my competence to comment critically on each of the contributions; the total effect of the two volumes, however, is impressive, and Giese and his collaborators are to be congratulated for a piece of work that cannot help but give focus and impetus to an expanding and significant field of scientific endeavor.

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Propellants for Rockets

Theoretical Evaluation of Chemical Propellants. Roger Lawrence Wilkins. Prentice-Hall, Englewood Cliffs, N.J., 1963. xvi + 463 pp. Illus. $15.

Wilkins has endeavored to make the five chapters and four appendices in his book a complete treatise for those who wish to evaluate the performance of chemical propellants in rockets. The author's own experience has made him aware of the great difficulty involved in obtaining or finding exact values for the thermodynamic quantities needed, and he uses the first four chapters to outline in some detail the methods one can use to arrive at good estimates of these values, when they have not been experimentally determined. The fifth chapter is a sound discussion of several methods used to arrive at an evaluation of the potential performance of chemical propellant combinations. Wilkins has been particularly careful to give adequate references for all data used in his discussions.

In the first chapter, "Calculations of thermodynamic functions of ideal gases," the author discusses several methods of calculating thermodynamic properties in the ideal gas state from molecular structure data derived from spectroscopic studies. In chapter 2, "Calculation of thermodynamic functions of solids and liquids," he deals with the problem of calculating thermodynamic properties of liquids and solids from limited spectroscopic data, and in chapter 3, "Theoretical methods for estimating standard heats of formation," he summarizes data available on heats of formation of compounds and discusses several reliable methods for making estimations when experimental data are lacking. In chapter 4, "Calculation of chemical equilibrium in complex systems," Wilkins shows how the data derived in the first three chapters are used to calculate equilibrium constants for individual chemical species. These constants can be used to calculate chemical equilibria, and the methods can be applied to a system that contains gaseous and condensed phases. In chapter 5, "Performance of chemical propellants for rocket engines," he shows how the methods developed in the previous chapters can be used to estimate the performance of chemical propellants. Typical results on a large number of chemical systems are also given in chapter 5.

The appendices are entitled "Thermodynamic functions of a monochromatic oscillator, with additional functions required for anharmonic corrections"; "Thermodynamic functions of some atomic species in the ideal gas state"; "Thermodynamic functions of some diatomic species in the ideal gas state"; and "Thermodynamic functions of some polyatomic species in the ideal gas state."

Overall, Wilkins has achieved his goal of providing a sound discussion of the thermodynamic methods involved in calculating propellant performance. The use of data at chamber pressures of 500 psia (pounds per square inch absolute) and 1000 psia is perhaps good. This should indicate to the newcomer that, although standard performance is quoted for chamber pressures of 1000 psia, actual usage will generally give a lower value.

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Atmospheric Research

Radio Astronomical and Satellite Studies of the Atmosphere. Jules Aarons, Ed. North-Holland, Amsterdam; Interscience (Wiley), New York, 1963. viii + 561 pp. Illus. $17.50.

This book includes the 28 papers presented at the summer school of the Advanced Study Institute at Corfu, Greece, in June 1962. The institute is one of a series of such meetings for specialists, held under the sponsorship of the Scientific Affairs Division of the North Atlantic Treaty Organization. The book title appropriately describes the major techniques utilized in the studies presented. The studies deal with the following topics: structure and composition of the atmosphere (a review), radio star scintillations, radar astronomical studies, cosmic noise absorption, satellite studies of the atmosphere by radio techniques, planetary atmospheres and incoherent scatter, and solar-terrestrial relationships.

Roughly one-half of the papers comprise reviews of relevant fields, with extensive bibliographies. Several of these are particularly valuable in view of the current status of research in the fields—for example, the reviews of techniques that utilize satellite radio transmissions for studying the earth's upper atmosphere. Such studies appear to have reached the stage where first order results are well in hand, and the reviews should be helpful in preparing for second generation experiments. Similar statements can be made about several other areas covered in the book.

In view of the above, I recommend this book as reading for specialists in the areas that it covers. The editor is to be commended for including, in the introduction, a summarization of the study groups recommendations with respect to the directions in which such researches should be pursued in the future. In fact, expanding that portion would have made the book even more valuable.

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Ecology

Quantitative Plant Ecology. P. Greig-Smith, Butterworth, Washington, D.C., ed. 2, 1964. xii + 256 pp. Illus. $8.95.

The first edition of this book (published in 1957) brought together leading concepts and thinking in quantitative approaches to plant ecology, by its clearly written and critical evaluation. The book has become the primary reference guide in this field of research and the most useful introduction to these problems for students in all aspects of community ecology. The second edition, which retain virtually all the material of the first, includes pertinent literature through 1962. By far the largest proportion of literature used is by British authors, entirely in keeping with the productivity of that group in quantitative studies, but an increased number of references to papers by workers in other countries indicates

generally wider attention to these problems. Although the author did not intend the book to be a general survey, the recent French and German literature remains underrepresented.

