



BEYOND THE EARTH. Looking at the sun through the wire-mesh dish of the large radio telescope at the Air Force

Cambridge Research laboratories. The heavy tripod at the top carries the telescope's receiving equipment.

(1935)] and Nye's book (*Physical Properties of Crystals*, Clarendon Press, Oxford, 1957). One is left with the impression, not altogether unintentional I suspect, that this little monograph outlines Jaswon's particular approach to the fundamentals of a subject to which he has contributed significantly. Since other approaches, equally good and in some instances possibly better, do exist, it is unfortunate that consideration is not given to them.

The reciprocal lattice itself merits only two pages, which hardly reflects its importance. The remaining sections of the chapter introduce Bloch functions, Brillouin zones and Bragg reflections, giving but the merest hint of the important applications of crystallography. More extensive treatment

of such topics would have served to emphasize the particular attractiveness of Jaswon's approach and thus add usefulness to the book.

Most of the text apparently developed out of graduate lecture courses given at the Imperial College, London, and at Brown University, and probably served to supplement related courses. The concept of the book is excellent, and now that Jaswon is heading the engineering mechanics department at the University of Kentucky we hope he will have occasion to broaden its scope. The binding of the book (hardcover) incidentally, is poor, even at the price.

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Beyond the earth

INTRODUCTION TO SPACE SCIENCE, Wilmot N. Hess, ed. 934 pp. Gordon and Breach, New York, 1965. Professional edition \$10.00, reference edition \$29.75.

by Jules Aarons

Both the word "space" and the definitions of the word "space" appear to approach infinity. Certainly, the range of the volume *Introduction to Space Science* is semi-infinite. The reviews by the staff of the Goddard Space Flight Center of NASA range from the very neat classical review paper by W. N. Hess (the editor) on the earth's radiation belt to a detailed description of the individual experiments and sightings of each of the astronauts (Russian and American) by W. S. Cameron to the (occasionally) self-indulgent article on the origin of the solar system by A. G. W. Cameron.

Introductory have been written by two groups of scientists, one the research workers from not-for-profit institutes or from government laboratories, the second, introductions from the university professor—research worker. The research workers frequently write in teams while the university professor will do a solo. The advantage of the team introductions is that the team consists of many specialists who know only their own subjects well but who, en masse, cover a field ably. The university professor—solo writer—teacher knows his specialty quite well but is only acquainted with other topics he is covering. He tends to over-stress his own field and to be unacquainted with the reevaluations of data, obsolete papers in the literature, and experiments which did not succeed and whose negative results were not published.

The solo writer however maintains a coherence to his book and (frequently) has experience in presenting the material to students in a consistent and logical fashion. The teams may well lack coherence in units, in presenting derivations but this may be made up by the completeness of the reviews.

An example of the nonteacher's approach can be seen from the following quotation from the cogent review on the sun: "A radio telescope operating



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STELLAR AND SOLAR MAGNETIC FIELDS

Proceedings of the International Astronomical Union Symposium no. 22 at Rottach-Egern, September, 1963.

Edited by R. LÜST, *Max-Planck Institut für Physik und Astrophysik, München*. Includes such topics as Stellar magnetic fields; some remarks on observational data of magnetic stars; abundances of the light elements in magnetic stars. 1965. 460 pages. \$17.50.

PHYSICS OF NON-CRYSTALLINE SOLIDS

Edited by J. A. PRINS, *Technological University, Delft*. Gives the proceedings of the International Conference, Delft, July 1964, held under the auspices of the International Union of Pure and Applied Physics. 1965. 667 pages. \$27.50.

PRELUDES IN THEORETICAL PHYSICS

In Honor of V. F. Weisskopf

Edited by A. DE-SHALIT, *The Weizmann Institute of Science, Rehovoth, Israel*; H. FESHBACH, *MIT*; and L. VAN HOVE, *CERN, Geneva, Switzerland*. A collection of essays that show Weisskopf's profound influence on modern physics and capture something of his spirit. 1966. 351 pages. \$12.75.

POTENTIAL SCATTERING

By V. DE ALFARO and T. REGGE, *both of the University of Turin, Italy*. A modern and rigorous treatment of recent development of the theory of potential scattering. Describes the interaction of elementary particles according to non-relativistic mechanics. 1965. 205 pages. \$8.00.

OPTICAL PROPERTIES AND ELECTRONIC STRUCTURE OF METALS AND ALLOYS

International Colloquium - Proceedings, September 13-16, 1965, Paris.

Edited by FLORIN ABELÉS, *Institut d'Optique, Théorique et Appliquée, Paris, France*. Includes such topics as: simple metals; rare earth metals; liquid metals; photo-emission; optical plasma effects; superconductors; magneto-optical effects; and non-periodic systems. 1966. Prob. \$17.75. In press.

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ELECTRON DENSITY PROFILES IN THE IONOSPHERE AND EXOSPHERE

By J. FRIHAGEN, *Norwegian Defence Research Establishment*. Proceedings of a NATO Advanced Study Institute, Finse, Norway, April, 1965. Contains papers dealing with many aspects of the complex problem of determining and understanding the state of the ionosphere and exosphere. 1966. Prob. \$18.75.

