tribution studies and on mass distributions. Although many more observations and types of data are available for the galaxy than for other stellar systems, neither its mass nor dimensions are satisfactorily established. Perek favors a galactic mass slightly less than 10^{11} suns, while other workers in the field—for example Brandt—favor a figure more closely comparable with that suggested for the Andromeda spiral: 3 to 4 $\times$ 10^{11} solar masses.

The shock-wave theory of novae is presented in considerable mathematical detail by John Hazelhurst. Whether or not one accepts this theory (and I do not), it is valuable to have a thorough presentation of shock-wave phenomena in stellar interiors or atmospheres. The theory of starlight polarization and the method for analyzing it are presented in some detail by K. Serkowski. Although it seems most likely that polarization results from the scattering of starlight by elongated grains in a galactic magnetic field, attempts to detect or measure the magnitude of this field by studies of the Zeeman effect on the radio-frequency 21-centimeter line have proved unsuccessful.

G. Herbig's review of the *T* Tauri stars is a well-organized, lucid account of these exotic variables, which are believed to represent the earliest stages of stellar evolution. Clearly many additional difficult observations will have to be obtained before we solve the problem presented by these stars. Data from both Schmidt cameras and large telescopes are needed to supply statistics, to monitor light variations, and to provide detailed information on individual strategic stars. Unfortunately, progress toward the solution of this and many other problems, such as galactic dynamics, is impeded by lack of adequate optical instruments. Despite great increases in astronomical activity, only three optical telescopes with an aperture greater than 60 inches have been constructed in the United States since World War II: California Institute of Technology, Kitt Peak National Observatory, and Lick Observatory. Most observatories have only small telescopes, many of which are more than half a century old.

Kopal and his associates have done a good service to astronomy by producing this excellent volume; hopefully, many other volumes will be published in the series.

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Avian Biology

The Life of Birds. Joel Carl Welty. Saunders, Philadelphia, 1962. xiii + 546 pp. Illus. $9.

This textbook of avian biology is intended for general, not advanced, students, and it successfully avoids mere technicalities. However, despite Welty's expressed modest aims, the coverage is much greater in scope and more inclusive in content than the opening statements led me to expect. In fact, the book will easily hold its place among recent ornithological texts. The author has read widely and has chosen his sources wisely. He states that he has depended on Stresemann's masterful volume more than on any other single reference (and who can criticize him for this?), but that he has included material and ideas from over 8000 books and articles, of which more than a tenth are listed in his bibliography. He has done a good job of organizing this vast amount of information and has created a simple, straightforward account that the general reader can follow with easy comprehension.

The material is presented in 23 chapters covering various aspects of morphology, physiology, locomotion, behavior, life histories, ecology, evolution, and the classification of birds. Each chapter is well illustrated with photographs, drawings by the late Norman Tolson, diagrams, and tables. On the whole, the drawings, either from the birds themselves or from the literature, are well done and demonstrate the superiority of drawings over photographs in conveying information. Bird photographers have produced pictures that give pleasure to lay audiences, but by and large they have not added seriously to the knowledge of birds. I have long thought that the very excellence of many photographers' "shots", which obviously involve the expenditure of much time, skill, and patience, could almost be used as a measure of the unused opportunities these men had to learn new facts.

Thus, the book's coverage is broad; birds from all parts of the world and of all families are used to exemplify and to illustrate special problems and topics, and the pertinent literature is used to document the account. If any criticism is to be made, and this may be only my personal reaction, it is that some of the author's generalizations are oversimplifications—for example, the first sentence of chapter 1: "The great struggle in most animals' lives is to avoid change," or the statement (p. 139) that brood parasites possess a "psychic control over egg-laying." The index is adequate.

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Organic Reaction Mechanisms

Physical Organic Chemistry. Jack Hine. McGraw-Hill, New York, ed. 2, 1962. x + 552 pp. Illus. $11.50.

After the appearance, in the early 1940's, of the important books on organic reaction mechanisms by Branch and Calvin, by Hammett, and by Watson, more than a decade passed before books of comparable scope and stature were published by Ingold (1953) and Hine (1956). Inasmuch as Ingold wrote as a charter member and dean of the field, it is a tribute to Hine that his *Physical Organic Chemistry* (a misnomer) achieved influence and authority on a par with Ingold's work.

