person. *Mass Spectrometry* contains 12 chapters by 14 authors. The complexities of instrumentation and the application of mass spectrometers virtually require such an array of specialists. As one would expect (and as the editor admits), the style of this book is not uniform and is somewhat repetitive, but the volume is much more comprehensive than would be possible otherwise.

Of course, it becomes increasingly difficult to review volumes to which so many specialists have contributed. Accordingly, this review was done by a reviewer versed in electronics and vacuum techniques applied to mass spectrometers in cooperation with one who applies mass spectrometric analyses to chemical and geological problems.

The 12 chapters are: "Types of mass spectrometers," by J. B. Farmer (38 pp.); "Mass spectrometry in research," by W. A. Bryce (24 pp.); "Ion sources," by R. M. Elliott (35 pp.); "Ion optics," by L. Kerwin (75 pp.); "Electronic techniques," by D. C. Frost (22 pp.); "High-resolution mass spectrometers," by H. E. Duckworth and S. N. Ghoshal (74 pp.); "Vacuum techniques," by H. A. Tasman (59 pp.); "Chemical analysis by mass spectrometry," by V. H. Dibeler (41 pp.); "Isotope abundance measurements and their application to chemistry," by C. C. Mullen and H. G. Thode (67 pp.); "Mass spectrometry of free radicals," by F. P. Lossing (64 pp.); "The ionization and dissociation of molecules," by C. A. McDowell (83 pp.); and "Ion-molecule reactions," by D. P. Stevenson (28 pp.).

Those who are not familiar with mass spectrometry will find that the chapter on types of mass spectrometers is an excellent source of introductory material. Methods of producing ions from various types of samples are well covered in the chapter on ion sources. With this exception, the chapters concerned with the performance of analyzers are largely designer-oriented; that is, they stress the mathematical treatments of principles without much discussion of the actual construction of components. A very complete coverage of ion optics and high resolution mass spectrographs is presented on this level.

The chapter on electronic techniques is a brief discussion of the electronic current and voltage regulators and amplifiers used in the production and detection of ion beams. The presentation of the transistorized versions of these circuits updates this section over the previous literature. As a reference source this chapter would be enhanced if ion data-handling techniques had been placed after the discussion of the electrometer presented elsewhere in the text.

Although its authors disclaim completeness, the chapter on vacuum techniques is an excellent summary of the problems, materials, and components of vacuum systems peculiar to mass spectrometers. This chapter should be of interest to individuals who construct their own equipment.

Because the authors attempt to review such a vast realm the chapter on mass spectrometry in research is abortive. Isotopic studies applied to geochemistry and cosmochemistry are covered in less than two pages, and the latest reference to sulfur isotopes is ten years old. Fortunately, Mullen and Thode's excellent chapter on isotopic abundance measurements salvages this field of endeavor.

"The purpose of this book is to provide a detailed and authorative account of the basic principles of mass spectrometry and the more important types of applications." We believe that this purpose, for the most part, has been obtained. But, the high cost of the book is regrettable.

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Astronautical Sciences

Progress in the Astronautical Sciences. vol. 1. S. F. Singer, Ed. North-Holland, Amsterdam; Interscience (Wiley), New York, 1962. xii + 416 pp. Illus. $14.50.

Many regret that the regular journals are no longer the sole outlet for new scientific and technical ideas. It complicates life a good deal to have to keep abreast of articles published in a variety of new books rather than limiting one's library (and reading) to the relatively few standard journals in a given field. In fact, I know one Nobel prize winner who does not consider an idea "published" until it appears in a journal. He may have a good point, but books are apparently here to stay—and we must welcome a good book.

Volume 1 of *Progress in the Astronautical Sciences*, edited by S. Fred Singer, is just the kind of book that complicates life, since it cannot very well be ignored. Each of its seven chapters is by a highly qualified author (or authors), each is a review of a given subject related to the field of astronautics (the upper atmosphere, space physics, space flight technology, and the like), and so far as I can tell each contains some interesting new ideas.

