Mars, Jupiter, and Saturn has been detected and promises interest for the future; indeed, the study of Jupiter has already revealed such fascinating features as a Van Allen type belt, with an associated magnetic field of at least about 7 gauss, which emits polarized decimeter waves, and powerful meter-wave outbursts that come from certain fixed regions. The steady rotation period of 9 hours, 55 minutes, 29.37 seconds, is presumably the period of the solid surface of the planet, but it seems that the emission must come from an ionized atmosphere.

Techniques of radio astronomy are treated by E. J. Blum. We learn that a sky survey with a beam width of 1 minute of arc would take 20 years to complete; hence the interest in radio image-forming techniques that depend on multiple lobes such as Blum himself has demonstrated.

F. D. Kahn summarizes information about interstellar matter; he refers to the cycle whereby material is blown from stars and, in due course, swept up to be processed again. Radio astronomy has had a direct impact on this subject, through studies of the 21-centimeter and continuum emission of interstellar hydrogen, and with studies of the radio emission from supernova remnants, and the galactic halo is contributing to an understanding of the evolution of a galaxy. The structure of the galaxy and gas motions, including the general outflow from the central region, are discussed by D. S. Heeschen. V. C. Reddish briefly explains the theory of 21-centimeter emission and then applies it to the calculation of the neutral hydrogen content of a galaxy. Detection of the galactic magnetic field by Zeeman splitting of the line is then discussed by Rod Davies.

Mechanisms of radio emission are presented by M. I. Large, and R. G. Conway describes radio source spectra and expresses the hope that spectral features might enable red shifts, and hence distances, to be measured.

From its beginning, radio astronomy has been concerned with the angular sizes of radio sources, and much ingenious instrument design has been stimulated thereby. Observational techniques and results for angular sizes are explained by H. P. Palmer, and the more general question of source brightness distributions is taken up by B. Rowson.

G. R. Burbidge describes the calculations which lead to the conclusion that astonishing quantities of energy are being released by the strong radio sources. Burbidge also discusses the various theories for the source of the energy (these theories were shortly thereafter abandoned by many of their proponents in favor of gravitational potential energy).

A technical discussion of the optical identification of radio sources, by D. W. Dewhirst, is accompanied by practical advice on how to determine celestial coordinates from the Palomar Sky Survey. Finally, the application of radio source observations to cosmology is taken up in a series of contributions by Ryle, McCrea, McVittie, and Palmer.

There is a good index; the book can be recommended as a clear and authoritative introduction to radio astronomy by leaders in the field.

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Applied Science

Light and Heat Sensing. Harrison J. Merrill, Ed. Pergamon, London; Macmillan, New York, 1963. xii + 457 pp. Illus. $20.

This book contains 27 papers presented at the sixth meeting of the Avionics Panel of AGARD (the Advisory Group for Aeronautical Research and Development) of the North Atlantic Treaty Organization in July 1962. The vastness of the field of sensing is reflected by the great variety of subjects treated in the papers, which are grouped by subject in six sections: (i) Sensors (papers dealing with the entire spectrum, from the ultraviolet to microwaves, as well as those on the information capacity of sensors and the limits of imaging at low brightness); (ii) Atmospheric Effects (the concentrations and size distributions of atmospheric particles, the resultant optical scattering, as well as a method of using stars to estimate atmospheric attenuation); (iii) Imagery Effects (dector considerations extended to the two-dimensional imaging case, including theoretical analysis of image intensifiers, problems of using human vision for air-to-ground detection, the uses of spatial filters to modify the transfer function of an optical system and remove unwanted patterns such as the lines on a TV screen, and the use of color photography for quantitative measurement of the surface temperatures of luminous bodies); (iv) Lasers (basic principles of gaseous, solid-state, and semiconductor lasers, applications to communication and optical ranging, and a discussion of methods of modulating infrared radiation); (v) Fiber Optics (a survey paper as well as some applications and descriptions of optical systems using fiber optics); and (vi) Sensor Systems (six papers dealing with various military and space applications).

The length of the individual papers varies from 2 pages (really a summary) to 31. Most are followed by a few references and brief comments or discussions by the conference participants. There are author and subject indices. Six of the papers are in French, the others are in English. Bilingual summaries at least of the articles in French, would have been useful. The papers were chosen for extensive coverage rather than intensive treatment in any one area. There is little duplication in the material presented by the various authors. In view of the sponsorship of the meeting, military and space applications are emphasized. For example, atmospheric scattering is treated in terms of its effects on aerial photography, and the communications aspects of lasers are stressed, rather than their uses as a tool in fundamental research. Nevertheless, developments that may have been motivated by military and space requirements often have repercussions in everyday life.

Many of the papers are of an analytical nature or describe specific devices or techniques that will continue to be useful for at least several more years. There are also many useful tables. The time lag is really noticeable in only a few cases—for example, in the rapidly developing field of semiconducting lasers which, at the time of the conference, were only a speculative possibility.

The typography is attractive and the photographs and figures are clear. There are a few misprints, and these seem to be more frequent in the French articles.

