earlier been made.

But 60 per cent of the book consists of pictures and only 40 per cent of text. On each page the lay-out is pleasing; so is the tasteful display of colour. Undoubtedly the book will sell well, particularly around Christmas, but for readers of *Nature* the criterion must be: Do the illustrations readily and accurately support the text? In this, all too many fail. This is notably so of many of the shadow relief maps of properties of the world ocean on which great store is set. Thus, on the relief map of pelagic deposits (pp. 94-95) the tinting used for terrigenous deposits and radiolarian ooze, and again for red clay and pteropod ooze, differ so slightly that it is quite impossible to make out which of each pair is which. On all too many illustrations the lettering is far too small—about 6-point—and contrasts poorly with the tint on which it is overprinted. The courses of Nansen's Arctic voyages (p. 60) and the place-names of submerged cities and wrecks in the Mediterranean (p. 138) are set in grey on grey and are unreadable, as are the codings. I myself