

In-Beam Gamma-Ray Spectroscopy

by H. MORINAGA and T. YAMAZAKI.

1976 about 550 pages
US\$ 62.50 / Dfl. 150.00

This book, in a sense supplementing Siegbahn's "Alpha-, Beta-, and Gamma-Ray Spectroscopy", opens with accounts of various experimental and theoretical techniques relevant to in-beam gamma ray measurements. Various types of spectroscopy are then described, namely spectroscopy with simple nuclear reactions and with continuum reactions; measurements of life-times and nuclear moments in beam, neutron capture gamma rays, and photoexcitations are dealt with, together with a discussion on electromagnetic properties of the nucleus revealed by in-beam gamma ray spectroscopy.

CONTENTS: Progress of detection techniques. Principles of gamma ray spectroscopy. Electromagnetic properties of nuclei. Nuclear reaction mechanisms. Gamma rays in low energy nuclear reactions. Gamma rays in direct nuclear reactions. Gamma rays in compound continuum reactions. Delayed gamma rays. Perturbed angular distributions and nuclear moments. Nuclear photoeffects. Gamma rays from neutron capture.

The Electromagnetic Interaction in Nuclear Spectroscopy

edited by W. D. HAMILTON.

1975 xi + 925 pages
US \$108.50/Dfl. 260.00

The papers in this multi-author work combine to form a comprehensive and unified treatment of the basic theoretical and experimental methods of nuclear spectroscopy. Part of the book deals with semiconductor detectors, as research in this area has been particularly fruitful. The many factors which must be taken into account, if these detectors are to achieve their full potential, are extensively discussed.

CONTENTS: Emission and absorption of electromagnetic radiation (K. Alder and R. M. Steffen). Emission of gamma radiation and nuclear structure (K. Alder and R. M. Steffen). Collective and microscopic model predictions of electromagnetic moments (K. Kumar). Nuclear shapes and phase transitions (K. Kumar). Transition probabilities

(K. E. G. Lobner). Delayed coincidence timing methods (K. E. G. Lobner). Coulomb excitation (J. O. Newton). Nuclear resonance fluorescence (S. J. Skorka). Doppler shift timing methods (K. W. Allen). The theory of internal conversion (K. Alder). Experimental techniques of conversion coefficient measurements (J. H. Hamilton). Angular distribution and correlation of gamma rays, theoretical basis (R. M. Steffen and K. Alder). Extranuclear perturbations of angular distributions and correlations (R. M. Steffen and K. Alder). Angular distribution and correlation measurements using radioactive sources (W. D. Hamilton). Angular distribution and correlation of gamma ray (P. J. Twin). Measurement of electric and magnetic moments of excited states (E. Bodenstedt). Gamma-ray energy and intensity measurements with a curved crystal spectrometer (J. J. Reidy). Gamma-ray energy and intensity measurements with Ge(Li) spectrometers (R. G. Helmer, J. E. Cline and R. C. Greenwood). Subject index.

Atomic and Molecular Physics and the Interstellar Matter

Proceedings of the XXVI Session of the Les Houches Summer School in Theoretical Physics, July-August, 1974

edited by ROGER BALIAN, PIERRE ENCRENAZ and JAMES LEQUEUX.

1975 xxiv + 634 pages
US \$66.75 / Dfl. 160.00

The Les Houches Summer School in Theoretical Physics 1974, was devoted to the physics of interstellar matter with special emphasis on atomic and molecular processes. The eight-week duration of the conference made it possible to examine in depth a broad range of topics.

CONTENTS: Atomic physics (H. Nussbaumer). Molecular spectroscopy and collisional excitation (S. Green). Atomic collision theory (D. Flower). Atom-atom collision processes in the interstellar medium (R. McCarroll). Formation and destruction of interstellar molecules (W. D. Watson). Physics of fully ionized regions (D. Flower). Observations and physics of dense neutral clouds (A. A. Penzias). Interstellar masers (P. Goldreich). Interstellar grains (E. M. Greenberg). Heating and ionization of the interstellar medium: star formation (G. B. Field). Dynamics of interstellar matter (F. D. Kahn). Nucleosynthesis and the origin of galactic cosmic rays (H. Reeves). Seminars given during the school.

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untransparent: infinities (having nothing to do with renormalization) are tossed about with abandon and at the end an r^{-7} results. No qualitative comparison is made with the shorter-distance behavior. Something must be happening to give time averages of the induced dipole moments, but if the reader wants to find out more on this subject he must look elsewhere.

Part II is much the same. Renormalization, always difficult to present, does not fare well here either. For K-meson decay the mass matrix ($M - i\Gamma$), justified only by the Wigner-Weisskopf analysis, is presented without even the usual "obviously." If perchance the student should realize that this is one of today's outstanding unsolved problems, there is no hint of where to turn for further reference.

