

Each chapter has a set of problems, graded according to their difficulty by several groups of students who have studied the material at Rice University. The authors' occasional use of whimsical section titles (such as "The Disappearance of Diabolical Degeneracies") and their inclusion of well chosen quotations at the beginning of each chapter help to maintain a sense of liveliness. This feeling also comes through in their style of writing.

My chief complaint about the book is its complete lack of any connection to experiment. No photographs of spectra, no tables of data, no comparisons of deduced results with any experimental values appear in this book. In fact, virtually no reference is made anywhere to the real world. At some time or other we have all heard and been appalled by stories of the early Greek philosophers, who deduced many results through their logical analyses from theoretical models but who refused to make even the simplest experimental tests to see if their deductions agreed with observations. Perhaps today we are moving back in that direction; this book is not the only one that ignores the question, "Do this model and the deductions based on it have any correspondence with physical reality?" If you want a book to help teach your students to apply quantum-mechanical methods to the central-force problem, the one-dimensional N -electron atom, the double square-well potential and other theoretical models, this book will do it and do it well. But if you feel that students also ought to acquire some basis for judging the validity of models or that they should learn something about how to inquire into the way Nature behaves, then this book must be supplemented with other material to provide a complete presentation of atomic, molecular and solid-state physics.

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Science in Flux

J. Agassi
553 pp. D. Reidel, Boston, 1975.
\$48.00

It is quite in keeping with the style of Joseph Agassi's book, which is at once racy and down-to-earth, to begin a review of it with some practical questions. About the quality of the mind displayed in it there can be no doubt—Agassi in these essays is lively, penetrating, often brilliant. But what inducement might there be for a person, or a library, to acquire this large and expensive book? Or for a scientist, for example, to embark on the "enjoyable hours of reading" promised on the dust-jacket?

The book is obviously about science, and Agassi has had a lot of good and original thoughts about science, which have been published here and there in philosophical journals. Many of these thoughts are republished here, with afterthoughts in the form of recurrent appendices, many of them also previously published. The net effect of all this is impressive and confirms his high standing among philosophers of science. But, while impressive, the result is less unified than its collection into one volume might lead one to hope (or even give one a right to expect). This criticism holds not only for the arrangement of the book but also for its contents. To quote the dust-jacket again, "An avant-garde comprehensive view of science should emerge from this collection of essays." Yet, even after a consecutive reading, Agassi's special contribution to the philosophy of science is hard to pin down with any precision.

In a way, of course, the title gives us fair warning; precision and neatness are hardly to be expected of a subject in flux. But there is something unsatisfactory about that as a final characterization of science. The title repudiates the inductivist-positivist view that science grows ineluctably toward perfect knowledge, but hardly anyone now holds that view, and Agassi admits that he doesn't take it seriously either. To see what is going on, one must place the book in its proper professional and historic context. The philosophical tradition to which Agassi belongs is that of Sir Karl Popper and his followers; the dedication of *Science in Flux* is to Popper, "in gratitude; with admiration and dissent," and Agassi says disarmingly in the preface that he wishes to play Maimon to Popper's Kant—that is, in effect, to go beyond the Master by the application of his own critical methods to the results of his own work. Now Popper has been of very great importance and influence in the philosophy of science, principally through his special interpretation of probability, his concept of demarcation, and his principle of falsification. Roughly speaking, Popper believes propositions to be scientific only when they take a certain kind of risk—that is, when the predictions they lead to are highly improbable. A lot of actual confirmations of a theory are of far less interest than a single possible falsification, and it is by their offering such possibilities that we can distinguish scientific theories from merely metaphysical ones. These views have led to a certain amount of controversy and misunderstanding, which Agassi tries, sometimes gently, sometimes with considerable impatience, to resolve or clarify. In particular he corrects—against his own admitted earlier misunderstanding—the popular view that Popper has been mainly interested in the actual falsification of theories.

The arguments on this and other points are, however, intricate and nuanced, and

there is little point in trying to summarize them for an audience of scientists. Agassi's book finds its place naturally enough in its context, but putting it there restricts its readership to a handful of professionals in the philosophy of science. If even philosophers can find Agassi sometimes disconnected, always idiosyncratic and often more subtle than the arguments with which he deals deserve, scientists are not likely to find him an easy entry into the philosophy of science. And yet some of them might like to try it anyway. Emerging from the detail of the graduate seminar, Agassi comes to examine, toward the end of the book, positive evidence as a social institution, for example, and the relationships between reason and religion. Many of his insights are formulated with trenchant precision; some of his images are powerful and memorable—for example, he represents the old positivist view by a monumental socialist sculpture, square-jawed and far-seeing, in contrast to Agassi's own perception of the wisest of humans as a clown on a tightrope. He ends, as Maimon did, poised between scepticism and metaphysics, between stability and flux, between agnosticism and assurance.

