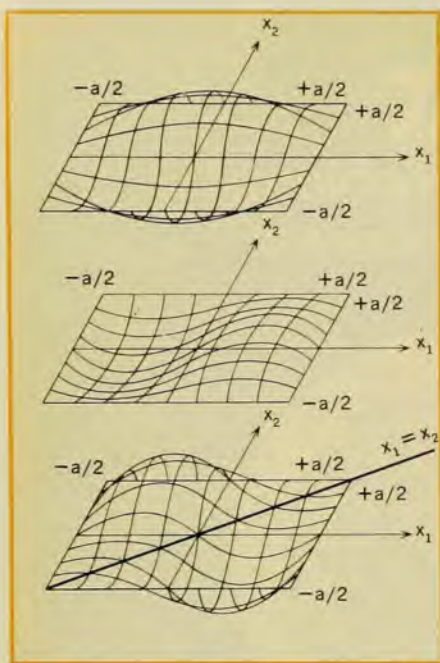




Antisymmetric space eigenfunction depicted for two identical particles. From the book.

der of the text consists of five chapters devoted to solid-state physics, nuclear physics and elementary particles. The second half of the book, like the first half, is a delight to read. The authors have managed to weave in many modern topics: semiconductors, superfluidity, superconductivity and the nuclear shell model, to name a few.

The clear organization of the book, its abundance of figures and photographs, and the high ratio of discussion material to mathematical equations make this an inviting book to pick up and read. Each chapter ends with a set of discussion questions (some of which are incredibly difficult) and a lengthy set of problems. The problems contain a good mix of simple numerical order-of-magnitude calculations along with the more traditional brain teasers. The book requires no previous knowledge of quantum mechanics or matrices. Knowledge of calculus is necessary.

This book is an excellent text for a junior-level course offered to either physics or non-physics majors. It could also work at the sophomore level for a group of high-quality physics majors. However, the book is probably too advanced to be suitable for use at the sophomore level in one of the broad, introductory physics courses that are traditionally taken by all science and engineering majors.

On the other hand, the book is not advanced enough for the typical senior-level quantum mechanics course. Students at the senior level should be given a somewhat greater exposure to the mathematical machinery of quantum mechanics (matrix elements, angular-momentum commutation relations and

perturbation theory) than this book contains. Seniors will still find this book a useful supplement to the more mathematical texts on quantum mechanics.

All in all, the authors are to be congratulated for the patience and hard work that went into the creation of this fine book.

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The Mackenzie-McNaughton Wartime Letters

M. Thistle, ed.

178 pp. U. of Toronto Press, Toronto, Ontario, 1975. \$12.50

War changed the scale and character of research in Canada. Before 1939 it was mostly basic science in universities. By the end of the war expenditure on applied research, as well as on basic research had increased greatly, and the public was convinced that the nation's economic future would depend on its scientific and technological resources.

The story of this transition is told in the *Mackenzie-McNaughton Wartime Letters* with the insight of the two men who were most responsible for it. General A. G. L. McNaughton was President of the National Research Council, the government agency that supported most university research and operated NRL (the National Research Laboratories, the most important research establishment in the country). When war began McNaughton was given command of the Canadian army overseas. C. J. Mackenzie became Acting-President of the National Research Council in McNaughton's absence.

The letters are selected from those in which Mackenzie kept McNaughton informed about the progress of research in Canada with the frankness that private correspondence permits, and McNaughton replied with guidance and encouragement about the importance of research progress to the war. The introduction and epilogue, written by Mackenzie, add background so that the letters provide a continuous and complete story. Canadian nuclear energy development is not discussed.

The research pertained to many aspects of war and supply of munitions: submarine detection, protection from magnetic mines, cooling of meat cargoes to Britain, gas-mask design, aircraft and propeller de-icing, landing skis, ballistics of high-velocity shells, high-explosive development, poison-gas dispersal, aerial photography and mapping, range finding and predicting, and other

military problems. In spite of early British doubts that it would be possible in Canada, improved radar-based anti-aircraft gun-aiming equipment and high-quality optical instruments were developed in NRL and manufactured in a Canadian-owned company created for the purpose. There is high praise for Sir Frederick Banting, who directed very productive wartime medical and biological research and for Otto Maass, who directed research on high explosives and poison gas, and appreciation for the work of many others.

The epilogue describes the return to peacetime research after the war. NRL had gained the admiration of important ministers in the government and Mackenzie's advice was highly respected and persuasive. Support for research continued to grow in the following years.

