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dealing with freshman (indeed, possibly high-school) mechanics (without calculus), adopts the old-fashioned practical approach. Since no indication of the original (Russian) date of publication is given, it is not clear whether this is still the preferred method in Russia. Despite the rather musty flavor of some of the presentation, the discussion of the underlying notions is quite extended, and the student who has completed this course should have at his easy command the basic concepts of vectors, point, body, and surface forces, and fundamental kinematics of a variety of mechanisms, as well as Newton's laws. There are many familiar examples mainly from the workshop. This leads the reviewer to suspect that this volume may have been designed to give some background to the apprentice mechanic (which it certainly does in an excellent manner) rather than as a "Russian Monograph and Text on Advanced Mathematics and Physics," as advertised by the publisher! This book is also distinguished by several pages of extreme historical chauvinism and some absurd political propaganda. Many Russian scientists and engineers are mentioned, but only Archimedes, Galileo, Newton, and Euler of the Western Europeans, and even Euler is claimed as a Russian!

Spectroscopic Properties of Rare Earths. By Brian G. Wybourne. 236 pp. Interscience, New York, 1965. \$10.50.
Reviewed by William F. Meggers, National Bureau of Standards.

When the two-volume treatise, *Quantum Theory of Atomic Structure* by John C. Slater (reviewed in *Physics Today*, May 1961, p. 48), was published in 1960, it was disappointing to find in 940 pages that the 28 rare-earth elements were omitted because "The shells of equivalent f electrons are more complicated than the d -shells . . . with the result that both the theoretical and experimental work done on the rare earths is rather fragmentary." Despite incredible complexities and difficulties, considerable progress has been made (since 1930) in the experimental description and quantum interpretation of characteristic spectra of 14 lanthanons (^{58}Ce to ^{71}Lu) and 7 actinons (^{90}Th to ^{96}Cm).

Now, in *Spectroscopic Properties of Rare Earths*, Wybourne has given a comprehensive but concise review of this progress with emphasis on the theoretical interpretation of experimental data. The subject is treated in 6 chapters: the rare earths, energy levels of rare-earth atoms and ions, intensities in rare-earth spectra, the Zeeman effect in the rare earths, hyperfine structure and isotope shifts, and spectra of rare-earth salts followed by a list of 487 references and a subject index of three pages. The second, and longest, chapter outlines the theory of such subjects as electronic configurations, interactions of various kinds, coupling schemes, quantum numbers, matrix elements of operators, calculation of energy levels, atomic wave functions, etc. In the next three chapters, this theory is then applied to selected problems in transition probabilities, external magnetic effects, and nuclear magnetic or isotopic effects in gaseous rare-earth spectra. In the final chapter, group theory is applied to absorption spectra of rare earths in crystals, primarily for the benefit of solid-state physicists.

As an example of intensity problems in rare-earth spectra, the line strengths of a transition array from europium ions are calculated and compared with reported measurements. The bulk of the discrepancy is ascribed to the experimental determination of oscillator strengths in spectra afflicted with wide hyperfine structure. Indeed, Eu II is second to worst in this respect, and it will be interesting to test this explanation with a comparison of calculated and measured intensities in a rare-earth spectrum where isotope shifts (Ce II) or hyperfine structures (Tm II) are relatively inconspicuous.

A valuable contribution is the list of 487 references to recent (since 1930) publications on experimental and theoretical developments. The only error detected is that references 9 and 96 are identical; the latter should be replaced by "Rev. Mod. Phys. 14, 96-103 (1942)," and 96 should replace 9 in Table 2-2 on page 41.

Guided by partial analyses of a few rare-earth spectra, and by theoretical considerations, Wybourne has boldly



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An in-depth study of the major theoretical techniques currently used in radar system analysis and design. The different aspects of the field are discussed by individuals who have worked intensively with their subjects and who present techniques they know to be useful. 1965. Approx. 632 pages. Prob. \$19.50.