This second edition, thoroughly revised and brought up to date, is as authoritative for 1962 as its predecessor was for 1956. The organization of the first edition is retained, for the most part, but two chapters have been added. One, on methylenes, is welcome both for the importance of the topic and for Hine's special contributions to that area. Another, on quantitative correlation of rates and equilibria, includes topics formerly treated in other chapters.

Hine's scheme of organization and his general emphasis tend to be guided by tradition. These and other conservative qualities are laudable, in that they guarantee attention to topics of focal interest in the recent past and restrain the endorsement of radical points of view, but the traditional approach is often uneven. For example, the chapter "Mechanisms for nucleophilic displacements on carbon" deals only with those mechanisms in which the old bond is broken *before* or *during* formation of the new bond. The equally important mechanism in which the old bond breaks *after* the new bond is formed is not presented until several chapters later, and even then that aspect is not placed in proper perspective.

Some topics are not adequately treated, and some important ones are

omitted: Kosower's Z values, the von Richter reaction, the isokinetic relationship, reactions of isonitriles, and the question of *ortho* : *para* ratio in aromatic nucleophilic substitution.

Despite these shortcomings, Hine's second edition is the leading book in its field, both as a graduate level textbook and a reference work.

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Introductory Textbook

Elements of Probability and Statistics. Frank L. Wolf. McGraw-Hill, New York, 1962. xv + 322 pp. $7.50.

This book, intended for use in an introductory course in probability and statistics, presupposes that the reader has had only high school algebra. Logarithms are outside its scope, and the author devotes space to the elementary notions of set algebra (using Venn diagrams without naming them as such), the meaning of an exponent, the use of the summation notation, the reading of algebraic expressions involving subscripts, the pronunciation of the Greek letters used, significant digits, and inequalities and absolute values. The reader is, however, presumed to be familiar with Euclidean geometry and the process of interpolation, and he is presumed to be well enough acquainted with physical principles to appreciate the interpretation of variance as a moment of inertia.

The book does provide a good elementary introduction to the vocabulary of probability and statistics and to the computation and use of the, by now, classical formulas of statistical theory.

The author states on page 165 that up to that point, with the exception of Problem 7-40 (dealing with the Poisson distribution) and the problems based on this distribution, he has restricted attention to experiments that have a finite number of possible outcomes; this is not completely correct—for example, Problem 7-30 and Problem 7-83.

The book contains a bibliography of 22 items, including ten paperback books, an index, and tables of square roots, binomial distribution (both individual terms and cumulative), random digits, cumulative normal distribution, chi-square distribution, F-distribution, and Student's t-distribution.

Overall, the book gives the impression of careful preparation and proofreading. I found surprisingly few misprints. I enjoyed the sense of humor manifested by the limericks the author uses to introduce some of the sections, his comment about the word scedastic, the imaginary dialogue between two characters, and his recommendation that the reader refer to Halmos's book on measure theory.

I believe the book will be a good text for classroom use at the level for which it is intended. For students with a better mathematical background, there are other books available, better designed for their needs.

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New Books

Mathematics, Physical Sciences, and Engineering

Clouds, Rain, and Rainmaking. B. J. Mason. Cambridge Univ. Press, New York, 1962. 145 pp. Illus. Paper, $1.95; cloth, $4.50.

Collection of Problems in Physical Chemistry. Jiri Bares, Cestmir Cerny, Vojtech Fried, and Jiri Pick. Translated by Helena Watney. Pergamon, London; Addison-Wesley, Reading, Mass., 1962. 626 pp. Illus. $9.75.

Decomposition of Austenite by Diffusional Processes. Proceedings of a symposium, Philadelphia, October 1960. V. F. Zackay and H. I. Aaronson, Eds. Interscience (Wiley), New York, 1962. 632 pp. Illus. $35.

Dynamics of Atmospheric Entry. Robert Clifton Duncan. McGraw-Hill, New York, 1962. 317 pp. Illus. $12.50.

Earth, Sea, and Air. Jerome Spar. 159 pp. Illus. Paper, $1.75; cloth, $2.95.

Elementary Solid State Physics. Charles Kittel. Wiley, New York, 1962. 351 pp. Illus. $8.75.

