BOOK REVIEWS

The Physics-Astronomy Frontier: by Fred Hoyle and Jayant Narlikar (W. H. Freeman and Co., Sanfrancisco), 1980; 483 pages, Price: $19.95.

The exciting developments in modern astronomy over the last 2 or 3 decades have led inevitably to an almost explosive growth of books, many of them of an introductory nature, aimed at a large cross section of school and university students, not necessarily those majoring in Physics. Among the better books in this category the one entitled 'Astronomy and Cosmology —a Modern Course' (W. H. Freeman and Company, 1975) by Fred Hoyle, the renowned British astrophysicist, has been noteworthy because of its stress on the intimate relationship of astronomy to physics. Hoyle and Jayant Narlikar have now come up with this new introductory text (entitled 'The Physics-Astronomy Frontier') which is again laudable for its emphasis on the physics of astronomical phenomena. To call it an entirely new book would not however be accurate since nearly half of it has been reproduced from the earlier work with only minor changes—a fact that has regretably not been mentioned either by the authors or the publishers.

From the point of view of its contents, the most noticeable change from the earlier book is that the section dealing with the Planetary System has been dropped altogether and the section on Cosmology has been effectively rewritten. The new additions are mainly in millimetre, infrared and X-ray astronomies and in the area of black holes and cosmology. The ordering of the material has, however, undergone a drastic change. Instead of the more conventional approach of starting from the Solar system and moving outwards (with the basic physical principles introduced wherever necessary), the material has now been divided into three parts corresponding to the fundamental (electrical, nuclear and gravitational) interactions in physics. Each of these parts is devoted to the phenomena that fall under the scope of the corresponding interaction. The first part thus contains a basic treatment of electromagnetic radiation and stellar spectra and has chapters devoted to the wealth of information that has been obtained from observations in different regions — optical, radio, millimetre, infrared and X-ray — of the spectrum. The second part highlights the role played by the strong and weak interactions in atomic nuclei in the generation of energy in stellar interiors and the consequent evolution of stellar systems. A chapter on the measurement of astronomical distances (reproduced from the earlier book) has been somewhat awkwardly placed in this part (it would be hard to fit it anywhere in the scheme followed by the authors).

The last two fifths of the book, on the gravitational interaction, attempts to understand the large scale structure of the Universe. The chapter on black holes is particularly well written. The various observational tests of cosmological models are discussed in a chapter on the Big-Bang Universe. Although the most widely accepted interpretations of these tests are mentioned, a good deal of the discussion is devoted to questioning these interpretations, making them appear less sound than is perhaps the case. The last chapter, outlines the authors' alternative (and not universally accepted) interpretation of the expansion of the Universe in terms of particle masses varying with cosmic epoch in a nonexpanding Universe.

The style of writing is highly readable. Very little mathematics has been used. There are many interesting anecdotes and accounts of Hoyle's personal involvement with astronomical developments and controversies which indicate the wide range of problems in which he has made significant contributions. The format and presentation is of a high quality. There are numerous useful tables listing the chemical elements, the nearest and brightest stars, etc. The figures are generally quite well done though a few are unclear or likely to confuse. Figure 4.21, for instance, shows a beam of particles shot out from what appears to be a spiral galaxy to form the double radio lobes, while this phenomenon is known to occur almost exclusively for elliptical galaxies. Although there is a useful Glossary at the end, no references or supplementary reading lists are given. This is particularly unfortunate since the authors often stress their unconventional interpretations.

A notable drawback of the book is that the material in many chapters appears dated or the choice of topics covered seems somewhat arbitrary. To give just one or two examples from the chapter on radio astronomy, there is no mention of the observations of the nuclei of radio quasars by Very Long Baseline Interferometry which for many years are known to indicate the apparent expansion velocities far in excess of the velocity of light. The discovery of long narrow jet-like features connecting the outer lobes to the nuclei of many radio galaxies has also not been touched upon. Although the radio emission from galaxies is now routinely being mapped with high angular resolution using aperture synthesis interferometry, the only examples shown of double radio structure (figure 4.23) are taken from low resolution observations of the early sixties in which the radio lobes are only schematically represented by circles.

V. K. KAPAHI

T.I.F.R. Centre,
Indian Institute of Science Campus,
Bangalore 560 012.

