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"Fills a distinct void in the current spectrum of texts on classical mechanics; it not only discusses significant topics frequently omitted from other texts, it also clearly presents topics of great current research interest."—*Professor Joseph Ford, Georgia Institute of Technology*

CLASSICAL AND MODERN MECHANICS

James H. Bartlett

Classical and Modern Mechanics is an up-to-date treatise, usable as a textbook, for physicists, astronomers, and engineers. It conveys the essentials of modern mechanics with typical problems for illustration; and it lays particular emphasis on the motion of particles, both slow and fast, under the influence of electromagnetic and gravitational forces. It covers its subject matter comprehensively, currently, and yet simply enough for the average graduate student and the advanced undergraduate. The use of mathematical tools is kept to the minimum necessary.

Paper \$6.50, Cloth \$15.00

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is almost entirely the work of two men—W. H. Miller and R. A. Marcus—working independently and from complementary points of view. In numerical tests the new theory has acquitted itself remarkably and sometimes outrageously well; it is no trivial extension.

M. S. Child heads the theoretical-chemistry department at Oxford and is known for excellent work on the semiclassical analysis of curve-crossing problems. His book covers the standard material of quantum scattering theory—phase shifts, Green's functions, perturbation theory, and so on—succinctly and often with elegance, but the emphasis is on recent work by chemists with application to molecules, and particularly on the semiclassical limit. We find a very full discussion of semiclassical theory for the central field problem, for resonances, for curve-crossing and nonadiabatic transitions in general, and finally for inelastic and reactive molecular collisions according to the new work of Miller and Marcus.

One can get to the semiclassical theory of complex collisions in two ways: from the integral (Feynman) formulation of quantum mechanics, following Miller; or from the differential (Schrödinger) formulation of quantum mechanics, following Marcus. Each route has advantages. Child emphasizes the work of Marcus, since it starts on more familiar ground and proceeds, for a while, as ordinary WKB theory, but there is also a brief section on the Feynman formulation.

The book ends with a number of useful appendices, among them notable material on the theory of connection formulas and of curve crossing in the momentum representation.

This is a text in the recent history of theoretical chemistry, because chemists discovered and adapted scattering theory, and it is rich with detail and example. Child's *Molecular Collision Theory* is not a primer in scattering. Rather, it is an excellent book to which one turns after consulting the introductory chapter on collisions in any of the standard quantum-mechanics texts.

PHILIP PECHUKAS
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Astronomy

F. M. Branley, M. R. Chartrand III, H. K. Wimmer

564 pp. Dun Donnelley Publishing Co., New York, 1975. \$13.50

Since the launching of the Soviet satellite Sputnik I (1957) and the following massive efforts by the US and Russia to win the space race, there has been a

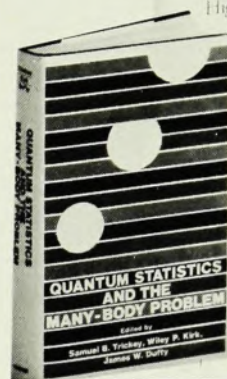
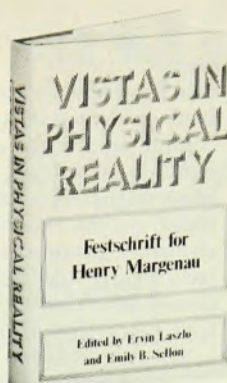
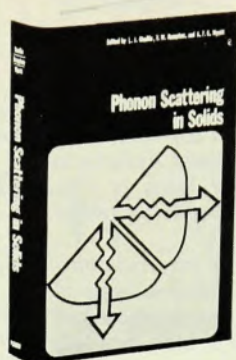
great upsurge in the popularity of astronomy. In particular, introductory (descriptive-type) astronomy texts for courses usually offered as science electives have been published in increasing numbers. *Astronomy*, by Franklyn M. Branley, Mark R. Chartrand III and Helmut K. Wimmer, is aided in its presentation by superb illustrations, surely the most striking new feature in the book. The more than 150 paintings and 100 photographs convey much information and are thought-provoking in their design. It is a great pity, however, that only a very small fraction of them appear in color.

The material in the text is presented in somewhat unorthodox order. The first half of the text covers the essential topics on stars, the stellar energy cycle, galaxies and the universe (including black holes). The last half, on the solar system, is brought up to date with the inclusion of some of the latest NASA photographs and findings. A final chapter deals with the search for life, providing the student much food for thought.

The text is well written, and great care has gone into making it clear to the reader. Some nice analogies are introduced via the illustrations and text (for example, "an erg is about the energy of a mosquito flying full speed ahead"). Equations, as well as geometric drawings, have been kept to a minimum; in the section on optical telescopes, to mention one case, a geometric drawing of the light rays and focal point would have been welcome. The book uses angstroms for wavelength measure; perhaps nanometers would have been better, in keeping with the modern trend. The captions for the figures are longer than in many texts and describe the illustrated ideas quite well. Some photographs of important current research are included, such as the neutrino experiment in a gold mine in South Dakota and the search for gravitational waves at the University of Maryland.