Isn't there anything good to say about these books? As I read them, and as the nature of this review began to be evident, the foregoing question oppressed me more and more. Perhaps this negative report arises from having hoped for too much. The multitude of calculations of relativistic effects in all sorts of systems from atoms to elementary particles can provide a valuable source of information; many of these topics are not covered elsewhere except in the original literature. Somehow, though, relegating a book in the Landau-Lifshitz series to the status of a handbook is so demoralizing that the secondary merits of the volume (when measured on the scale of ordinary books) are inadequate consolation.

LAWRENCE SCHULMAN
Indiana University
Bloomington

Science Policy Making in the United States and the Batavia Accelerator

A. G. Jachim
208 pp. Southern Illinois U. P., Carbondale,
1975. \$8.95

This book is concerned with the politics of Gigabuck Physics. It is described as a "case study of the allocation of a 200-BeV accelerator to Weston, Illinois, set in a social systems framework by a political scientist." The book attempts to use the Weston decision as a basis for examining science-policy formation in the United States. The author is a faculty member at the State University of New York at Plattsburgh; he had previous experience with science policy as a research assistant at the National Academy of Sciences.

The first three chapters of the book describe the historical and organizational background necessary for under-

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standing the character of the disputes that were to develop over the Weston decision. These chapters deal with the rationale for government support of basic research, the federal organizations that support this research and the role of various scientific organizations in science policy and politics. Considerable emphasis is given to the intense debate that developed during the mid 1960's concerning the geographical distribution of federal R&D expenditures. The author quite properly considers that debate to have had a very important influence on the subsequent events involving the Weston accelerator.

The next three chapters deal with the events surrounding the decision to build the accelerator. The author describes the competition between the major centers of high-energy physics for the accelerator and then chronicles the battle that subsequently took place between the political "heavies" over the location of the machine. Most of the information provided by the author is derived from congressional records and interviews with various participants in the

controversy. The last chapter is an attempt at analysis.

My qualifications for reviewing this book are limited. I did not participate substantially in any of the decisions described in the book, though I was involved in a minor way while a member of the Office of Science and Technology during the period 1966 to 1967. I attended the reviews by the director of the then Bureau of the Budget at the time the first small items were appearing in the president's budget concerning the 200-BeV machine. There took place a lively debate between OST and BOB concerning the planning money that was being proposed. While those amounts were relatively modest, BOB recognized the nostrils of a camel of monstrous dimensions and was very concerned with the implications for funding other areas of high-energy physics as well as the support for science in general. I found it somewhat paradoxical that the BOB exhibited more concern with this aspect than did the worthies of the scientific community at the time.

Some will find the book useful and interesting reading, but only if their needs are quite limited. If one is seeking a short discussion of the "geographical distribution" debate of the mid 1960's or some overall sense of the political struggle that was associated with the decision, then Jachim's book provides a compact and lively description of some of the principal events. However, the book is least successful when judged in terms of the goals that the author set for himself. The book does not provide new insights or much new material concerning the very complicated subject with which it deals. While the author did not claim to have major prescriptive goals in his work, there is little discussion of how federal policy can be changed to deal more effectively with a number of difficult problems that arose in the context of the Weston decision.

Perhaps it is unrealistic to expect to learn very much about science policy in general from events that are almost singular. In spite of the huge expenditures on this accelerator, the total costs still represent a small fraction of the money allocated to the support of basic scientific research. Of course, "special events" can be used to illuminate particular features and inadequacies of the decision-making process; this is done persuasively in several places in the book. But extrapolation to more normal situations is not easy. If the subject were marital policy, I would be equally skeptical of extrapolating from a case study of the Taylor-Burton affair.

A number of troubling and unresolved issues are implicit in the book. Not the least of these concerns the means by which priorities for the sup-



Groundbreaking in 1969 for the National Accelerator Laboratory at Batavia, Illinois, featured Robert R. Wilson, director, and AEC chairman Glenn Seaborg sharing shovel.

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1975 Nobel Prize co-winners in Physics, Professors Bohr and Mottelson cover in Volume II, as well as in Volume I, a systematic treatment of the basis that has been gradually established during the last decades for understanding the vast body of data on nuclear properties and reactions. The presentation involves partly a development of the theoretical concepts and mathematical tools and partly a critical analysis of experimental results in terms of these concepts. While the first volume is concerned with single-particle motion and the formulation of symmetries, the second volume deals with collective rotational and vibrational motion as well as with the coupling of single-particle motion to the collective degrees of freedom.

