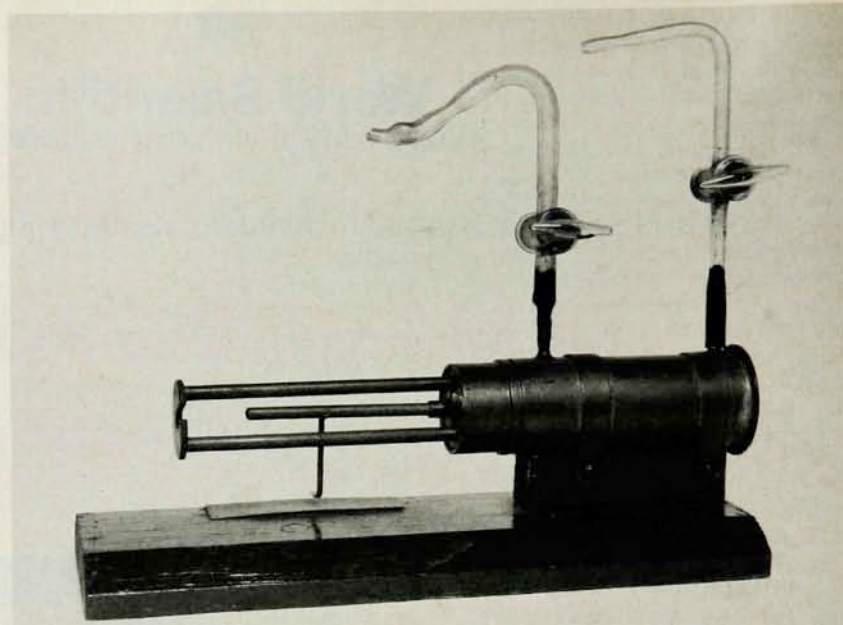


fields and superstrings are omitted, except for a brief note added in proof, thus minimizing prerequisites.)

Volume 2 makes frequent reference to parallel material in the first volume. Nevertheless, physicists with backgrounds in subnuclear phenomena dating from the late 1960s or later, and with exposure to a reasonable dose of flavor-SU(3), could start with volume 2 with little discomfort (except for what a few minor misprints and some disagreements over matters of taste could produce).

Perhaps the value of these two volumes will be best measured by how much they help to diminish the perceived intellectual distance between "big" and "small" physics, and by whether they reignite the flame of excitement that brought many of us into physics (or is keeping us here)—a flame that seems to thrive on the marvelous unity that emerges in physics at every turn. In my judgment this pair of volumes, like the *Feynman Lectures*, is a work that belongs in the hands of every physicist, even though, unlike the Feynman volumes, it covers but one vital corner of the vast frontier of our discipline. These books may inspire leaders in other subdisciplines to write similar works and thereby bring the frontiers of physics closer to the center. Gottfried and Weisskopf have set a fine standard for such an endeavor.

TIMOTHY D. SANDERS
Occidental College, Los Angeles



Apparatus used by Ernest Rutherford to discover the proton.
(Reproduced from *The Particle Hunters* by permission of the Cavendish Laboratory, Cambridge, UK.)

fundamental forces, conservation laws, the particle generations. The descriptions are filled out with brief discussions of experimental techniques: cosmic rays, traditional accelerators and accelerator experiments, particle colliders and collider experiments. In the first few chapters the authors provide the theoretical foundations for all of this with mostly qualitative presentations of special relativity and quantum mechanics.

The level of theoretical discussion is somewhat uneven. Readers who had taken a serious class in elementary physics or chemistry could learn much about particle physics from the book, but they would not be able to follow the explanations of subjects such as isospin or the eightfold way. (I confess that on some days when I'm puzzling over a possible discrepancy in the hadronic decays of the tau lepton, I'm not sure I understand isospin of strongly interacting particles.) Novices in particle physics reading the book on their own would have to let some subjects go by without understanding.