In retrospect, Mackenzie comments on the importance of a nation's strength in both pure and applied research to prepare to meet emergencies or to capitalize quickly on major technological innovations. No nation will be well prepared "that does not consider pure research an essential overhead of its scientific technology." He notes with examples the difficulties in peacetime of maintaining strength in applied research in a branch-plant economy. "How to maintain a viable science must now be considered one of Canada's Canadian-American problems."

The Mackenzie-McNaughton Wartime Letters is a fascinating history of the organization of a large diversified scientific effort to serve an urgent purpose. I recommend the book particularly to Canadians who are concerned about government policy on science, because the views it expresses are based on exceptionally full knowledge of Canadian science and on successful experience in its guidance and administration. They differ greatly from opinions of some who have been advocating major changes in organization and control of research in Canada.

GEORGE C. LAURENCE
Deep River, Ontario

Growth of Crystals from the Vapour

M. M. Faktor, I. Garrett

300 pp. Halsted, New York, 1974. \$22.75

Marc Faktor and Ian Garrett have included a wide spectrum of topics of interest to experimentalists involved in the growth of crystals from the vapor. The emphasis is on fundamentals—more specifically, on the applicability of thermodynamics to vapor-growth systems. It is the authors' stated premise that

MUON PHYSICS

edited by VERNON W. HUGHES and W. S. WU

This comprehensive treatise, the product of a collaboration among many internationally known research physicists, comprehensively covers theoretical and experimental muon physics. It is published in three volumes, each dealing with a separate domain of the subject.

The first volume covers the electromagnetic interactions of muon, describing in detail the static properties of the muon and the validity tests of QED in the simple muonic system. Its presentation of the subject of muonic atoms will serve as a starting point for new experiments on muonic atoms with the next generation of meson facilities.

The second volume deals with the weak interactions of muon, with theoretical treatments of elementary particle aspects of muon decay and muon capture, and of semi-leptonic weak interactions in nuclei. It reviews and discusses the experimental results on low energy weak interactions, with sections on muon decay, rare and ultrarare muon decays, and muon capture. The third volume covers the broad field of muon chemistry and muons in solids.

CONTENTS OF VOLUME 1: C. S. Wu and V. W. Hughes, Introduction and History. V. W. Hughes and T. Kinoshita, Electromagnetic Properties and Interactions of Muon. J. Hüfner, et al., Muonic Atoms. R. C. Barrett, Numerical Evaluation of

Muonic-Atom Energy Levels. R. K. Adair and H. Kasha, Cosmic Ray Muons. (the above contents are tentative)

1976, about 268 pp., \$36.50/£18.25

VOLUME 2—WEAK INTERACTIONS

CONTENTS: **Weak Interactions:** H. Primakoff, Elementary-Particle Aspects of Muon Decay and Muon Capture. A. M. Sachs and A. Sirlin, Muon Decay. S. Frankel, Rare and Ultrarare Muon Decays. J. D. Walecka, Semileptonic Weak Interactions in Nuclei. E. Zavattini, Muon Capture. C. Baltay, Interactions of Muon Neutrinos.

1975, 416 pp., \$59.00/£29.50

VOLUME 3—CHEMISTRY AND SOLIDS

CONTENTS: **Muon Chemistry and Muons in Solids:** J. H. Brewer, et al., Positive Muons and Muonium in Matter. S. S. Gershtein and L. I. Ponomarev, Mesomolecular Process Induced by μ - and π -Mesons. V. S. Evseev (translated by S. J. Amoretti), Depolarization of Negative Muons and Interaction of Mesonic Atoms with the Medium.

1975, 320 pp., \$41.50/£20.75

Set price for these volumes, \$115.00 (if purchased separately, the three volumes of this set would cost a total of \$137.00)

ADVANCES IN ATOMIC AND MOLECULAR PHYSICS, Volume 11

edited by D. R. BATES and BENJAMIN BEDERSON

"This volume continues an excellent series of collected monographs . . . excellent compendium . . . deserves a place in the private libraries of working physicists."—*Physics Today*

CONTENTS: I. C. Percival and D. Richards, The Theory of Collisions between Charged Particles and Highly Excited Atoms. P. G. Burke and W. D. Robb, The R-Matrix Theory of

Atomic Processes. R. B. Bernstein and R. D. Levine, Role of Energy in Reactive Molecular Scattering: An Information-Theoretic Approach. J. M. Hansteen, Inner Shell Ionization by Incident Nuclei. H. R. Griem, Stark Broadening. M. F. Golde and B. A. Thrush, Chemiluminescence in Gases.

