

included in the appendix. Furthermore, it would have been a convenience to the reader if the references to the selections had been placed after their titles rather than grouped together in an appendix.

The above criticisms, the editor's as well as the reviewer's, should not deter one from reading an informative and fascinating chapter in astronomical history. In the words of the compiler and editor, these contributions "satisfactorily illustrate the vigorous march of astronomical science during the interval 1900 to 1950—contributions which are at the same time informative to the general reader".

Space Research. Symp. Proc. (Nice, Jan. 1960). Edited by Hilde Kallmann Bijl. 1195 pp. (North-Holland, Amsterdam) Interscience Publishers, Inc., New York, 1960. \$24.00. Reviewed by Herman Yagoda, *Air Force Cambridge Research Laboratories*.

THIS encyclopedic volume on space physics is subdivided into seven major headings dealing with the earth's atmosphere, the ionosphere, tracking of space vehicles and the telemetry of data, the solar radiation, cosmic radiation, interplanetary dust, and lastly the moon and the planets. The book contains about 100 contributions from diverse lands by the participants in the first international space science symposium held at Nice in January of 1960. With the exception of 10 papers written in French, the remainder is printed in English. The individual papers have abstracts printed in both English and Russian, and all the Russian contributions have been either presented in English or translated. The subject matter is largely concerned with recent measurements secured since the first Sputnik was launched and extends into the second half of 1959, a period which includes the data from the American Explorer VI satellite and the three Russian moon probes.

The diversity of topics treated in this ponderous volume makes it very difficult to present a unified review of the contents. However, judging by the excellent quality of the papers on the cosmic and trapped radiations, with which the reviewer has a current working familiarity, it can be assumed that the rest of the volume is of comparable worth. The papers dealing with high-energy space radiations occupy 270 pages, a veritable book in itself, and contain the results of cosmic-ray studies secured not only by rocket and satellite exposures, but also by balloon-borne equipment. A series of 20 Skyhook balloon flights made over a period of five years clearly demonstrate the existence of large changes in the cosmic-ray flux near the top of the atmosphere which exhibits an inverse correlation with solar sunspot activity. Vernov and co-workers of the Russian Academy of Sciences give a detailed description of their observations on the trapped radiation for which they have coined a designation of TCR—terrestrial corpuscular radiation. This appears to be an apt nomenclature, as future interplanetary space probes may well reveal that some of the other planets have

magnetically trapped radiation belts. Meanwhile, the Russian lunar probes indicate the absence of a lunar radiation belt. A large part of the data has not been published elsewhere, and in general, the reports are presented in greater detail than space allotments in current journals would permit. It is perhaps well to caution the reader that not all papers of a given genus are grouped under the same heading. Thus, the cosmic-ray physicist may read with interest about the correlation between Forbush cosmic-ray decreases and satellite drag which appears in the group of papers dealing with the earth's atmosphere. Likewise a short but excellent review on the interaction of cosmic radiation with meteorites is located under the category of Interplanetary Dust. The editor, Hilde Kallmann Bijl, deserves credit for setting a high standard of quality in this report which should serve as a model for future symposia in this series.

Towards a Unified Cosmology. By Reginald O. Kapp. 303 pp. Basic Books, Inc., New York, 1960. \$6.50. Reviewed by Richard Schlegel, *Michigan State University*.

"IN physics a generalization that is logically possible is also physically possible. It can therefore be represented by an actual example and is so represented by a frequency that is determined by statistical considerations only." Professor Kapp calls this statement the principle of minimum assumption, and it is the basis on which he rests a group of physical hypotheses. The minimum assumption about a physical process, he tells us, is always the true generalization, and such an assumption has many times led to new and valuable discoveries in physics. He cites Dirac's prediction of the positron as one of his examples; it was a minimum assumption to accept the possibility of negative energy states, in contrast to the specific assumption that denies their existence.

We might argue that we have in minimum assumption a new form of Leibniz' principle of sufficient reason rather than a universal principle of physics. Still, this does not deny that there is interest in Kapp's bringing this canon of reasoning to physical problems. The most striking result of his considerations is the hypothesis of the impermanence of matter. He accepts the continuous creation of matter from empty space, as in steady-state cosmological theory, but makes the further assertion that for the existence of an element of matter there is no more reason to believe the "always will" than the "always has". Matter has a half life then, and any bit of it will eventually disappear. No certain determination of the half-life magnitude is given, but it is suggested that matter disappears in units of entire nuclei.