The presentation reflects the authors' view of nuclear physics as part of the broad development of concepts describing quantal many-body systems ranging from atoms and condensed matter to the structure of elementary particles. Since the more advanced theoretical concepts and mathematical tools employed in the text are explicitly developed, the prerequisites do not go beyond those expected of a graduate student in physics. However, the subject is carried to the limits of our present comprehension in a field that comprises a vast richness of phenomena, and a full understanding of the material may require several stages of study using different dimensions of the presentation.

(W.A. Benjamin title)

Vol. I: 1969, xiv, 471 pp., illus., \$29.50

Vol. II: Dec. 1975, xviii, 748 pp., illus., \$37.50

"... The set of volumes is evidently going to be the standard of reference in nuclear structure physics for many years... The method of presentation makes a good background in nuclear physics a prerequisite for the reader. Truly this is nuclear structure for nuclear physicists... it will be read and reread by all serious students and practitioners of nuclear physics... The first volume alone demonstrates clearly that *Nuclear Structure* will take precedence on the bookshelves of all nuclear physicists, both theoretical and experimental." — Mark Bolsterli, *Science*

M. A. PRESTON and R. K. BHADURI
STRUCTURE OF THE NUCLEUS
McMaster University

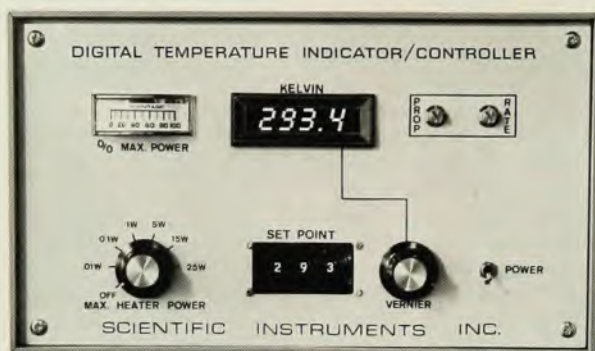
Though this book began as a revision of Professor Preston's widely used 'Physics of the Nucleus,' substantial developments in nuclear physics since 1962 have made this an essentially new book, emphasizing nuclear structure. Throughout this book the underlying emphasis is on how a nucleus is constituted through the interaction between the nucleons. Physicists must still deal with some of the fascinating aspects of nuclear behavior on the basis of models whose connection with fundamental theory is not complete. Thus, although the authors tend to emphasize the basic approach which should unify the concepts used to describe nuclei, the book, like its predecessor, remains semiductive. Choice of topics makes possible a one-volume work that not only fits the requirements of many current graduate courses but also is of use to research physicists.

1975, xiv, 693 pp., illus., hardbd. \$29.50;
paperbd., \$19.50

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port of basic research can be evaluated within the scientific community. An interesting relevant exchange between an Illinois congressman and Commissioner Gerald Tape of the Atomic Energy Commission is quoted in the book. Asked what would be his toughest job in selling one of the designs proposed by the Lawrence Radiation Lab, Tape replied that he thought the "roughest job" would be in "selling the non-high energy physics community." I am not aware that any such selling was attempted; no appropriate marketplace or currency exists for the transaction.

RAYMOND BOWERS
Cornell University
Ithaca, New York

Quantum Theory of the Chemical Bond

H. F. Hameka

312 pp. Hafner Press, New York, 1975.
\$16.95

The author states that "this book is written for a one-semester course at the undergraduate or first-year-graduate level in quantum chemistry." Little more mathematical knowledge than familiarity with calculus is assumed. The book consists of eight chapters, entitled "The principles of quantum mechanics," "Exact solution of the Schrödinger equation," "Atomic structure," "Light and spectroscopy," "The spectra of diatomic molecules," "The chemical bond," "The solid state," and "Magnetic resonance," a total of 312 pages. Each chapter contains a set of problems for the student and a short list of books for further reading.

Derivations of theoretical equations are given only in simple situations, but in these cases the reader is often led by the hand in great detail. One opportunity that is missed, however, is that of introducing the momentum operators $p_q = (-tr/i) 2/2q$ and from these obtaining $p^2/2m$ for use in the Hamiltonian. In more complicated situations, often only results are stated, or only approximate qualitative representation is given. The author explores connections between theory and experiment.

The chapter on the chemical bond contains sections on H_2^+ , H_2 , diatomic molecules, electronegativity, hybridization, unsaturated molecules, and conjugated and aromatic molecules, and an appendix on the calculation of these integrals in elliptical coordinates. In the section on hybridization, the structures of CH_4 , NH_3 , and H_2O are discussed in terms of localized molecular orbitals that are nonorthogonal (although the points of these pertaining to the central atom are mutually orthogonal). The