1975, 448 pp., \$49.50/£25.55; also available in Library Edition with Microfiche, \$64.00/£32.90; Microfiche only, \$35.00/£18.20

LAWS OF HADRONIC MATTER

edited by A. ZICHICHI

A Volume in the SUBNUCLEAR PHYSICS Series

The proceedings of the 11th Course of the International School of Physics "Ettore Majorana" are contained in this volume. Lectures in the Course aim to present the most recent advances in experimental and theoretical physics, and each is followed by the discussion it engendered. Perhaps the most significant news came from Ugo Amaldi who lectured on experiments carried out at the CERN Intersecting Storage Rings to measure the total proton-proton cross-section. Contrary to everybody's expectations this cross-section

was found to rise 10% in the ISR energy range. Other topics on the experimental front include reviews of mesons and baryons, a report on the status of the so-called daughter trajectories, together with a phenomenological attempt to understand the ISR results on short- and long-range correlations, multiplicities and high transverse momentum phenomena.

1975, 910 pp., \$49.00/£21.50

CHEMISORPTION AND MAGNETIZATION

by P. W. SELWOOD

Chemisorption and Magnetization is essentially a completely revised and updated edition of the author's 1962 publication, *Adsorption and Collective Paramagnetism*. Professor Selwood, a pioneer and leading researcher in the use of magnetic methods in catalytic research, described in detail the experimental techniques and interpretation of results involved in using magnetic measurements to gain information about chemisorbed molecules on certain kinds of solid surfaces. Though the treatment is on an advanced level, the wealth of detail and numerous examples make the book accessible to

anyone with a basic knowledge of surface chemistry, heterogeneous catalysis, or solid state physics.

The method outlined here is applicable to ferromagnetic solids and especially to nickel metal; there is no restriction on the kind of adsorbate for which the method may be used. Basically, this method gives the number of adsorbent atoms primarily affected by the adsorbate molecule under almost any experimental conditions.

1975, 192 pp., \$19.50/£10.15

HIGH SPEED PULSE TECHNOLOGY, Volume 3

Capacitor Discharge Engineering

by FRANK B. A. FRUNDEL

CONTENTS: The Capacitor, Its Characteristics and Its Applications in Discharge Circuits. Switching Means. Line Conductors. Conversion of Capacitor Energy into Current Impulses. Conversion of Capacitor Energy into Voltage Impulses and Its Practical Applications. Conversion of Capacitor

Energy into X-Ray Flashes and Beams of Electrons, Ions, and Neutrons. Conversion of Capacitor Energy into Heat. Conversion of Capacitor Energy into Magnetic Fields. Conversion of Capacitive Stored Energy into Acoustic Pulses.

1975, 522 pp., \$39.50/£20.55

N.B.: Postage plus 50¢ handling charge on all orders not accompanied by payment.

Prices subject to change without notice.

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the crystal growers do not place sufficient reliance on thermodynamics, which they consider to be "the cornerstone for discussions on theories of crystal growth." This is one viewpoint that merits attention, and it is appropriate that it is discussed by authors who have established their credentials in the field, as is the case here. The thermodynamicist's viewpoint is carried from an early section specifically labeled "Thermodynamics of Crystal Growth" to other topics in the book, such as inorganic chemistry as related to transporting agents, a treatment of the vapor-crystal interface (which includes adsorption, nucleation, and surface diffusion) and a discussion of vapor transport processes (which includes vapor diffusion, vapor transport and sublimation). Inserted in the latter section is an unusually detailed treatment of "Stefan's flow." Consideration is given to both chemical and physical vapor growth processes.

Also treated in some detail, but with considerably less emphasis, are topics on crystallography (structural crystallography, crystal imperfections). Rounding out the general picture are discussions of gas-flow dynamics, sequential processes in crystal growth, and experimental procedures. The authors state that they have chosen to emphasize well-developed basic principles. Using this approach, they run the risk of duplicating material found in standard texts. On the issue of the application of thermodynamics, they have succeeded in bringing new perspective through specific application to topics of particular interest to crystal growers. On the topics of crystallography and experimental techniques, it is not so clear that a new viewpoint is offered. It is useful, however, to have collected in one volume these topics that are of interest to crystal growers.

With the authors' orientation towards thermodynamics, it is not surprising that they have discussed almost exclusively vapor-growth systems in which the chemistry involved is close to equilibrium. There is a related emphasis on closed tube, or "almost" closed tube, vapor-transport systems. It is in such systems, of course, that the thermodynamic approach is most useful. This has led the authors into a detailed discussion (16 pages) of the transport of nickel as nickel carbonyl and the transport of carbon with sulphur. The interest of crystal growers in these systems is questionable. There is a briefer discussion (5 pages) on the transport of gallium arsenide. Silicon is not mentioned, even though the authors recognize the heavy involvement of the electronics industry in crystal growth from the vapor. Another obvious omission is a discussion of reaction kinetics. It is certainly the authors' prerogative to

emphasize what they wish; a more appropriate title, however, could have been chosen. Readers who would be most interested in this book would have been more alerted to a title such as: "The Fundamentals of Near-Equilibrium Vapor Transport Systems."

