

observations) says: "Even the effect itself, noted by Alter, might easily be called into question."

Similar doubts have been raised and undoubtedly will be raised for some time to come concerning the reality of the luminescence of the lunar surface. The final section of the chapter by Grainger and Ring states that "several distinct characteristics of moonlight all point . . . to the existence of luminescent regions. . . ." Taken individually, different observational procedures seem to leave much to be desired. Nevertheless, the results by these authors constitute a good beginning in a novel, and therefore somewhat difficult, observational study.

Astronomical Techniques. W. A. Hiltner, ed. Volume 2 of Stars and Stellar Systems, edited by Gerard P. Kuiper and Barbara M. Middlehurst. 635 pp. Univ. of Chicago Press, Chicago, 1962. \$12.50. *Reviewed by Cecilia Payne-Gaposchkin, Harvard College Observatory.*

THE broadening scope of astronomy is a result of the application of new techniques. Electronics, the high-speed computer, the rocket, and the satellite are transforming the "oldest of the sciences" into a group of highly specialized fields. Several series of astronomical compendia are filling the need for acquainting astronomers with the results that have been obtained in these very diverse areas.

The inclusion of a volume devoted to the techniques themselves is a most welcome feature of the University of Chicago series. The two dozen articles were written by practicing experts, most of whom have themselves been responsible for the development of the equipment they describe.

The volume has a twofold value. It conveys an understanding of the nature of the observations on which the new astronomy rests. It also contains invaluable practical details, and advice on the use of the techniques, which will stimulate other astronomers to make use of them and will make for a realistic understanding of their applications and possibilities.

Not all of the techniques discussed are new in themselves. Those sturdy foundations of astronomical observation, spectroscopy, spectrophotometry, photographic photometry, and photographic astrometry are presented and described in their most modern forms. The newer field of photoelectric photometry is thoroughly covered, and chapters are devoted to the image converter, the television camera tube, and the spectrum scanner. The measurement of magnetic fields and polarization are discussed, and there is a chapter dealing with infrared instrumentation.

Two phases of modern instrumentation are omitted, or covered in a limited way, but it would be a carping critic who belittled the volume on that account, for to include them in a book of reasonable dimensions would have been impossible. The preface indicates that the coverage is confined to "earth-bound techniques"; none of the chapters deals with rocket or satellite astronomy,

but a comparable volume would have been needed to do justice to the subject. The same can be said of the astronomical applications of high-speed computers, which are, however, represented by a discussion of their use in photoelectric reductions.

Astronomical Techniques is a valuable work of reference, both for those who wish to appraise the data of modern astronomy, and for those who are concerned with making additions to those data.

Fundamentals of Celestial Mechanics. By J. M. A. Danby. 348 pp. The Macmillan Co., New York, 1962. \$8.00. *Reviewed by T. Teichmann, General Dynamics Corporation, General Atomic Division.*

CELESTIAL mechanics is among the oldest of the sciences, and although its methods are basic to astronomy, and replete with mathematical interest (and complication), it had fallen out of fashion till the last few years, perhaps because its main applications were rather stereotyped and beyond human control. The advent of artificial satellites and the impending prospects of space travel have changed this and extended interest in the subject. While the problems of astronautics transcend those of celestial mechanics, they arise from the same foundation, and a sound understanding of the bases of celestial mechanics is necessary in order to proceed very far in astronautical investigation. Danby's book is well adapted to provide such a basis though it was not written with that aim particularly in mind. Starting with an introduction of relatively elementary astronomical and mathematical notions (vectors, particle mechanics), it proceeds through central orbits, extended bodies, and the two-body problem, to orbit determination, 3- or n-body problems, numerical procedures, and perturbation methods. The final chapters deal with the motion of the moon and the earth with particular reference to perturbations and internal motions (extended body effects). There are some useful appendices on conics, physical constants, and series occurring in orbit calculations.

The discussion is clear, and where necessary extended, and though the introductory part is elementary, the end of the book is not. The book does not pretend to be other than an advanced undergraduate or beginning graduate textbook and, as such, meets its aim in a palatable and useful, if not inspiring, manner.

Proceedings of the Rutherford Jubilee International Conference, Manchester 1961. J. B. Birks, ed. 856 pp. Academic Press Inc., New York, 1961. \$32.00. *Reviewed by Evans Hayward, National Bureau of Standards.*

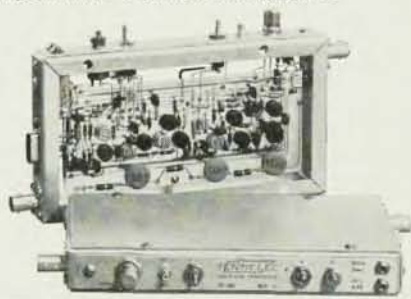
A NUCLEAR physics conference to commemorate the fiftieth anniversary of Rutherford's discovery of the atomic nucleus was held in Manchester from September 4-8, 1961. This thick volume is the complete record of that conference. At the time of the conference, each delegate received copies of the texts of the

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invited papers, abstracts of all the contributed papers, as well as a two-page text for each of the more important contributed papers. These have now been bound together along with the sometimes very witty discussion, the proceedings of the open session organized (out of chaos) by P. C. Gugelot, the conference summary of D. R. Inglis, and one of those amusing group photographs of the chairmen and invited speakers.

The conference covered the broad subject of nuclear physics and included sessions on direct interactions, weak interactions, collective oscillations, high-energy phenomena, the nuclear ground-state, and the open session which was devoted to nuclear forces and models. It was the task of the invited speakers to combine the material from the many contributions with their own thoughts and come up with coherent papers. These were unavoidably in large part reviews and updatings of subjects covered at the Kingston Conference held the previous September. The sessions on high-energy physics and weak interactions were especially welcome as they included material specifically excluded from the earlier conference. In fact, this represented the occasion for the announcement and first public discussions of the discovery of the three-pion resonance. A further diversion is offered by the fascinating review by W. A. Fowler of the relative ages of the universe, the galaxy, the solar system, and the elements. This paper is outstanding for its readability and general interest.

Every active nuclear physicist will want to have this book within easy reach though its high price may exclude it from his personal library. After all, this kind of collection represents his only chance of keeping abreast of who's doing what where, with still enough time left over to do something himself.

Life in the Universe. By Francis Jackson and Patrick Moore. 140 pp. W. W. Norton & Co., Inc., New York, 1962. \$3.95. Reviewed by R. Bruce Lindsay, Brown University.

THE problem of life on other worlds has long fascinated scientists and laymen alike, in spite of the fact that life itself is so difficult to define. The recent proposals for a detailed and expensive exploration of signals from outer space to see whether they can be interpreted as signals from intelligent beings is but a contemporary and somewhat sophisticated example of the mysterious zest which the problem has always had for the human race. In this book the authors, one a bacteriologist and the other an astronomer, provide a semipopular, rather chatty and informal review of the present status of scientific knowledge of life in the universe.

The first half of the volume is devoted to a survey of the currently accepted views about the structure of the universe, the structure of the atoms of which all things are composed, and the nature and origin of life on the earth. Though readable, this part is marred by numerous unfortunate and unnecessary errors and misleading statements, giving evidence of somewhat hasty