Singer states that the purpose of this new series is to fill a need for "a publication which reports advances in the various astronautical disciplines in a manner easily intelligible to the scientist or engineer, regardless of his field of specialization." The chapters are inevitably uneven in meeting this goal, but I am convinced that each can serve as a useful and authoritative source of information—as long as the reader recognizes that our knowledge about most of these subjects is advancing so rapidly that already *some* of the ideas are dated. (This is one trouble with a book, whose cover conveys a false impression of permanence to the words therein.)

The chapters by D. G. King-Hele, "Properties of the atmosphere revealed by satellite orbits," and F. S. Johnson, "The physical properties of the earth's ionosphere," will both stand the test of time very well, I think, even though there is now more that could be said about these broad scientific areas. The chapters by A. M. Stone and G. C. Weiffenbach, "Radio doppler method of using satellites for geodesy, navigation, and geophysics," and George Leitmann, "The optimization of rocket trajectories—A survey," will probably appeal to the engineer who wants to be brought up to date in these two important technical subjects. The two chapters by Ernst J. Öpik, "Surface properties of the Moon" and "Atmosphere and surface properties of Mars and Venus," are sure to delight all who are interested in our neighbors in space. Öpik has a very high place, in my estimation, among the astronomers who have made real contributions to our knowledge of the solar system, and, while there are points about which we disagree, these chapters are excellent reviews of three controversial areas. I noted with amusement the salty Öpikian comments on a variety of new Soviet lunar "discoveries." The last chapter, "Biodynamics of space flight" by Henning E. Von Gierke and Edwin P. Hiatt, is a comprehensive review of a rela-

tively new and unsettled subject; this chapter is for nonspecialists. Of particular interest here, it seems, is the treatment of the effects of prolonged exposure to a severe noise and vibration environment for a pilot or astronaut.

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Atmospheric Motions

Jet-Stream Meteorology. Elmar R. Reiter. Translated from the German edition (1961). University of Chicago Press, Chicago, 1963. xiv + 515 pp. Illus. $17.50.

This English translation of Reiter's *Meteorologie der Strahlströme* (1961) is a monograph on many aspects of atmospheric motions; its extensive descriptive discussions are supplemented by brief summaries of certain related theoretical material. The total body of fact and interpretation collected here is impressive, but the wisdom of its organization and the significance of many points are open to serious question.

The book serves a useful purpose in that it incorporates in a single volume coherent summaries of a great many recent research papers. The bibliography is 74 pages in length, the text 433 pages; this ratio of one to six gives a fair impression of the exhaustive scope of the work and of the necessarily limited depth of the discussion. In contrast to the bibliography, the index is only seven pages, and this too gives a fair impression of my reaction to the book—the names of the authors stand out more strongly than the physical concepts with which they were concerned.

Reiter's account of the results of Project Jet Stream is well organized and clearly presented; for many readers it is probably the best part of the book. Other topics of which Reiter has made useful summaries include wind measurement, model experiments, and the influence of mountains.

In my opinion, "jet stream meteorology" no more exists than does "polar front meteorology" or "south wind meteorology," and the chief deficiency of Reiter's book is that this phantom deflects the author's real objective and confuses the reader. Reiter is concerned with the atmospheric field of motion, and he obviously knows that jet streams are descriptive abstractions of certain detectable features of the field. But the title leads to arbitrary choices: the inversion wind maximum passes the test, the convection cell does not, the monsoon is accepted, the sea breeze is not. And the title leads to distortions in emphasis and in interpretation—for example, "The second jet maximum . . . draws its energy from an anticyclone . . ." (p. 239)—so that it would be dangerous to recommend this book to readers not already fairly sophisticated in meteorology.

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Theoretical Models

Luminescence in Crystals. D. Curie. Translated from the French edition (1960) by G. F. J. Garlick. Methuen, London; Wiley, New York, 1963. xii + 332 pp. Illus. $8.50.