Annual Review of Neuroscience: (Vol. 5) Eds. W. M. Cowan, Z. W. Hall and E. R. Kandel, (Annual Reviews Inc., Palo Alto, CA, USA), 1982, Pages: 392, Price: $25/-. USA $22.00.

This is a unique volume, unlike the ones of the previous years. In the present volume, in addition to ten usual review papers, there is a "special section" of contributions by five of the greatest of the contemporary neuroscientists "representing the various strands of neural science in order for them to describe the major influences on their work intended to highlight key developments rather than to cover systematically the broad panorama of neurosciences".

In the section of the usual reviews, A. Iggo has reviewed the details of structure of the mechanoreceptors of the skin of mammals and other vertebrates, and also briefly of the thermoreceptors and nociceptors. R. O. Brady has reviewed the inherited sphingolipidoses, the glycoproteinoses, mucolipidoses and ceroidlipofuscinoses. The polymorphism of cholinesterase and acetylcholinesterase has been reviewed by J. Massoulie and S. Bon. The usage of intracellular dialysis and perfusion techniques to study the controls of the electro-chemical gradients in nerve cells, oocytes, and other types of cells has been reviewed by P. G. Kostyuk. T. H. Bullock has reviewed upon the new class of receptors "electroreceptors", which are specialised detectors of electrical fields. The review of P. R. Burgess, F. J. Clark, J. Simon and J. Y. Wei provides how the joint receptors and the cutaneous receptors present around the joints are not much concerned in the conscious awareness of joint position, and how the muscle receptors are concerned in this signalling, and the review of P. B. C. Matthews has recapitulated as to how the classic contributions of Sherrington on "muscle sense" receptors are confirmed by the recent researchers. G. M. McKhann's review gives a comprehensive account of all aspects of the problem of multiple sclerosis. L. R. Squire's review on memory specifies that amnesia could result from damage to the mammallary bodies and the dorsomedial thalamic nucleus, or to the hippocampal formation together with amygdala. M. Ito has reviewed the role of flocculus in the vestibulo-ocular reflex.

The "special section" reviews are contributed by Eric Kandel (Preface: The Origins of Modern Neuroscience), Kenneth S. Cole (Squid Axon Membrane: Impedence Decrease to Voltage Clamp), John C. Eccles (The Synapse: From Electrical to Chemical Transmission), Rita Levi-Montalcini (Developmental Neurobiology and the Natural History of Nerve Growth Factor), David H. Hubel (Cortical Neurobiology: a Slanted Historical Perspective).

Kandel emphasizes that "the ultimate goal of neuroscience is to understand mentation: how the brain perceives and initiates action, how it learns and remembers". In the studies of the higher functions and of cerebral cortex how the application of cellular techniques have helped has been exemplified by Hubel. How the nerve cells are designed to signal messages and how they differentiate to produce their characteristic interconnections and intercommunication has been dealt by Cole, Eccles, and Levi-Montalcini. These personalised narrations provide glimpses into some of the great events in the origins and developments of the modern neurosciences. Hence, these should be read and re-read by those who work in any of the fields of neurosciences.

T. DESIRAJU

Department of Neurophysiology,
National Institute of Mental Health and
Neuro Sciences,
Bangalore.

Angular Momentum in Quantum Physics by L. C. Biedenharn and J. D. Louck (Vol. 8) of the series Encylopedia of Mathematics and its applications (Addison-Wesley Advanced Book Program, Reading, Massachusetts 01867, USA) 1982, pp. 716, Price $ 54.50.

This treatise on the theory and applications of Angular Momentum in Quantum Physics is a masterly work by L. C. Biedenharn and J. D. Louck, two well-known experts in the field. The book is divided into two parts, Part II consisting of the single lengthy chapter 7, all the three hundred pages of which are devoted entirely to applications ranging from the generally familiar theory of the Zeeman Effect to the highly instructive and exhaustive treatment of the Spectra of Spherical Top Molecules, through such diverse topics, as the theory of the Hydrogen specturm in relation to the four-dimensional rotation group SO (4), the Density Matrix Formalism in Quantum Mechanics and application to Nuclear Structure.

Part I of the book is an excellent presentation of the theory of Angular Momentum exhibiting in a natural manner its relation to the theory of the three-dimensional rotation group SO (3) and Spherical Foundations.