An Introduction to the Chemistry of Complex Compounds. Aleksander Abramovich Grinberg. Translated from ed. 2 (1951) by J. Rovtar Leach. D. H. Busch and R. F. Trimble, Jr., Eds. Pergamon, London; Addison-Wesley, Reading, Mass., 1962. 384 pp. Illus.

Introduction to Ligand Field Theory. Carl J. Ballhausen. McGraw-Hill, New York, 1962. 307 pp. Illus. $11.75.

An Introduction to Mathematical Machine Theory. Seymour Ginsburg. Addison-Wesley, Reading, Mass., 1962. 157 pp. Illus. $15.

Linear Active Network Theory. Louis de Pian. Prentice-Hall, Englewood Cliffs, N.J., 1962. 552 pp. Illus. Trade ed., $16; text ed., $12.

Linear Electric Circuits. Z. Hennyey. Translated from the Hungarian by N. Izsak. Pergamon, London; Addison-Wesley, Reading, Mass., 1962. 330 pp. Illus.

Magnetostatic Principles in Ferromagnetism. vol. 1. William Fuller Brown, Jr. North-Holland, Amsterdam; Interscience (Wiley), New York, 1962. 214 pp. Illus. $7.75.

Metals Reference Book. vols. 1 and 2. Colin J. Smithells. Butterworth, Washington, D.C., ed. 3, 1962. 600 pp. Illus. $32.50.

Noise and Fluctuations. An introduction. D. K. C. MacDonald. Wiley, New York, 1962. 126 pp. Illus. $6.50.

Nuclear Graphite. R. E. Nightingale, Ed. Academic Press, New York, 1962. 559 pp. Illus. $15.80.

Ordinary Differential Equations. L. S. Pontryagin. Translated from the Russian by Leonas Kacinskas and Walter B. Counts. Addison-Wesley, Reading, Mass., 1962. 304 pp. Illus. $7.50.

Permanent Magnets and Magnetism. Theory, materials, design, manufacture, and applications. D. Hadfield, Ed. Iliffe, London; Wiley, New York, 1962. 568 pp. Illus. $16.50.

Physics and Chemistry of Electronic Technology. Harry L. Van Velzer. McGraw-Hill, New York, 1962. 384 pp. Illus. $10.

Programming and Utilization of Research Reactors. vol. 1. Symposium, Vienna, October 1961. Academic Press, New York, 1962. 344 pp. Illus. $9.

Reactor Handbook. vol. 3, pt. B, *Shielding.* Everitt P. Blizard and Lorraine S. Abbott, Eds. Interscience (Wiley), New York, ed. 2, 1962. 303 pp. Illus. $9.

Recent Progress in the Chemistry of Natural and Synthetic Colouring Matters. T. S. Gore, B. S. Joshi, S. V. Sunthankar, and B. D. Tilak, Eds. Academic Press, New York, 1962. 686 pp. Illus. $24.

Semiconductor and Conventional Strain Gages. Mills Dean and Richard D. Douglas, Eds. Academic Press, New York, 1962. 402 pp. Illus. $15.

A Sophisticate's Primer of Relativity. P. W. Bridgman. Wesleyan Univ. Press, Middletown, Conn., 1962. 199 pp. Illus. $4.50.

Space Age Astronomy. Symposium, California Institute of Technology, August 1961. Armin J. Deutsch and Wolfgang B. Klemperer, Eds. Academic Press, New York, 1962. 552 pp. Illus. $16.50.

Statistical and Inductive Probabilities. Hugues Leblanc. Prentice-Hall, Englewood Cliffs, N.J., 1962. 160 pp. Illus. Trade ed., $6.65; text ed., $5.

Strange World of the Moon. An inquiry into its physical features and the possibility of life. V. A. Firsoff. Science Editions, New York, 1962 (reprint). 236 pp. Illus. Paper, $1.65.

Surface Phenomena in Metals and Alloys. V. K. Semenchenko. Translated from the Russian by N. G. Anderson. R. Kennedy, Ed. Pergamon, London; Addison-Wesley, Reading, Mass., 1962. 486 pp. Illus. $14.75.

Theory and Applications of Ultraviolet Spectroscopy. H. H. Jaffe and Milton Orchin. Wiley, New York, 1962, 639 pp. Illus. $15.

Transformations of Surfaces. Luther Pfahler Eisenhart. Chelsea, New York, 1962. 390 pp. Illus. $4.95.