

BOOK REVIEWS

Astronomy of the 20th Century. By Otto Struve and Velta Zeberg. 544 pp. Macmillan, New York, 1962. \$12.50.

Reviewed by **E. J. Öpik**, *Armagh Observatory and University of Maryland.*

A contribution to the history of astronomy, as well as a popular summary of astronomical research, written on the basis of his own scientific life, this is the swan song of Otto Struve, whose untimely death in April 1963 deprived the astronomical world of one of its greatest representatives. The compressed, vivid, and sometimes informal style is often in the first person, implying that the role of the two authors in producing the manuscript was far from being equal.

The work is not history in the rigid sense of the word; for that, it is too incomplete and selective. Also, it is primarily concerned with giving a popular account of the results achieved. To a great extent, it is a recollection of personal experience in research and human contacts, with a strong preference for branches in which Struve himself was active. Thus, stellar astronomy is given preference, and especially the physics of stellar envelopes, where he was a pioneer. Technical terms in physics and astronomy are explained currently in the text, to make them understandable to the lay reader, and a glossary is appended. With the same purpose,

an appendix—the only one—of 27 pages explains the principles of formation of stellar absorption lines which adumbrate the main theme of these astronomical memoirs. In contrast, the internal factors of stellar evolution are brought out but dimly. One of the greatest achievements of modern theory—the explanation of giant stars by way of thermonuclear evolution of unmixed stellar models—is not elucidated (a problem with which Eddington had grappled unsuccessfully), and the proton-proton reaction is not even mentioned. However, the factual evolution of the external observable parameters of the stars is described in detail. Planetary and interplanetary physics are intentionally and greatly neglected. Thus, the moon is given one page in the text, consisting of 8 lines referring to its atmosphere and the origin of its craters, the rest being filled with *curiosa*—the doubtful “eruption” in the crater Alphonsus, and an amusing letter from a Russian who in the 1920’s claimed to have been able to observe the hidden side of the moon. For water on Venus, “oceans” is still the verdict of one-time wishful thinking. These are a few examples, representative of a certain systematic trend of the book.

The senior author is an offspring

of an astronomical dynasty who left Russia as a political refugee in his early youth. The junior author, his assistant, is the daughter of a refugee astronomer who had to leave his Baltic home more recently. The historical side of the memoirs appears to be strongly influenced by the origin of the authors, prominence being given to Russian astronomy and political events that influenced the fate of astronomers there. On the other hand, many leading figures—to name only one, Banachiewicz of Poland—who were prominent in the history of astronomy—are not mentioned.

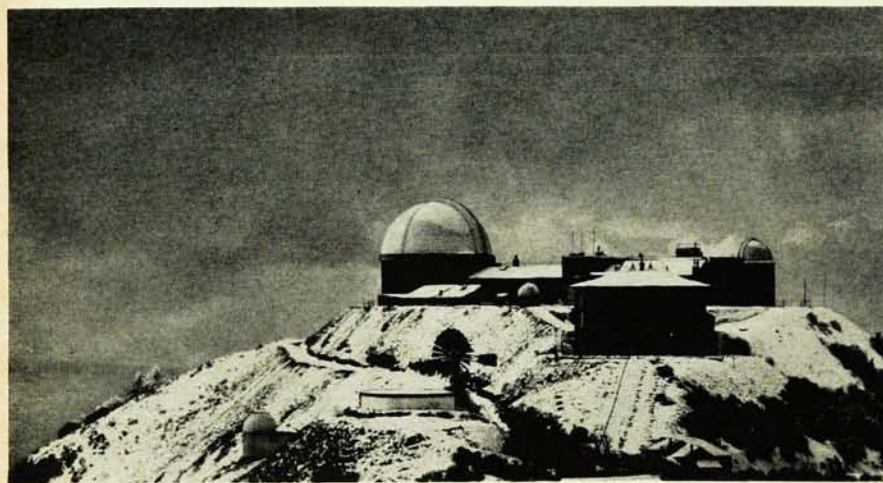
These remarks are not meant as a reproach to the authors; they are intended to point out to the reader, what he can, and what he cannot hope to find in the book. With its 239 excellent illustrations with pictures of 78 identified astronomers (out of modesty, Struve’s own picture is missing, however), it is a splendid laconic review of various branches of astronomical research, presented with authority in a popular style and a varying degree of detail. For astronomers, it is a human document of specific charm.

Space Flight. Vol. 2, Dynamics. By Krafft A. Ehricke. 1210 pp. Van Nostrand, Princeton, N. J., 1962. \$29.75.

Reviewed by **R. E. Street**, *University of Washington, Seattle, Washington.*

For one man to write three volumes on space flight is a tremendous undertaking, especially when the first two have already totaled more than 1700 pages. Only the author of this work, with his knowledge, enthusiasm, and persistence, could do so. Thus the present volume covers almost all of the aspects of the flight problem which are unique to man-made space vehicles, in contrast to the classical celestial mechanics and discussion of the solar system which was contained in the first volume (*Physics Today*, Oct. 1960, p. 62). Navigation, propulsion, rendezvous, touch-down, etc., are promised for the third volume.