The "List of Symbols" at the beginning of the volume is largely honored in the breach. For example, in Fig. 1 of the very first article, "A" is used but not defined. The "List of Symbols" denotes "A" as "area," which quite obviously does not apply in this figure. Several pages later we find that "A" signifies the "mean number of ambient

photons." And so on. One can sympathize with the author who uses the usual "T" to represent absolute temperature, rather than the "K" given in the list. The reader should be warned, if previous experience has not already warned him, that the list is far from inclusive.

For the most part, this book will appeal to engineers and applied scientists. Few will be interested in all the papers; however, the variety of topics dealt with will provide almost everyone with something of interest.

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Botany

Principles of Angiosperm Taxonomy. P. H. Davis and V. H. Heywood. Van Nostrand, Princeton, N.J., 1963. xx + 556 pp. Illus. $15.

Davis (University of Edinburgh) and Heywood (University of Liverpool), both working taxonomists who are especially familiar with the Mediterranean flora, have written a new textbook on plant taxonomy, a subject on which new books are not a frequent occurrence. Most American colleges use Lawrence's *Taxonomy of Vascular Plants* (1951) and very recently Benson's *Plant Taxonomy: Methods and Principles* (1962). More than half of Lawrence's useful volume is devoted to treatments of particular families, and the book is primarily concerned with traditional methods, treated rather briefly. Benson's text is more theoretical, but it contains extensive discussions of specific examples, many drawn from the genera *Quercus* and *Ranunculus*.

The new work is entirely theoretical and therefore especially welcome. It is also comparable to but much more comprehensive than Simpson's *Principles of Animal Taxonomy* (1961). It delves especially into the theory of characters, both macroscopic and microscopic, and its application to classification and goes fully into taxonomic evidence from plant morphology, anatomy, palynology, embryology, cytology, and genetics. An admirable exposition is given of the "new systematics," including intensive treatments of evolutionary and phylogenetic theories, and especially of population theory (by Turesson and others), breeding behavior, and the newest fields of phytochemistry and machine methods in taxonomy (necessarily limited to the few published papers, chiefly by Sokol and Sneath). The stimulating contributions to the taxonomic treatments made by such relatively new concepts as ecotypes, polyploids, apomicts, clines, introgressants, and species aggregates is especially full and welcome in that there are no uniformly accepted methods at present. The book does not entirely neglect herbarium methods in taxonomy. (Heywood is the chairman of the editorial committee for the monumental *Flora Europaea,* the first volume of which is expected momentarily, and is thus entirely familiar with traditional methods.) However, since this book deals only with taxonomy, restricted to the principles of classification, and not with systematic botany in general, the authors do not discuss any particular systems of classification in detail, for such information can be readily obtained elsewhere—in Lawrence's text or Benson's *Plant Classification.*

It is inevitable that a British text should draw chiefly on the European literature and that Benson and Lawrence should draw most of their references from American publications. The new work is therefore even more valuable in that it covers and synthesizes a large body of information from European sources, including the Soviet Union, which are not otherwise readily available to teachers and students. This new text, being the only one to bring together and integrate the vast body of present-day knowledge bearing on taxonomy, should and undoubtedly will be used as a text in many college courses in systematic botany, and all working taxonomists will need to have it close at hand. Zoologists too will find it necessary, since the taxonomic principles involved are the same essentially in plants and in animals.

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On Science Popularization

A History of Communications. Maurice Fabre. Hawthorn, New York, 1964. vii + 105 pp. Illus. $5.95.

This book is the ninth in a series of 12 volumes, *The New Illustrated Library of Science and Invention,* which purport to "chronicle mankind's major scientific and technological achievements." Although written in a lively style by a French popularizer and handsomely printed in Switzerland, this volume fails to live up to its promise; many significant communication advances are omitted, or treated only superficially, and the author frequently forgets that the book's focus is supposedly scientific and technological.

In brief, Fabre is more concerned with the sociocultural and economic relations of communications than with its scientific and technological development. For example, in the chapter "Books, paper, and printing," only three sentences are devoted to technical advances in printing after Gutenberg, but several pages are given to the rise of publishing as a business and the growth of public libraries. The chapter entitled "The rise of the press" allows only two paragraphs to technical matters, such as the linotype and rotary press, and is devoted almost entirely to the history of the freedom of the press. In his final chapter, the author confesses that communications theory "is too complex and too technical for a book of this nature" (!), mentions the name of Claude Shannon in passing, and hurriedly moves on to lengthy—and frequently shallow—discussions of the role of advertising and the effects of radio and television on mass culture.

The illustrations (many in full color) are beautiful examples of the arts of the photographer and engraver. Unfortunately, most of them are as irrelevant to the text as the text is irrelevant to the scientific and technological history of communications.

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Mathematics

Lectures on Boolean Algebras. Paul R. Halmos. Van Nostrand, Princeton, N.J., 1963. vi + 147 pp. Illus. Paper, $2.95.

Although it was composed at about the same time, this book is a younger, more spritely cousin of Sikorski's *Boolean Algebras* (Berlin, 1960). Except for some exercises and a few sections, the material is an explication and modernization of Stone's contributions, but it is clear that much has been done about Boolean algebras since