The first five chapters have been revised only to the extent of interpolating accounts of selected new literature. Chapter 6, "Plant communities," of the first edition, has been nearly doubled in length and divided into two chapters treating "description and comparison" and "classification and ordination," the latter built largely on work published since 1957. These two chapters will be especially useful for orienting students confronted by the variety of viewpoints taken by different groups of workers. The final summarizing chapter is little changed. Three new tables have been added to "Appendix B," and the list of references is nearly doubled.

The second edition is more suitable for use as a textbook, particularly as a result of the new treatment of the section on plant communities, but the book necessarily has a sharp focus on quantitative methods in community ecology and is suitable only for advanced instruction. A list of mathematical symbols in the front would have facilitated use of the book as a reference work and textbook. This book is the most critical evaluation of measurement and analysis problems in plant ecology available in one volume, and the second edition again brings it abreast of contemporary work. We are indebted to the author for the criticism and stimulation he applies to developing thought in this fundamental area within the realm of ecology.

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Science and Discovery Series

The Laws of Physics. Milton A. Rothman. Basic Books, New York, 1963. viii + 254 pp. Illus. $4.95.

There is a class of readers for whom I would think this book a boon indeed: those who are already well into the essential abstractions of physics and much excited about it, and who want to see the road ahead. Around this central group there are others who will respond positively, out to and including people who teach physics. The writing is very simple and straightforward, and in this style the author introduces a number of topics that are usually dodged at this level. For example, about 15 pages are devoted to mechanics after Newton—energy and potential, the Lagrangian and the Hamiltonian, and the relation between symmetries and conservation laws. The discussion goes in a fairly conventional pattern into forces and fields and thence into relativity. A sketch of quantum physics is preceded by a simple treatment of probability and of thermodynamics. A final chapter on elementary particles ends with the strong and weak interactions. There are three appendices: on momentum and energy in elastic collisions, on the relativistic transformations, and on the Mössbauer effect.

A critical reader will produce quite a few marginal questions and exclamations, but I think many of these comments will refer to matters that are essentially minor [for example, the "special theory deals only with systems moving at constant velocity" (p. 141)], if the intent of the book is kept clearly in mind. Rothman's brief treatment of the direction of time seems utterly misleading.

I have one much more general criticism. The historical and philosophical by-play is unhistorical and unphilosophical. There are the standard animadversions about the Greeks—Aristotle, but any Greek will do, even Democritus, *daimon* of physics. There is the standard contrasting of modern science with previous philosophers (rationalists all), followed (only two pages later) by the statement that "Newton was able to show by mathematical proof that the moon's travel around the earth must indeed be ruled by the force of gravity (p. 16)."

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Biospeleology

Biospéléologie: La Biologie des Animaux Cavernicoles. A. Vandel. Gauthier-Villars, Paris, 1964. xviii + 619 pp. Illus. F. 64.

Rich, endemic cave faunas are best developed in temperate regions near the margins of Pleistocene glaciation, regions like those found in southern and western Europe, the southeastern United States, Japan, and New Zealand. Systematic investigations of cave animals began about 1840 in both Europe and the United States. In this country, cave biology flourished between 1870 and 1910, with the work of Packard, Cope, Banta, and Eigenmann, but the foundations of modern biospeleology were laid in Europe by E. G. Racovitza, René Jeannel, and others in the period between 1907 and World War II. There has been no general treatise on cave biology since Jeannel's *Les Fossiles Vivants des Cavernes* (1943).

Owing to the rapid advances made during the last two decades in the study of this unique habitat, a fresh and more comprehensive approach is certainly indicated. It is especially appropriate that this should be attempted by Vandel, the director of the Laboratoire Souterrain du C.N.R.S. at the Grotte de Moulis (Ariège), France. The experimental investigations carried out by the author, his colleagues, and his students at the cave laboratory are reviewed and well integrated with the descriptive material that forms the core of his book.

After a short introduction, there is a detailed inventory (246 pages) of the cavernicolous animals of the world. This is by no means a checklist, which would more than fill a volume of this size, but a carefully balanced treatment of each of the known groups of cavernicoles at the ordinal, familial, or generic level, depending on their ecological significance and diversity. Part 3 deals with geographic distribution and ecology of cavernicoles. Parts 4 and 5 treat physiology and behavior, and Part 6 the evolution of cavernicoles.

The sources of food utilized by cave animals include not only organic debris washed underground by sinking streams, but also microorganisms that occur in cave silts and clays. Evidence is reviewed for the dependence of many cavernicoles on cave mud, either throughout their life cycle or in juvenile stages. Most troglobites (obligate cavernicoles) have undergone evolutionary changes that led to loss or reduction of eyes and pigment, reduction of the metabolic rate, and loss of the ability to adapt physiologically to temperature and humidity conditions other than those prevalent in caves. The few species that have been studied have a much longer life cycle than their close epigean relatives.

There is abundant evidence, well presented by Vandel, which suggests that preadaptation has been historically significant in determining which groups of animals could successfully colonize