

ticipants involved in such a major task.

These personal accounts are, of course, not history, but they do record for the benefit of historians and the rest of us insights into a few of the many facets of the Manhattan Project and the events leading up to it. And the authors have managed to convey to the reader the sense of urgency and intellectual excitement that drove the pioneering atomic scientists to initiate the atomic age.

MARY ARGO

HAROLD ARGO

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An Introduction to Invariant Imbedding

R. Bellman, G. M. Wing

250 pp. Wiley, New York, 1975. \$18.95

This text constitutes another welcome volume in the Wiley Interscience series. Richard Bellman and G. Milton Wing take their readers to the forefront of a fascinating region of research conducted in mathematics and applied disciplines, including among others physics, statistics and engineering.

The first three chapters develop the

theory and are accessible to anyone with a knowledge of differential equations and some applied mathematics. These introductory chapters lay the foundation for the following more advanced subject matter, which for the most part has been available mainly in research journals up to the present. Here, invariant imbedding methods are employed to discuss problems formerly attacked by classical techniques.

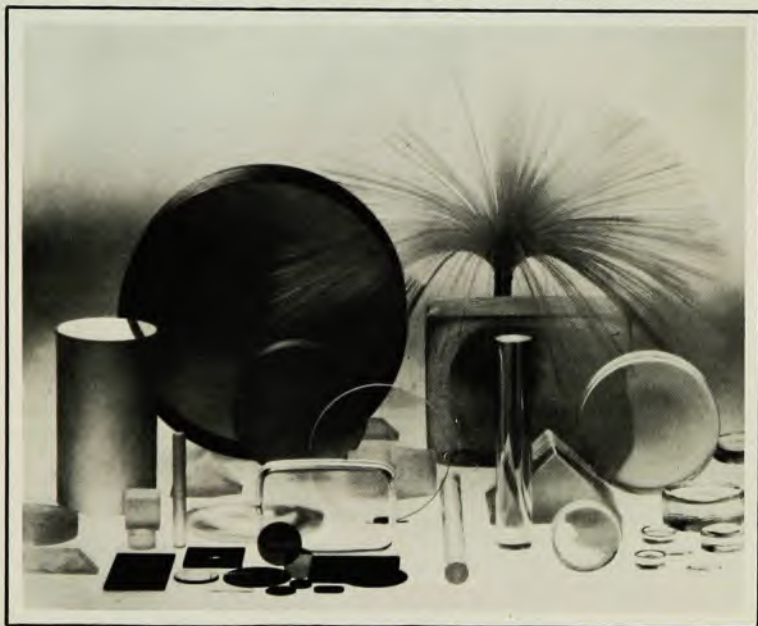
Though the notation is not always standard, I do not know of any other book in this field written so lucidly and containing such a variety of material. The book develops into a remarkable text as the authors progress. The method of invariant imbedding has been discussed by others, but few have focused entirely on the subject matter as have Bellman and Wing.

The authors present their ideas most effectively by means of clear definitions and numerous applications. Theory and computational procedures are combined and given equal emphasis. From the very beginning Bellman and Wing explain precisely what they intend to do. Such topics as wave propagation, time-dependent problems, random walks, transport theory, radiative transfer and integral equations are given special emphasis. There are a number of well chosen problems, references and a summary at the end of every chapter. Among books on invariant imbedding available in English today, this book represents a precise and valuable account. In a letter to me, Bellman states his desire to use it as a text, and indeed it appears suitable for the curriculum of any inquiring university. I highly recommend *Invariant Imbedding* either as a text or as reference material.

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book notes

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

In her article in this issue of *PHYSICS TODAY*, Esther Conwell surveys the development of integrated optics, or, in her words, "the use of microwave techniques at optical frequencies to perform such functions as transmission, modulation, switching, mixing and upconversion . . . [and] . . . miniaturization of components such as lasers, modulators, detectors . . . [and] . . . integration of different optical functions on the same substrate." In this book, referenced by Conwell in her article, Theodor Tamir of the Polytechnic Institute of New York, Brooklyn, has brought

together five contributors (including himself) to write a monograph on these topics. The authors are Herwig Kogelnik, Tamir, J. M. Hammer, F. Zernike and E. Garmire. Apparently Tamir finished his work on the volume in April 1975.

The Next Fifty Years in Space. P. Moore. 144 pp. Taplinger, New York, 1976. \$12.95

Patrick Moore blends scientific caution and visionary speculation in an engaging survey of mankind's extraterrestrial prospects from the present through the year 2025. Informal, sometimes folksy prose carries the reader from our own Space-Shuttle era to a time when nuclear-powered spacecraft ply between Earth and her permanent bases on Mercury and Mars, when our ambition begins to fix upon nearby stars. Moore dismisses intelligent life elsewhere in our solar system, but he entertains the vision of interstellar societies in telepathic communication.

The book is profusely illustrated with photographs and with Andrew Farmer's colorful conceptions, among them a solar observatory on Mercury and the Mariner probe amid Saturn's rings.

Mössbauer Effect Data Index Covering the 1966-68 Literature. J. G. Stevens, V. E. Stevens, P. T. Deason Jr, A. H. Muir Jr, H. M. Coogan, R. W. Grant, eds. 522 pp. Plenum, New York, 1975, and

Mössbauer Effect Data Index Covering the 1973 Literature. J. G. Stevens, V. E. Stevens, eds. 495 pp. Plenum, New York, 1975. \$49.50

These two indexes complete a series that records reference and data information for research by Mössbauer methods, from Rudolf L. Mössbauer's original 1958 article through those written in 1973. The book of 1966-68 data, with more than 1600 references, closes a longstanding gap in the set; its index section alone comprises 268 pages. The volume on 1973 literature lists the 100th excited resonance state and contains over 1200 references. Review articles on Au^{197} , Eu^{151} and I^{129} also appear in the 1973 volume, and both books include calculations of statistical errors for the "derived parameters" on isotope pages.