The topic coverage is thorough. There is a discussion of free-flight bal-



The Lick Observatory in 1889 (from the book *Astronomy of the 20th Century*)

listic trajectories, including error analysis and ballistic recovery from space. A longish chapter considers satellite orbits around the earth extending well out toward the moon's orbit as well as close in to the earth. This involves a discussion of the various types of perturbation, especially atmospheric drag, and those due to the earth's oblateness. One chapter is devoted to orbit change and orbit transfer in a central force field; all possible orbit maneuvers are included as well as an analysis of errors. Another considers the escape or capture maneuvers in a field produced by two central forces, again with an extended discussion of error analysis for the orbits.

Powered trajectories of all types are treated in the next three chapters; the one on low-thrust space flight being especially complete. Up to this point the discussion has been quantitative with the derivations of all pertinent equations very complete. The next chapter, on lunar flight, is less so, only the results of apparently long, tedious calculations being presented in graphical form. Actually most of the theory needed was presented in the chapter on perturbations in Volume I. Similarly the last chapter on interplanetary flight, one of the longest in the book, assumes by now that the reader is able to perform the detailed calculations and presents most of the information on transfer orbits in graphical form.

Since this volume like the first one contains many typographical errors, indicating a poor job of proof reading, there may or may not be some doubt as to whether all of the figures are correctly drawn. Checking equations and sentences does not take as much time as reploting graphs so this reviewer only attempted the former, here and there. In the first 228 pages for instance, there are at least 40 errors and probably more. Consequently the reader should check everything as he goes and the publisher ought to issue lists of errata for both volumes as soon as possible.

Where the first volume contained mostly material which could be found elsewhere (although point of view and style were plainly those of the author), this volume is unique for there just is no other such exhaustive treatment of

the problem of space flight. Since a third volume is promised, the three volumes should, if reprintings correct the numerous irritating errors, constitute the most complete theoretical presentation of the subject of space flight from the dynamical point of view as now understood.

Statistical Physics. By G. E. Uhlenbeck, N. Rosenzweig, A. J. F. Siegert, E. T. Jaynes, S. Fujita. Vol. 3 in 1962 Brandeis University Summer Institute Lectures in Theoretical Physics, edited by K. W. Ford. 252 pp. Benjamin, New York, 1963. Cloth \$8.00, paper \$4.95.

Reviewed by Nandor L. Balazs, State University of New York at Stony Brook, Stony Brook, L. I., New York.

Statistical mechanics as we now know it is very nearly a hundred years old. (Maxwell's paper on the Maxwell distribution was published in 1859; Boltzmann's paper on the same subject appeared in 1868, while his great memoir on the relation between entropy and probability dates from 1877.) Notwithstanding this, the discipline shows no sign of age and continues to exert great fascination. A sampling of the topics which are of current interest are brought together in this volume. During the last thirty years, a recurrent problem has been the existence and description of phase transition within the framework of statistical mechanics. The first paper by G. E. Uhlenbeck provides the clearest and *easiest* exposition of these matters. He first discusses the nature of the problem and some general theorems concerning phase transitions. Finally, he gives an exposition of the recent results based on the one-dimensional model invented by M. Kac, and further developed by Kac, Uhlenbeck, and Hemmer. This model exhibits phase transition, is physically quite realistic, and is mathematically so tractable that all thermodynamical and statistical properties can be explicitly computed. During recent years increasing attention is being paid to the use of functional integrations in statistical mechanics. Siegert describes the use of these techniques in the evaluation of partition functions. In particular he develops an approximation scheme for the Ising lattice problem and for the partition function of a fully ionized gas. Recently, Van Hove with his

school and Prigogine with his school have developed general methods to deal with the statistical description of irreversibility. Fujita reviews the method of each school and the relationships between them. In particular, he discusses the assumptions which go into the derivation of the master equation and the initial conditions associated with it. Jaynes returns to one of the oldest problems of statistical mechanics, the relation between entropy and probability. Instead of utilizing the old Boltzmannian approach, using an ensemble, he prefers the notion of subjective probability and the use of the theory of statistical estimations. The energy spectrum of a nucleus is notoriously complicated. In 1956 E. P. Wigner conjectured that although the density of levels at a given energy will depend on the particular nucleus under consideration, the fluctuations in the precise position of the levels can be interpreted as if they were following definite and simple probabilistic laws. This idea led to the invention of a statistical mechanics, in which not the levels of a Hamiltonian are subject to probabilistic laws, but the Hamiltonians themselves. The mathematical treatment of these matters forms the content of Rosenzweig's lectures.

Each contribution is clear and explicit and serves as a good introduction; the literature references are well chosen. The printing is clear, and the book is well bound.

The Mathematical Theory of Viscous Incompressible Flow. By O. A. Ladyzhenskaya. Revised English ed. transl. from Russian by Richard A. Silverman. Vol. 2 of Mathematics and its Applications, edited by Jacob T. Schwartz. 184 pp. Gordon and Breach, New York, 1963. \$9.50.

Reviewed by Jacques E. Romain, Centre de Recherches Routières, Sterrebeek, Belgium.

Although it may seem inappropriate to mention the translator before the author of a book, let a breach in usage be made in the present case. The translation is so clear and well written, and it is so rare a pleasure to come across a genuine counterexample to the Italian saying "Traduttore, traditore", that it is well worth mentioning.

The book is a highly mathematical