Scientists who desire to know more about luminescence in crystals are fortunate in having a book on the subject written by an expert, D. Curie, and translated by another expert, G. F. J. Garlick. The "treatment is mainly theoretical," and its chief emphasis is on theoretical models for explaining the many interesting and important phenomena that involve the emission of light from crystals. With a few brief exceptions at the end of the book, there are no descriptions of experimental apparatus and measurements or discussions of practical applications. There are careful definitions of terms and thorough descriptions and explanations of all the phenomena connected with luminescense in crystals. There is a comprehensive bibliography with about 1400 references. The book is clearly written. It is especially helpful in that it gives mechanisms and models to explain and predict the emission of light under widely varying types of stimulation.

The material covered includes spectra and probabilities of emission and absorption, configurational coordinate diagrams, optical transitions in photoconducting crystals, luminescence centers in phosphorescent sulfides, phosphorescence and thermoluminescence, activation of trapped electrons, energy transfer, sensitization and quenching, electroluminescence and electrophotoluminescence, and effects of high energy radiation.

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New Books

Mathematics, Physical Sciences, and Engineering

Linear Regression. And its application to economics. Zdzislaw Hellwig. Translated from the Polish edition by J. Stadler. H. Infeld, Translation Ed. Pergamon, London; Macmillan, New York, 1963. 250 pp. Illus. $5.

Molecular Equilibrium. A programmed course in general chemistry. P. H. Carnell and R. N. Reusch. Saunders, Philadelphia, 1963. 226 pp. Illus. Paper, $2.25.

Networth Analysis and Synthesis. Louis Weinberg. McGraw-Hill, New York, 1962. 708 pp. Illus 19.50.

The New World of Physics. Arthur March and Ira M. Freeman. Random House, New York, 1962. 207 pp. Illus. Paper, $1.45.

Once-Forbidden Beta-Transitions. L. N. Zyryanova. Translated from the Russian edition (Moscow 1960) by Prasenjit Basu. Reginald W. Clarke, Ed. Macmillan, New York, 1963. 123 pp. Illus. $5.

Optimum Design of Digital Control Systems. Julius T. Tou. Academic Press, New York, 1963. 198 pp. Illus. $7.

Paramagnetic Resonance. vols. 1 and 2. Proceedings of the first international conference (Jerusalem), July 1962 (vol. 1, 414 pp., $16; vol. 2, 543 pp., $19). W. Low, Ed. Academic Press, New York, 1963. Illus. Set, $30.

Physical Chemistry of Petroleum Solvents. W. W. Reynolds. Reinhold, New York; Chapman and Hall, London, 1963. 221 pp. Illus. $10.

Principles of Bioastronautics. Siegfried J. Gerathewohl. Prentice-Hall, Englewood Cliffs, N.J., 1963. 575 pp. Illus. $16.

A Programmed Course in Basic Electricity. By the staff of the Electrical Technology Department, New York Institute of Technology, under the direction of Alexander Schure. McGraw-Hill, New York, 1963. 349 pp. Illus. Paper, $6.95.

Programmed Supplements for General Chemistry. vol. 1. Gordon M. Barrow, Malcolm E. Kennedy, Jean D. Lassila, Robert L. Litle, and Warren E. Thompson. Benjamin, New York, 1963. 139 pp. Illus. Paper, $3.95.

Thermal Physics. Philip M. Morse. Benjamin, New York, rev. ed., 1964. 469 pp. Illus. $10.50.

Les Volcans Tertiaires et Quaternaires du Tibesti Occidental et Central (Sahara du Tchad). Pierre M. Vincent. Editions B.R.G.M., Paris, 1963. 308 pp. Illus. Plates. Paper.

Wind-Driven Ocean Circulation. A collection of theoretical studies. Allan R. Robinson, Ed. Blaisdell, New York, 1963. 171 pp. Illus. $3.75.