Special mention must be made of Chapter 4 dealing with the theory of turns as an alternative approach to rotations and its relationship to the multiplicative group of (real) unit quanternions on the one hand, and of Chapter 5 on the Boson Calculus applied to the Theory of Turns on the other. Both these chapters contain essential new material and the discussion of the Young tableaux, the Weyl and Gelfund patterns in relationship to the Boson calculus is especially illuminating.

The Foot Notes and Remarks contain much useful and interesting information and naturally form a harmonious whole with the core material. There is a wealth of references and an extremely useful appendix of Tables.

The book makes an instructive reading and the authors must be congratulated on achieving their aim of producing an encyclopediac work in which one not only finds what one is looking for but also a lot more information one had no idea existed.

In a work of this magnitude, it is not surprising that an error or two in proof-reading may have escaped notice, as for instance, the omission of a factor 1/2 on the right side of equation (2.26) on page 20, but otherwise the get-up of the book is excellent, containing a beautiful photograph of Eugene P. Wigner. It is most appropriate that this masterly work is dedicated to the *high priest of Group Theory in Physics.*

K. N. SRINIVASA RAO

Professor of Theoretical Physics (Retd.),
University of Mysore,
No. 22, 7th Main, Malleswaram,
Bangalore 560 003

Annual Review of Entomology, Volume 27, Editor: Thomas E. Mittler and associate Editors: Frank J. Radovsky and Vincent H. Resh (Annual Reviews Inc., 4139 EL Camino Way Palo Alto, California 94306 USA) 1982 pp viii + 503, price $ 22.00 in USA and elsewhere $25.50.

The Annual Review of Entomology, volume 27, 1982 is out. It contains eighteen authoritative review articles of interest in different fields of Entomology. All the articles are well written by eminent scientists in their respective specialisations. These articles cover various aspects of economic entomology, physiology, biology, etc. Apart from the author and subject indexes, it also contains well arranged cumulative indexes of contributing authors as well as of chapter titles of all the articles/reviews contained in volume more or less subjectwise. The articles that have been published in this "Review" are:

(1) Courtship and mating behaviour in spiders, (Michael H. Robinson), (2) Immune responses to arthropods and their products. (Stephen K. Wikel), (3) The rice brown planthopper: feeding physiology and host plant interactions, (Kazushige Soogawa), (4) Structure and function in tick cuticle, (R. H. Hackman), (5) Thermal responses in the evolutionary ecology of aquatic insects, (James V. Ward and Jack A. Stanford), (6) Biology of Mayflies, (John E. Brittain), (7) Chemical ecology and biochemistry of insect hydrocarbons, (Ralph W. Howard and Gary J. Blomquist), (8) Insect pests of potato, (Edward B. Radcliffe), (9) Maternal direction of oogenesis and early embryogenesis in insects, (Spencer J. Berry), (10) Mite pests of honey bees, (David De Jong, Roger A. Morse, and George C. Eickwort), (11) Recent advances in mode of action of insecticides, (Richard W. Beeman), (12) Rangeland entomology, (J. Gordon Watts, Ellis W. Huddleston, and John C. Owens), (13) Biology of new world bot flies :Cuterebridae, (E. P. Catts,) (14) Biochemistry of insect venoms, Justin O. Schmidt), (15) Effects of air pollutants on insect populations, (D. N. Alstad, G. F. Edmunds, Jr., and L. H. Weinstein), (16) Evolutionary ecology of astigmatid mites, (B. M. OConnor), (17) The role of pheromones, kairomones, and allomones in the host selection and colonization behaviour of bark beetles (David L. Wood), (18) Perspective on systems analysis in crop production and insect pest management, (Wayne M. Getz and Andrew P. Gutierrez).

Of all the titles listed above, the last article 'A Perspective on systems Analysis in Crop Production and Insect Pest Management, is most valuable and informative. Of the other articles some are of economic importance and a few are of academic value. Specially the articles 3,8,11 and 17 are of much practical utility.

This valuable volume, although out of the reach of many individuals to purchase, should necessarily be available at all the libraries of Research Institutes, Universities and Colleges for the benefit of post-graduate students, research workers and teachers.

V. G. PRASAD

Indian Institute of
Horticultural Research
Hessaraghatta,
Bangalore 560 080

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