reviews

Meeting the challenge of astronomy

Paul Davies

Black Holes, Quasars and the Universe. By H. L. Shipman. Pp. 309. (Houghton Mifflin: Boston, Massachusetts, 1976.) $12.95. Paperback edition available in UK (Houghton Mifflin : London, 1976.) £2.50.

THIS is an astronomy book written in the best Fred Hoyle tradition—informative without being boring, accurate without lacking excitement and comprehensible to a wide range of readership from the intelligent layman to the specialist. For the reader who wishes to actually learn some modern astronomy, as well as be entertained and intrigued, Dr Shipman's book is for them.

For some years modern topics like black holes and quasars have received only scant attention in the serious literature, and have been the subject of much sensationalistic, science-fiction-style speculation in popular books. The treatment presented here is hard-headed, down-to-earth and carefully factual. Nevertheless, this does not prevent the author from indulging his and our imagination in some of the *possible* far-reaching consequences of recent advances in theoretical and observational astronomy. But always Dr Shipman puts us back on the straight-and-narrow when the speculation becomes too divorced from the known facts. He continually draws a distinction between the model world of the theoriser, and the real world of telescopes and observations. Speculation is fun, and could be right—but remember it is only speculation.

Within this commendable framework, the author then proceeds to review all the latest exciting developments in astronomy and cosmology over the past decade or so. The text is crammed full of interesting facts, but the engaging style prevents the reader from tiring with an information overload. The book is divided into three sections. The first deals with black holes—both the underlying theory and the X-ray sources, which are observational contenders for real black holes. Dr Shipman emphasises how theory has far outstripped observation in this topic. At the end of this section a cautionary summary distinguishes the different levels of discussion presented—the strictly factual, the well-founded theory, and the wilder speculations. A clear distinction between them is urged on the reader.

Section II is devoted to quasars, a field in which observations are numerous and theoretical understanding minimal. Many technical details of modern astronomical procedures are clearly and simply explained. No discernable theoretical axe is ground by the author. The more bizarre explanations of quasar redshifts are carefully separated from the rest.

The final section deals with cosmology. The treatment is straightforward and up-to-date, although a little brief.

The presentation of the book is excellent. A preparatory section explains in simple language some of the elementary concepts needed for the rest of the book, including a fine discussion of the role of theoretical models and the way in which scientific progress takes place. A glossary and bibliography are also given.

The author's style is brilliant. Direct, simple, clear and informative. This is a no-nonsense book which meets the challenge of modern ideas without losing contact with reality. It is admirably suited to introductory astronomy courses, and can be easily read and enjoyed by science specialists and non-scientists alike. It is certainly one of the best science books I have read for a long time. □

Paul Davies is a lecturer in the Department of Mathematics at King's College, University of London, UK.

Galaxy Formation: A Personal View. By John Gribbin. Pp. viii+79. (Macmillan: London and Basingstoke, May 1976.) Hardcover £5.95; papercover £2.95.

ONE of the key observational principles in Astronomy is that which links lifetime with number of observable objects. A star, for example, spends a large fraction of its lifetime as a main sequence object, and a much shorter time as a protostar, so that we can observe relatively far fewer protostars at any epoch. An often-used piece of astronomical method is the use of statistics to overcome our inability to experiment, and above all to experiment in a controlled way. Theories of stellar evolution involving chains of nuclear processes with different probabilities are tested against the large number of available stellar spectra in which the end products of the reactions are exhibited. Stellar evolution theory is by now one of the most firmly based branches of Astrophysics.

The situation with galaxy evolution theory is far less developed. Partly this is because the formation phase, as with stars, is likely to be only a restricted fraction of the galaxy lifetime, so that protogalaxies would be inherently few. Partly it is because galaxies are distant and composite objects, whose structure and chemical composition are hard to determine finely. Above all it is, as John Gribbin has correctly stressed in his book, because galaxy formation and evolution are so closely bound to the macroscopic properties of the observable universe. For galaxies the lifetime-frequency link is useless as an observing tool until one has answered the question "Were all galaxies formed at a single epoch, or is galaxy formation continuous?"—or some more qualified version of the question. If at a single epoch, the key to understanding is to observe at distances currently not possible to reach—seeing the universe near to the origin of its current expansion phase, when pregalactic objects may have existed—whereas continuous creation of galaxies is hard to sustain either observationally or on cosmological theory.

John Gribbin has done a useful job of gathering into a short and readable space much of the current thinking about galaxy formation. He rejects the traditional view of galaxies forming by gravitational instability within gas clouds, because there seems to be no way of forming entities exclusively within the observed mass range. Ambartsumian has tried to overcome this problem by postulating that the fragmentation process is still going on, since clusters of galaxies may well not be gravitationally bound, and galaxies themselves are in states of central ac-