Despite the somewhat puzzling idiosyncrasies of this book, one cannot argue with the viewpoint that a firm grasp of fundamentals is good preparation for experimental activity in crystal growth from the vapor. This book should prove to be of value to individuals entering the field, and will serve as a useful reference text for the more experienced experimentalists.

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Theory of Elementary Atomic and Molecular Processes in Gases

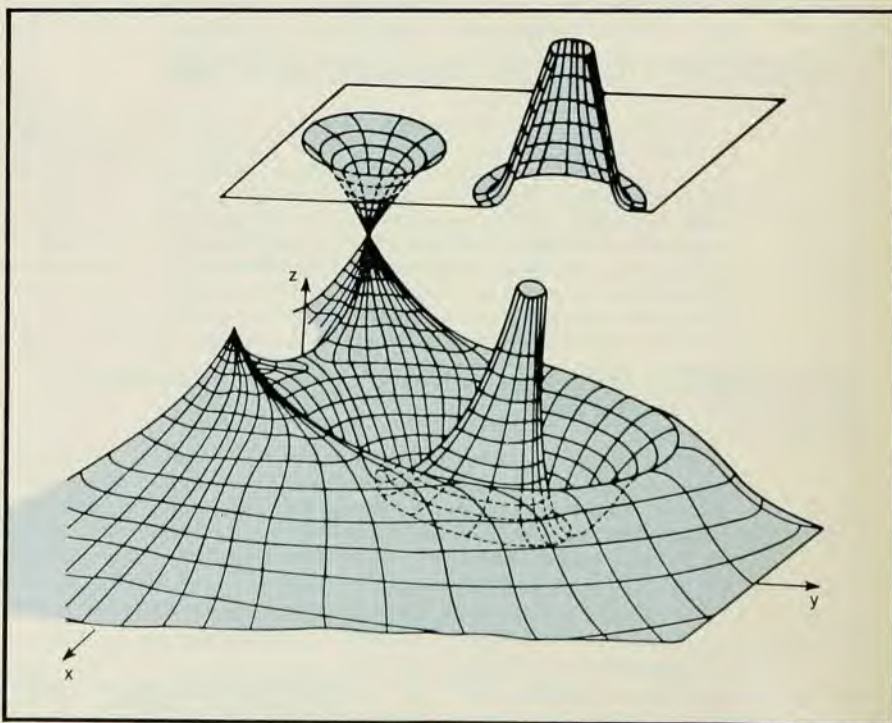
E. E. Nikitin
472 pp. Oxford U. P., New York, 1974.
\$42.50

Sometimes a book review in *PHYSICS TODAY* begins with "This is an excellent book." I could have made such a claim for *Theory of Elementary Atomic and Molecular Processes in Gases*, but now I shall go further: this may well become an important book. Rarely does one find such a clear and scholarly exposition, particularly of a field that nor-

mally lies beyond the level of conventional graduate courses. The book, in eight rather long chapters, covers a timely, fast-developing subject on the border between physical chemistry and physics, with a form of presentation that makes the material accessible to physicists and chemists alike.

Thorough understanding of the field of elementary reactions in gases is vital for anyone dealing with such device-oriented topics as gas lasers, plasmas and electrical discharges in gases. Evgenyi Nikitin's book is an ideal source from which any physicist can train himself in this subject almost to the level of the current research. Each topic is developed mathematically, and most important, each theory is discussed at length to expose its physical content and the limitations of its applicability. Nikitin makes extensive comparisons among alternative theories, shows how successive refinements have evolved, and unifies his book with frequent indications of the close relationships between theories that developed historically in different areas. Moreover each topic is illustrated clearly by examples of specific reaction systems.

The scope of the book reflects Nikitin's own range of interest, and the interests of his colleagues at the Institute of Chemical Physics at the Academy of Sciences, Moscow: exchange of translational, vibrational and electronic energy among colliding molecules; surface-crossing; the general theories of reaction including transition-state theory, statistical theory and diffusion theory;



Potential energy surface of the nonlinear H_3 system. This qualitative picture shows the rapid energy increase (within the saddle) due to Coulomb repulsion between nuclei. From the book.