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Editor: **E. H. LEE**, 1965. 714 pages. \$30.00.

PART 3—General Papers

Editor: **E. H. LEE**, 1965. 637 pages. \$26.00.

PART 4—Symposium on Biorheology

Editor: **A. L. COPLEY**. 1965. 634 pages. \$25.00. *Interscience Books.*

PHYSICS OF NON-CRYSTALLINE SOLIDS

Proceedings of the International Conference, Delft, July, 1964

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A careful treatment of: principles of statistical mechanics . . . applications of the canonical distribution . . . statistical thermodynamics of gases . . . applications of fermi- and bose-statistics . . . strongly interacting systems . . . and fluctuations and kinetic theories. *A North-Holland (Interscience) Book*. 1965. 425 pages. \$19.00.

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presented the established and inferred normal electron configurations (and spectral terms) of 14 neutral lanthanum atoms and their first three stages of ionization; likewise of 14 neutral actinon atoms and four stages of ionization—125 spectra in all. Here is a challenge to several generations of experimental spectroscopists who must either confirm or correct these predictions!

Science in Progress, 14th Series. Wallace R. Brode, ed. 286 pp. Yale University Press, New Haven, 1964. \$8.50.

Reviewed by R. B. Lindsay, Brown University.

The National Lectureships sponsored annually by the Society of the Sigma Xi and the Scientific Research Society of America are well known and justly admired. For many years it has been customary to publish the lectures in collected form, and the book under review constitutes the 14th series. It contains nine articles with an editorial preface by Wallace Brode. It is their purpose to present in general review form latest developments in certain aspects of science, both physical and biological. Physics is represented by material on magnetogasdynamics, engineering by an essay on space propulsion engines, chemistry by articles on structural reorganization through ligand interchange and the properties of solid carbon. In the biological sciences there are papers on the relation between nutrition and human behavior, the uniqueness of plants, and social anthropology. Finally, there are two articles devoted to what may be called, in the broad sense, the philosophy and sociology of science. As might be expected, the last two are the easiest for the general reader to handle.

All the articles are authoritative, are written with care, and are amply illustrated. On the other hand, they make a variety of demands on the reader's background. The physics article, for example, will not convey too much to the person who is not already familiar with electromagnetic theory, thermodynamics, and plasma physics. Similarly, the paper on ligand interchange implies a thorough grasp of modern theories of chemical reactions. It is true that an examination of

this material may stimulate the general reader's interest sufficiently so that he will want to go and inform himself further on these matters. But inevitably the interesting question arises: for what audience are these lectures really intended? If they are directed to the scientific specialist who wants to know more about some specialty other than his own but in his own branch of science, the articles in the present volume succeed admirably, but one wonders why they should be collected in a single volume. If on the other hand, they are intended for the scientist who wants to know what is going on in quite another branch of science than his own, this reviewer feels that the success of the present volume must be considered as only moderate. If the latter aim is the intended one, it would seem that the authors have not fully met the obligation to present their results in more general and descriptive terms with less emphasis on analysis and more stress on the relation with science as a whole. This is of course by no means an easy thing to do, but is being accomplished with considerable success in most of the articles in such magazines as *Scientific American* and especially in the *New Scientist*.

The volume is beautifully produced. Each article is accompanied by a brief bibliography, and there is an adequate index.

Plasma Diagnostics with Microwaves. By M. A. Heald and C. B. Wharton. 452 pp. John Wiley, New York, 1965. \$13.50.

Reviewed by Harold P. Furth, Lawrence Radiation Laboratory.

A precondition for the development of experimental plasma physics has been the availability of accurate non-destructive diagnostics. An important diagnostic tool of this type is a weak beam of electromagnetic radiation: by sampling the plasma dielectric constant along its trajectory, it can provide information about plasma density, temperature, and degree of quiescence, as well as about the interior magnetic field strength.

The range of maximum usefulness of microwave diagnostics is determined by the condition that the beam frequency must exceed the plasma frequency if transmission is to take place