

BOOK REVIEWS

Of Men and Galaxies. By Fred Hoyle. 73 pp. University of Washington Press, Seattle, 1964. \$2.95.

Reviewed by J. Gillis, Weizmann Institute of Science, Rehovot, Israel.

It is stimulating as well as amusing to follow the speculations of a brilliant mind. In these lectures Professor Hoyle discusses a wide variety of topics ranging from some of the less edifying aspects of budget-jockeying among scientists to the possibilities of communication with extraterrestrial civilizations. Most of the assertions belonging to the former end of the range of topics can be examined in the light of observation, and it must be admitted with regret that they stand up well to the test. The topics at the other end are as yet beyond our investigation, and for that reason are more fun as subjects of speculation.

It would be salutary if practising research scientists made it a rule to take time off occasionally and devote some thought to where we all came from and what is our destination, and to the background against which we are travelling. If this book encourages them to do so it will have served its purpose. At the least, it is guaranteed good value for an evening's sophisticated entertainment.

Collected Scientific Papers. By Wolfgang Pauli. R. Kronig and V. F. Weisskopf, eds. Vol. 1, 1133 pp.; Vol. 2, 1408 pp. Interscience, New York, 1964. \$70.00

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

Pauli often used to say, with a slight shake of his head, "Man soll keine Irrlehren verbreiten" (Do not propagate false doctrines). His collected works show how completely he succeeded in following this advice: they show variety, depth, generality, and clarity. The two volumes, which exceed 2500 pages, are organized as follows: Volume I contains his contributions to books and his books on meson theory; Volume II contains his articles published in journals, conference reports, and discussions. Each volume carries an index to both vol-

umes. The first volume also contains a photograph of Pauli from his later years, a short introduction by the editors (which contains a brief autobiography of Pauli), and finally a facsimile of a letter written by Pauli to Weisskopf on January 27, 1957, after his first encounter with the experimental results which dealt with the nonconservation of parity. (The cryptic reference at the end of this letter refers to his article in *Scientia*, 1936, reprinted in Vol. I, p. 737.) Within each volume the arrangement is chronological.

Pauli's interest in physics was universal and specific. He was inspired by any problem with general implications but not by problems which were merely applications of a theory however complex, unless they served didactic purposes. (One can appreciate this most easily by contrasting, say, Fermi's collected works with Pauli's.)

The contributions number about one hundred and thirty articles belonging to several major fields: relativity (7;1), quantum theory (33;5), quantum field theory and symmetry (34), statistical mechanics and thermodynamics (6), philosophical articles on the conceptual foundations of natural sciences, psychology, book reviews. (The numbers in brackets give the number of papers published in the corresponding fields. Where a second number appears, it refers to the more extensive review articles.) The articles are reproductions from the original. This worked very well, except in one case. The famous article on Relativity (I,1) is a reproduction of the German original, while the supplementary notes (I,238) refer to the page numbers of the English translation. Also, one wishes that the *Handbuch* article on wave mechanics (I,771) were a reprint of the original 1933 edition and not of the revised edition of 1958, since the revision eliminated the interesting last thirty pages on field quantization.

Everybody has his favorite articles. Instead of discussing my own favorites,

let me mention a few remarks which are amusing and characteristic of Pauli. The theory of the Mössbauer effect gave rise to an active discussion on the instantaneous or slow nature of emission, and on the quantum versus classical description of radiation damping. One will appreciate Pauli's insight, if one notes that in 1926, before the advent of wave mechanics, he already emphasized the fundamental differences between the classical and quantum theory of emission in spite of the strong formal similarities (I,69-70). [See, also, his illuminating remark in a book review about the mean life of an oscillator state in classical and quantum theory (II, 1391)]. Another extraordinary piece is a short discussion between Dirac and Pauli (II,567) about the definition of the energy of an electron in an external magnetic field, with particular reference to the Landau diamagnetism. All those who feel that this problem is trivial, or obvious, should first read Dirac's objection and Pauli's answer. The best critique of Bohm's and de Broglie's work on a causal interpretation of quantum theory is given in (I,1115). Many of the asides are worth noting. They not only give a human touch, but also tell about Pauli's way of assessing others. On Dirac: "... with his fine instinct for physical realities, he started his argument without knowing the end of it ..." (II,1239); on Schwinger: "A careful reading of the paper shows, however, that it does not permit one to draw certain conclusions about Schwinger's own opinion on this point" (I,1242). (The paper referred to is Schwinger's own!) Those of us who are strongly in favor of the algebraic and/or symbolic approach to quantum theory would do very well to read Pauli's strictures in his reviews of Born's and Jordan's *Elementare Quantenmechanik*, and Dirac's *The Principles of Quantum Mechanics*, (II, 1397). As he says "one cannot blame here the reviewer for finding the grapes sour because they are out of his reach." Pauli's inter-

est in psychology, in particular in C. G. Jung's archetypes, is well known. Here we find reprinted two papers which are otherwise not easily accessible: One deals with the influence of the archetypes on Kepler (I,1023); the other discusses certain aspects of the unconscious, (II,1212). Particularly interesting is Pauli's opinion on extra-sensory perception (II,1228,1298). It is also impressive to see how much harder it is to be clear, even for Pauli, if one is not writing about physics.