I now revert to my own questions and answer them: Time spent on this book will not be wasted for anybody who shares Agassi's sense of the simultaneous grandeur and oddity of the scientific enterprise, and though one might not be inclined to invest in the book oneself, it would always be good to know where one could lay hands on it.

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book notes

University Physics, 5th edition. F. W. Sears, M. W. Zemansky, H. D. Young. 811 pp. Addison-Wesley, Reading, Mass., 1976.

The basic philosophy and outline of this popular general-physics text remain unchanged, but much of the material has been rewritten and reorganized. The chapter on electromagnetic waves has been entirely redone, and the material on atomic and nuclear physics has been expanded to include elementary-particle, high-energy and solid physics. One finds a chapter on relativistic mechanics added, as well as several new sections throughout the book. The principal system of units employed, with SI conventions and nomenclature, is the mks scheme. Also, the authors have included some 300 new problems, for a total of more than 1400.

Unfortunately, this fifth edition is the last in which Francis W. Sears plays a part in the revisions; he died in November of 1975 at the age of 77 (see *PHYSICS TODAY*, February 1976, page 65).

Group Theoretical Techniques in Quantum Chemistry. C. D. H. Chisholm. 271 pp. Academic, London, 1976. \$22.25

This volume's purpose is to close the gap between elementary texts on group theory and advanced works, and it offers a description not only of the more familiar point groups but of the symmetric group and some important continuous groups as well. The author assumes knowledge only of elementary calculus and matrix theory; other mathematical considerations, such as linear algebra and Lie algebras, he introduces and explains as needed. Topics include finite molecular symmetry groups, the method of irreducible tensors, spinors and double groups, branching rules and fractional parentage. Physicists will find discussed some applications of group theory to the quantum mechanics of simple systems and the classification of many-electron states.

Scientific and Engineering Problem-solving with the Computer. W. R. Bennett Jr. 457 pp. Prentice-Hall, Englewood Cliffs, N. J., 1976. \$17.95

This introduction to BASIC programming is meant for undergraduate and graduate students, in whatever discipline, who need to develop a practical familiarity with computer techniques. The book includes chapters on advanced programming, plotting techniques, language, dynamics, random processes, wave motion, Fourier series, electronics and communications. But the problems used are the special feature; William Bennett has illustrated the methods as such with a collection of novel and entertaining simulations and challenging questions. A computerized Shakespeare-simulation employs the statistical properties of English to attack The Eddington Monkey Problem ("If an army of monkeys were strumming on typewriters they *might* write all the books in the British Museum.") and obtain—amid reams of gibberish—an occasional phrase reminiscent of the Bard: "TO DEA NOW NAT TO BE." The Cavorite Problem (Novelist H. G. Wells's gravity-blocking substance, called "cavorite," was employed in *The First Men in the Moon* to propel a spaceship) also proves intriguing; Bennett demonstrates that achieving a stable orbit about the Moon is no easy feat using Wells's vehicle. The spread of diseases through populations is investigated in The Martian Problem (Wells again—a common-cold epidemic demolished the invaders in *The War of the Worlds*) and The Sailor-Prostitute Problem. The computerized detection of phase discontinuities and splices in tape

recordings (The Watergate Problem) and an analysis of the Velikovsky hypothesis are two of the many other items of interest in this volume.—FCB

new books

Elementary Particles and Fields

Meson-Nuclear Physics—1976 (AIP Conf. Proc., Vol. 33—Topical Conf. on Meson-Nuclear Physics, Carnegie-Mellon University, Pittsburgh, Penna., May 1976). P. D. Barnes, R. A. Eisenstein, L. S. Kisslinger, eds. 771 pp. American Institute of Physics, New York, 1976. \$24.75

Nuclei, Nuclear Physics

Nuclear Analogue States (Benchmark Papers in Nuclear Physics, Vol. 1). D. Robson, J. D. Fox, eds. 381 pp. Dowden, Hutchinson and Ross, Stroudsburg, Penna., 1976. \$27.50

Photonuclear Reactions (Benchmark Papers in Nuclear Physics, Vol. 2). E. G. Fuller, E. Hayward, eds. 426 pp. Dowden, Hutchinson and Ross, Stroudsburg, Penna., 1976. \$30.00