The major portion of the book is taken up with a presentation of developments from the impermanence hypothesis. A theory of the development and rotation of galaxies is presented. Space curvature waves, and hence gravitation, are hypothesized as being associated with the extinction of matter, whereas the expansion of

intergalactic space is associated with the formation of matter. The treatment is essentially only qualitative, and at best the book must be taken as one that suggests new approaches rather than as one that gives any kind of detailed development in cosmological or physical theory. Although he ably discusses the limitations of thinking by models in physics, the author (who is a prominent British engineer and educator) often gives model-like treatments that do not do justice to the subtlety and complexity of current physics. It must be said, though, that some interesting and well-reasoned reflections on the problem of the unification of physical science are a strong feature of this book. These discussions, taken with the presentation of the disappearance-of-matter idea, will warrant some attention to the book by the speculatively minded physicist.

The Universe at Large. By Hermann Bondi. 154 pp. (Science Study Series S 14) Doubleday Anchor Books, Garden City, N. Y., 1960. Paperbound \$0.95. *Reviewed by Otto Struve, National Radio Astronomy Observatory.*

PROFESSOR Bondi, King's College, University of London, is one of the most active theoretical astrophysicists in the world today. He is also one of the most versatile writers of popular and semipopular books and articles on astronomy; his ability to present difficult ideas and problems in simple and novel forms reminds the reader of the popular books by George Gamow. Incidentally, both Bondi and Gamow were "gifts" to the free world by the totalitarian regimes of eastern Europe; Gamow escaped to America from Soviet Russia, while Bondi went to Great Britain just ahead of Hitler's occupation of Austria.

The small book under review appeared originally as a series of articles in the *Illustrated London News*, and has now been published in book form in the "Science Study Series" organized by the Physical Science Study Committee at the Massachusetts Institute of Technology.

Bondi's own interests and views are strongly emphasized in this book. During the past 10 or 15 years he has worked in close association with a number of other British astrophysicists; his wife, Christine Mary Stockman Bondi, Messrs. Hoyle, Gold, Lyttleton, McCrea, and several others. Some years ago I jokingly referred to this group at a symposium as the "British School of Astrophysics" to distinguish it from an equally active and vociferous "Soviet School of Astrophysics" (V. G. Fessenkov, A. G. Mashevich, and others). The name has stuck, and the British school has been the butt of many criticisms from the Soviet school.

Bondi's book is an up-to-date version of the theories developed by the British school. He no longer emphasizes the theory of accretion (i.e., the growth of stars of small original mass through the accretion of diffuse interstellar matter) which was the main source of disagreement with the Soviet school at the above-mentioned symposium. But he strongly defends the "steady-

state cosmology", according to which "we have no choice but to postulate that there is going everywhere and at all times a continual creation of matter, the appearance of atoms of hydrogen out of nothing. . . . In the whole of the volume of the earth it would amount only to a mass like that of a particle of dust every million years or so."

It may be appropriate to correct here a historical mistake that has become quite frequent in the current astronomical literature. I am referring to what Bondi calls "Olbers' Paradox". In an article entitled "Über die Durchsichtigkeit des Weltraums", dated March 7, 1823, and published in "Bode's Jahrbuch" for 1826, Olbers had suggested that the entire sky would be as bright as the surface of the sun if the universe were infinite in size and populated uniformly with stars of solar type. But essentially the same argument was put forward in 1744 by L. de Cheseaux of Lausanne in an article entitled "Sur la force de la lumière et sur la distance des étoiles fixes", in which he suggested that interstellar space is filled with some kind of "fluid" (ether) which is capable of intercepting the light of distant stars. According to F. G. W. Struve (*Etudes d'Astronomie Stellaire*, St. Petersburg, 1847, p. 84, Notes, p. 46) it is probable that Olbers was unaware of Cheseaux's earlier work, despite the fact that the copy of the latter's publication in the library of the Pulkovo Observatory (which was used by Struve) had been purchased from Olbers' personal library. I do not advocate that we should, at this late date, substitute the name of Cheseaux for the much better known name of Olbers; this might cause additional confusion. Nevertheless, the contribution of Cheseaux has considerable historical interest.

Physics of the Upper Atmosphere. Edited by J. A. Ratcliffe. 586 pp. Academic Press Inc., New York, 1960. \$14.50. *Reviewed by Henry Wise, Stanford Research Institute.*

THE team approach to scientific research, so conspicuous a feature of our present-day society with its crash programs, missiles, and nuclear reactors, has now found its counterpart in the multiple authorship of scientific textbooks. In scientific research the team effort has been justified by the large scope of the field of investigation encompassing many disciplines, and the need for obtaining a solution as quickly as possible. Should similar considerations apply in the writing of a textbook?

A physical picture of the upper atmosphere requires detailed knowledge of the chemistry as well as the dynamics of mass and energy transport of a gas composed of atoms, molecules, excited species, and charged particles influenced by the geomagnetic field. A listing of the chapter headings indicates the range of subjects discussed: (1) The Thermosphere—The Earth's Outermost Atmosphere (Chapman), (2) The Properties and Constitution of the Upper Atmosphere (Nicolet), (3) The Upper Atmosphere Studied by Rockets and Satel-