Finally, one must express one's gratitude to the two editors, R. Kronig and V. F. Weisskopf, for collecting and editing this magnificent work, and to the publishers for presenting it so well. May one wish, however, for a third volume? Pauli wrote many additional lecture notes, and semi-public letters which should receive wider circulation; (e.g., his lecture notes in Zurich on quantum theory, quantum field theory, statistical mechanics, and optics; notes from summer schools, as Les Houches; his widely circulated letter to Schwinger on quantum field theory, etc.). These are not even listed in the two volumes here. Perhaps one should collect them as well; even though they were not officially published, they bear Pauli's imprimatur.

Aufgaben und Lehrsätze aus der Analysis. By G. Pólya and G. Szegő. Vol. 1, 338 pp., DM 34; Vol. 2, 407 pp., DM 38. Springer-Verlag, Berlin and New York, 1964.

Reviewed by Dagmar Renate Henney, The George Washington University.

"Was ist unterrichten?

Zum eigenen Erfinden des Lernenden systematisch Gelegenheit geben."

(Nach Spencer)

This motto precedes the famous two volumes by Professors Pólya and Szegő and its philosophy is felt throughout the text. These books do not merely represent a collection of exercises and theorems, but the main emphasis is put on the order of the material. The authors desire most of all to activate the reader into being able to pursue mathematical analysis at his own pace and with increasing interest and capability. The great popularity of these two volumes shows

beyond doubt that they were successful.

The first printing of the *Aufgaben und Lehrsätze* appeared in 1925. The 1964 printing is the third and corrected version. It seems that there are few other books in mathematics—with the possible exception of Euclid's *Elements*—which have sold so many copies. The books have been translated into many languages. Dover Publishing Company came out with a photograph version in 1945. The books are quoted frequently and are well known to almost every mathematician as classical references in mathematical analysis.

There are many books in the mathematical literature—in French even more than in German—which comprise a collection of exercises, the above two volumes presenting possibly the most renowned. The books are primarily designed for independent study for the student as well as for the professor and the researcher. Much time has been spent by the authors collecting problems in a meaningful and effective way so as to guide the reader in his study of mathematical analysis. Transmitting knowledge is only of secondary importance to the authors. They are primarily interested in instilling within the reader a fruitful attitude towards mathematical thinking and to further the discipline of his scientific thoughts which they deem extremely important in the study of mathematics. According to the authors' point of view, it is of no use to memorize certain rules for the correct thinking process of solving a mathematical problem; rather one has to digest them carefully and then be able to use them almost instinctively. The same thoughts have been expressed by Pólya repeatedly, see for example his book entitled *How to Solve It*.

The collection of exercises includes those which have been published previously and those which have been passed on to the authors by word of mouth. Some of them are new results which have been changed into the form of an exercise and are now formally published for the first time.

The first volume contains three parts of fundamental character. The second contains six parts which are designed to cover more specialized questions and applications. Each volume contains ex-

ercises in the first half of the book and their solutions in the following half. At the beginning of each chapter in the collection of exercises the reader finds explanations which are helpful in recalling the needed definitions and theorems and provide the necessary motivation for his research. Frequently a hint is given to simplify a solution.

It would be presumptuous of the reviewer to praise the mathematical power of these books. These two volumes by Pólya and Szegő are not only a powerful and very effective mathematical treatise on analysis, but a work of art as well.

Atomic Migration in Crystals. By L. A. Girifalco. 162 pp. Blaisdell, New York, 1964. \$3.75.

Reviewed by Stuart A. Rice, University of Chicago.

This slim volume is intended to be an introduction to the theory of diffusion in solids, designed primarily for the intelligent layman. It is, in my opinion, a very clearly written monograph which provides a good survey emphasizing the important physical principles. I would have liked to have seen more emphasis on the role of dynamics, i.e., vibrational structure, to supplement the microscopic interpretation in terms of statistics, but this is a minor demurrer.

In general, I believe Professor Girifalco has achieved his goal and that the book will also be useful as supplemental material in freshman courses.

Elements of Quantum Electrodynamics. By A. I. Akhiezer and V. B. Berestetskii. Transl. by Israel Program for Scientific Translations. (2nd ed.) 301 pp. Oldbourne Press, London, 1964. Distr. by Daniel Davey, New York. \$13.50.

Reviewed by Bruce W. Shore, Harvard College Observatory.

The respected text by Akhiezer and Berestetskii deserves a wider use in this country. By restricting their exposition to the electromagnetic field, the authors are able to provide a detailed discussion of the quantum theory of electrons and photons. Electromagnetic interactions are treated in the framework of the S matrix, following the approach of Dyson. The text discusses in detail, if a bit tersely, renormalization and the removal of divergences from the S matrix. The