Atoms and Molecules

Introduction to the Theory of Heavy-Ion Collisions (Lecture Notes in Physics, Vol. 51). W. Nörenberg, H. A. Weidenmüller. 273 pp. Springer-Verlag, New York, 1976. \$10.30

Photoionization and Other Probes of Many-Electron Interactions (Proc. of a NATO Advanced Study Institute held at the Centre "Les Cigales" in Carry-le-Rouet, France, August–September 1975). F. J. Wuilleumier, ed. 472 pp. Plenum, New York, 1976. \$45.00

Chemical Physics

A Unitary Calculus for Electronic Orbitals (Lecture Notes in Physics, Vol. 49). W. G. Harter, C. W. Patterson. 144 pp. Springer-Verlag, New York, 1976. \$7.40

Symmetry Rules for Chemical Reactions: Orbital Topology and Elementary Processes. R. G. Pearson. 548 pp. Wiley, New York, 1976. \$24.50

Solubility of Gases and Liquids, A Graphic Approach: Data—Causes—Prediction. W. Gerrard. 275 pp. Plenum, New York, 1976. \$39.50

Theoretical Chemistry: Advances and Perspectives, Vol. 2. H. Eyring, D. Henderson, eds. 298 pp. Academic, New York, 1976. \$30.00

Acoustics

Acoustic Imaging: Cameras, Microscopes, Phased Arrays, and Holographic Systems. G. Wade, ed. 325 pp. Plenum, New York, 1976. \$25.00

Optics

Light, Vols. 1 and 2, 3rd edition. R. W. Ditchburn. 482 and 290 pp., respectively.

Academic, London, 1976. \$17.25 each volume (paperbound)

Quantum Electronics and Lasers

International Conference on Infrared Physics (CIRP) (Zurich, August 1975). T. S. Moss, ed. 327 pp. Pergamon, Oxford, England, 1976. \$30.00

Fluids and Plasmas

Neutral Current Sheets in Plasmas (Proc. of the P. N. Lebedev Physics Institute, Vol. 74). N. G. Basov, ed. 163 pp. Consultants Bureau (Plenum), New York, 1976. \$39.50

Materials and Solid State

Physics of Structurally Disordered Solids (Proc. of a NATO Advanced Study Institute held at the University of Rhode Island, Kingston, July–August 1974). S. S. Mitra, ed. 791 pp. Plenum, New York, 1976. \$69.50

Theory of Metal Oxidation, Vol. 1: Fundamentals. A. T. Fromhold Jr. 547 pp. North-Holland, New York, 1976. \$63.50

Principles and Techniques of Radiation Hardening: Vols. 1, 2 and 3. N. J. Rudie. Unpagged. Western Periodicals, North Hollywood, Calif., 1976. \$60.00 (paper-bound)

Ceramic Fabrication Processes (Treatise on Materials Science and Technology, Vol. 9). F. F. Y. Wang, ed. 379 pp. Academic, New York, 1976. \$39.50

Growth of Crystals, Vol. 10. N. N. Sheftal', ed. 290 pp. Consultants Bureau (Plenum), New York, 1976. \$37.50

Astronomy, Space Physics

Space Science and Astronomy: Escape from Earth (The Macmillan Sky and Telescope Library of Astronomy, Vol. 9). T. Page, L. W. Page, eds. 467 pp. Macmillan, New York, 1976. \$13.95

Geophysics and Planetary Science

Optics of the Atmosphere: Scattering by Molecules and Particles. E. J. McCartney. 408 pp. Wiley, New York, 1976. \$24.95

Chemistry and Physics of the Stratosphere (Reprinted from *Review of Geophysics and Space Physics*). 171 pp. American Geophysical Union, 1909 K Street, NW, Washington, D.C. 20006, 1975. \$6.00 (Available for \$5.10 prepaid to identified members of AIP member societies)

Biological and Medical Physics

Neutron Scattering for the Analysis of Biological Structures (Proc. of a Symposium, Brookhaven National Laboratory, June 1975). B. P. Schoenborn, ed. 553 pp. BNL, Upton, N.Y., 1976. (Available as BNL 50453 (Biology and Medicine-TID-4500) from NTIS, US Dept. of Commerce, Springfield, Va. 22161 for \$13.50)

Theory and Mathematical Physics

Theoretical and Applied Mechanics, Vol. 24 (Proc. of the 24th Japan National Congress for Applied Mechanics, November 1974). H. Tanaka, ed. 511 pp. Tokyo U.P., Japan (Distributed by ISBS Inc., P.O. Box 555, Forest Grove, Ore. 97116), 1976. \$49.00