Chapter 14 covers the concepts of right ascension and declination, as well as a description of some seasonal constellations. Unfortunately, the figures on the seasonal constellations only stress certain individual stars. Because the study of constellations and their identification is so popular with students taking a course on this level, I feel that additional constellation figures with lines connecting the appropriate stars would greatly enhance the book. Alternatively, separate star charts could be added to the text as an appendix.

In chapter 16, information on the solar system's planets is well tabulated and brought up-to-date. It would be of great interest to include a tabulation of artificial-satellite data in this same chapter, thereby allowing one to compare such parameters as distance, orbit-



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al periods and so forth for the planets and natural and artificial satellites.

HELMUT K. WIMMER



In addition to the text, an instructor's manual is provided which contains quizzes and worksheets. The quizzes assume no mathematical background, as is the case with the questions in the main text; the worksheets contain some bare minimal mathematics. Both are optional, and the instructor must decide whether or not to supplement the main text with them.

This book, with its beautifully designed illustrations, should provide many introductory astronomy students with new insights on this subject.

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Theory of Defects in Solids: Electronic Structure of Defects in Insulators and Semiconductors

A. M. Stoneham

955 pp. Oxford U. P., New York, 1975.
\$79.50

Solids are known for the cornucopia of defects of all degrees of pathological complexity that determine most of their properties; by now the number of defects must have surpassed even the plethora of elementary particles. All of these defects have structural as well as electronic aspects, although in many instances only one type is dominant. To treat all of them with any theoretical detail in one book would have been an

unmanageable undertaking, and the result would have been much longer than A. M. Stoneham's nearly 900 pages (at almost 10 cents per page!). Stoneham has therefore limited the scope of his book to defects in insulators and semiconductors, with only an incidental mention of metals and heavily doped semiconductors. He has also concentrated on the theoretical aspects of the electronic properties of these defects; in fact, nearly half of the book is concerned with theoretical *methods* rather than theoretical *results*.

The presentation and intercomparison of advantages and disadvantages of various theoretical approximations and schemes is very complete and detailed. One consequence is that, when it comes to experimental data, only those are given that are essential for guidance or comparison with theory. The stress is placed on directly observable electronic phenomena (such as optical transitions, photoionization, local modes, infrared absorption, external fields and resonance) of *static* defects. Hardly any mention is made of kinetic and dynamic questions of the formation, motion and annealing of defects, although the electronic aspects of these phenomena are often crucial, as illustrated by the frequent failure of the simple point or shell-model theories. The book is not and does not intend to be an encyclopedia of defects. Rather, it is a very systematically written survey of the variety of theoretical approaches necessary for the study of defects. The author's attitude is well illustrated by the first sentence of his chapter on vacancies in valence crystals: "There is no adequate theory of the defects discussed in this chapter." True but disconcerting.

Upon reading this book, one realizes why defects in insulators and semiconductors provide such a rich field for theory: even though usually many kinds of defects are simultaneously present, (1) they can often be observed individually, (2) they produce many easily measurable effects, either electronic or optical or elastic or resonance and (3) last but not least, they are not hidden behind the sometimes quite impenetrable curtain of electrons in metallically conducting solids.

The author avoids dwelling too long in the many areas where he made his own major contributions (polarons, F , V_k and H centers, quantum theory of diffusion and so on), and the result is a very uniform, coherent and pleasing presentation. The book also strikes a happy medium between being a textbook and a monograph, with a thoroughness of presentation and explanation that makes it suitable for graduate students. The wide coverage, the list of nearly 2000 references and a fair subject index make it a true monograph on theoretical methodology in this particular

field. In that sense it is unique and of great value to all interested in the basic aspects of defects in solids.

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new books

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Muon Physics, Vol. 3: Chemistry and Solids. V. W. Hughes, C. S. Wu, eds. 305 pp. Academic, New York, 1975. \$41.50

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Optics

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Topics in Applied Physics, Vol. 7: Integrated Optics. T. Tamir, ed. 315 pp. Springer-Verlag, New York, 1975. \$34.40

Quantum Electronics and Lasers

Engineering Applications of Lasers and Holography. W. E. Kock. 400 pp. Plenum, New York, 1975. \$25.00

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Fluids and Plasmas

Plasma Electrodynamics, Vol. 2: Non-Linear Theory and Fluctuations. A. I. Akhiezer, I. A. Akhiezer, R. V. Polovin, A. G. Sitenko, K. N. Stepanov, eds. 303 pp. Pergamon, Oxford, U.K., 1975. \$22.50

Microwave-Plasma Interactions (Proc. of the P. N. Lebedev Physics Institute, Vol. 73). D. V. Skobel'tsyn, ed. 135 pp. Plenum, New York, 1975. \$36.00