Use of Physics Literature. H. Coblands, ed. 290 pp. Butterworths, London, 1975.

The editor of this slim volume, with 16 other contributors, guides one through the morass of international physics-literature sources to provide improved access for librarians, information officers and, of course, physical scientists. How does one use abstracting and indexing services? Which are the principal texts and journals in astronomy, crystallography, theoretical physics? To whom does one write for catalogues? This book has the answers. Unfortunately, biophysics and geophysics

are not here; the interested reader must find these topics in other volumes of the Information Sources for Research and Development series, of which this book is part.

The Helium Liquids (Proc. of the 15th Scottish Universities Summer School in Physics, 1974). J. G. M. Armitage, I. E. Farquhar, eds. 512 pp. Academic, New York, 1975. \$41.50

Eighty-three lecturers spoke at the 1974 summer school on theoretical and experimental aspects of Helium 3 and Helium 4, at the University of St. An-

drews in Scotland. In this book, eleven of them have written on such topics as quantum-fluid hydrodynamics, Kapitza conductance and superfluidity in restricted geometries. The authors are G. V. Chester, G. Rickayzen, Seth Putterman, L. J. Campbell, Ann Eggington, A. Ron, John C. Wheatley, P. W. Anderson, W. F. Brinkman, Gordon Baym and L. J. Challis.

Crystal Technology. W. L. Bond. 342 pp. Wiley, New York, 1976. \$21.95

Walter Bond's book, part of the Wiley Series in Pure and Applied Optics, is a

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"how-to" guide for crystal workers. Chapters on crystal sawing, flat grinding and the preparation of cylindrical and doubly curved surfaces deal in techniques and hardware. The x-ray orientation goniometer alone consumes 50 pages, and the many illustrations include sketches of apparatus and circuit diagrams. Bragg angles for crystals (using copper K α x rays) appear in extensive tables, and an appendix on stereographic projection concludes the book.

Crystal Growth (Int. Series in the Science of the Solid State, Vol. 6). B. R. Pamplin,

ed. 672 pp. Pergamon, New York, 1975. \$45.00

Nearly everyone concerned with crystal-growing methods will find something of interest here. The volume's contributors—most of them British—have covered both theory and practice in 17 chapters. Theoretical subjects include interface stability and nucleation. Zone melting, bulk crystallization, growth from the vapor phase and from molten metal solutions, and crystal pulling number among topics treated experimentally. Copious references, the bulk of them from 1973 and earlier, enhance the volume.

new books

Elementary Particles and Fields

Symmetry Principles in Elementary Particle Physics. W. M. Gibson, B. R. Pollard. 380 pp. Cambridge U. P., New York, 1976. \$39.50

Gauge Theories of Weak Interactions (Cambridge Monographs on Mathematical Physics, Vol. 3). J. C. Taylor. 167 pp. Cambridge U. P., New York, 1976. \$26.50

The Nucleon-Nucleon Interaction. G. E. Brown, A. D. Jackson. 242 pp. North-Holland, Amsterdam, The Netherlands, 1976. \$19.95

Nuclei, Nuclear Physics

Gamma Ray Angular Correlations. R. D. Gill. 228 pp. Academic, New York, 1975. \$23.25

Experimental Reactor Physics. A. E. Proffo. 811 pp. Wiley, New York, 1976. \$30.00

Mössbauer Effect Data Index Covering the 1966-1968 Literature. J. G. Stevens, V. E. Stevens, P. T. Deason Jr, A. H. Muir Jr, H. M. Coogan, R. W. Grant, eds. 522 pp. Plenum, New York, 1975.

Mössbauer Effect Data Index Covering the 1973 Literature. J. G. Stevens, V. E. Stevens, eds. 495 pp. Plenum, New York, 1975. \$49.50

Atoms and Molecules

The Theory of Molecular Spectroscopy, Vol. 1: The Quantum Mechanics and Group Theory of Vibrating and Rotating Molecules. C. J. H. Schutte. 512 pp. American Elsevier, New York, 1976. \$67.95

Atomic Energy Levels and Grotrian Diagrams, Vol. 1: Hydrogen I-Phosphorus XV. S. Bashkin, J. O. Stoner Jr. 615 pp. North-Holland, Amsterdam, The Netherlands, 1975. \$59.95

Advances in Atomic and Molecular Physics, Vol. 11. D. R. Bates, B. Bederson, eds. 433 pp. Academic, New York, 1975. \$49.50

Elementary Excitations in Solids, Molecules, and Atoms, Part B (Lectures presented at a NATO Advanced Study Institute, Univ. of Antwerp, June 1973). J. T. Devreese, A. B. Kunz, T. C. Collins, eds. 385 pp. Plenum, New York, 1974. \$33.60

Atomic and Molecular Processes in Astrophysics (Fifth Advanced Course in Astrophysics, Valais, Switzerland, March 1975). A. Dalgarno, F. Masnou-Seeuws, R. W. P. McWhirter. 308 pp. Swiss Society of Astronomy and Astrophysics, Switzerland, 1975. Sw. Fr. 30

Chemical Physics

The Dynamics of Spectroscopic Transitions. J. D. Macomber. 332 pp. Wiley, New York, 1976. \$19.95

Materials and Solid State

The Interaction of Gases with Solid Surfaces (Int. Encyclopedia of Physical Chemistry and Chemical Physics, Vol. 3: Topic 14—

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