PROGRESS IN OPTICS

Volume V

Edited by E. WOLF, *University of Rochester*. The latest volume in this series that provides review articles about current optical research—both theoretical and applied. 1966. 383 pages. \$15.00.

THE GROWTH OF CRYSTALS FROM THE MELT

By JOHN CHADWICK BRICE, *Mullard Research Laboratories, Redhill, Surrey, England*. Describes the scientific foundations of the craft of crystal growth from the melt. The book can be divided into two portions—theoretical and practical. 1965. 192 pages. \$8.00.

FERROMAGNETISM AND FERROMAGNETIC DOMAINS

By DEREK JOHN CRAIK, *University of Nottingham*; and ROBERT SOULSBY TEBBLE, *University of Sheffield*. Of particular interest at this time because of the use of magnetic materials in storage memory devices in computers, this book presents the subject of domains in relation to the wider field of the magnetic and physical properties of ferromagnetic metals and ferrites. 1965. 337 pages. \$14.00.

SEMICONDUCTOR SURFACES

By A. MANY, Y. GOLDSTEIN and N. B. GROVER, *all of The Hebrew University, Jerusalem*. A clear, up-to-date, and self-contained presentation of theories, techniques, and experimental data on the electrical behavior of semiconductor surfaces. 1965. 496 pages. \$17.50.

PROGRESS IN ELEMENTARY PARTICLE AND COSMIC RAY PHYSICS

Volume VIII

Edited by J. G. WILSON, *Professor of Physics, Leeds*; and S. A. WOUTHUYSEN, *Professor of Physics, Amsterdam*. Devoted to reviews in the field of elementary particle physics. Strikes a balance between experimental and theoretical contributions, consequently including two reviews on experimental subjects together with two on theoretical topics. 1965. 393 pages. \$14.00.

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at a wavelength of 1 meter would require an antenna about two miles in length to equal the resolving power of the human eye! For a parabolic reflector antenna of diameter D , the half power beamwidth can be calculated from $60\lambda/D$ where λ is the operating wavelength. Since many sources of radio emission in the solar atmosphere are of the order of minutes of arc, very high resolution is required". The mixture of meters and miles in the first sentence does not appear necessary since kilometer is used throughout the volume. Secondly, the beamwidth turns out to be in degrees, which is not stated, although "minutes of arc" is mentioned later in the paragraph and is certainly misleading.

The book is well printed and designed to sell to individuals at \$10 and to libraries at \$29.75. The former price is a welcome change that should increase the volume's availability to students and research workers. The sections on particles and fields in the vicinity of the earth and in interplanetary space are excellent; there the NASA program has shown in experiment and analysis its greatest in-house capability. Some of the astronomical sections appear to me to stray beyond space physics and into the realm where texts on astronomy and astrophysics might be used although Jastrow and Rasool's article on planetary atmosphere keeps us up to date on this exciting and expanding field.

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Swinging vectors

A VECTOR APPROACH TO OSCILLATIONS.
By Henry G. Booker. 149 pp. Academic,
New York, 1965. Cloth \$5.50, paper
\$2.45.

by Richard Waterhouse

The author is professor of applied electrophysics at the University of California (San Diego) and has done distinguished work in electromagnetic wave propagation. In his book he advances the thesis that the usual way

of treating e.m. oscillations, involving complex numbers, is unsatisfactory. (He states that the language of pure mathematics, when used to describe rotating vectors, that is, electrical oscillations, is "peculiar to the point of being deceiving.")

To replace the complex-number treatment, Booker develops a vector treatment using real numbers only. In order to do this, he introduces several novelties, including two new terms, the "planar product" and the concept of "actance." The actance of an oscillation is defined as a vector S , which does not vary with time. A time varying vector is then written as e^{st} and is shown on an 'actance diagram.'

A polar notation is used for the vectors, in which a vector A is written

$$A = A \angle \alpha,$$

where A is the length of a straight line segment, and α is the counterclockwise angle it makes with a reference direction. Then a quotient of two vectors is defined as

$$\frac{A}{B} = \frac{A}{B} \angle \alpha - \beta = C,$$

a "third vector."

The planar product is defined and written as

$$A B = A B \angle \alpha + \beta = D,$$

another vector which is coplanar with A and B . The planar product "undoes the quotient operation" defined above, and "is repeatedly required in using vectors to handle oscillations."

Thus to recoup the advantages of the complex notation he has rejected, the author introduces his own ad hoc type of vector analysis.

It is easy to see that Booker is no slave to convention where pure mathematics is concerned. "The accent is on the creation of vivid concepts, not on adherence to tradition," he states. However, even the impure physicist may feel that vector analysis is too important to play around with in this way. Is it sound to teach students a new type of vector analysis for use only with electrical oscillations? They may get confused when they learn that, in mathematical physics generally, the quotient of two vectors must have a tensor form.

It is clear that, indeed, a real-number treatment of rotating vectors