The instructor choosing this book as a text in an introductory particle physics course could either supplement the difficult parts or simply tell the students to ignore these. I would not recommend the book in a first course for students who intend to become professional particle physicists. They require a more systematic introduction to the advanced courses. But I might well use the text for teaching physics students intending

to specialize in other fields and for engineers and chemists who want to get a feel for elementary particles.

This book will have a special appeal to its readers when they know that one of the authors, Yuval Ne'eman, is one of the pioneers in the classification of elementary particles. This is particle hunting described by the hunters.

MARTIN L. PERL
Stanford Linear Accelerator Center

The Particle Hunters

Yuval Ne'eman and
Yoram Kirsh

Cambridge U. P., New York,
1986. 272 pp.
\$49.50 hc ISBN 0-521-30194-7;
\$13.95 pb ISBN 0-521-31780-0

The Particle Hunters provides a pleasant introduction to the phenomena, theories and experimental techniques of elementary-particle physics. The book's structure is historical, beginning with J. J. Thomson's electron and Ernest Rutherford's atom, and ending with the discovery of the W and Z⁰ particles and with speculations about the Higgs boson. Along the way, there are anecdotes, quotes and interesting photographs. There are some nice insights; the chapter on accelerators, for example, is entitled "Particle Accelerators—or From Hunters to Farmers."

Most of the text is devoted to describing the known facts and accepted concepts in particle physics: quarks, leptons, hadrons, the four

Field Theory in Particle Physics, Volume 1

B. de Wit and J. Smith
North Holland, New York,
1986. 490 pp.

\$45.00 hc ISBN 0-444-86996-4;
\$23.00 pb ISBN 0-444-86999-9

Quantum Field Theory

Lewis H. Ryder
Cambridge U. P., New York,
1985. 443 pp.

\$80.00 hc ISBN 0-521-23764-5;
\$24.95 pb ISBN 0-521-33859-X

Gauge Theories of Strong and Electroweak Interactions

Peter Becher, Manfred
Böhm and Hans Joos
Wiley, New York, 1984. 306 pp.
\$79.95 hc ISBN 0-471-10429-9

Because all forces among elementary particles may be described by gauge

NORTH-HOLLAND ANNOUNCES

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ELSEVIER SCIENCE PUBLISHING CO., Inc., 52 Vanderbilt Ave., New York, NY 10017

Hadronic Physics at Intermediate Energy, II

Proceedings of the Winter School held in Folgaria, Italy, Second Course, February 23-28, 1987

edited by T. Bressani, B. Minetti and G. Pauli

1987 about 540 pages
Price: US \$73.25/Dfl. 150.00
ISBN 0-444-87084-9

This book is the second in a series presenting, at an elementary level, the main perspectives of intermediate energy physics with hadrons. This is a field which unifies nuclear and particle physics both from a theoretical and experimental point of view. Particular emphasis was placed on topics not treated in depth in the first volume, such as computational aspects and peculiar experimental methods and techniques. Future possibilities in the field are presented and discussed in the light of the European Hadron Facility.

Contents: Preface. 1. **Theoretical Aspects of the Hadronic Interactions.** The physics of weak non-leptonic interactions (G. Preparata). Electron-positron annihilation in the fire-string model (L. Nitti). Hadronic physics at EHF (F. Cannata). Selected topics on antinucleon annihilation on light nuclei (T. Bressani and F. Cannata). Exotic atoms with supercritical Z (P. Quarati, P.P. Delsanto and A. Devoto). APE: A supercomputer for quantum chromodynamics (G. Fiorentini). 2. **Subnuclear Physics with Hadrons at Intermediate Energy.** Antineutrons (S. Serici). How to detect possible $\Delta B = 2$ processes (M. Baldo-Ceolin). CP violation (R. Cester). The case of the H particle (C. Guaraldo). Dibaryons and baryonia (P. Schiavon). Open problems in (e^+e^-) hadron production below 3 GeV (R. Baldini-Ferrolli). A possible accelerator experiment to solve the solar neutrino puzzle (P. Pistilli). 3. **Nuclear Physics with Hadrons at Intermediate Energy.** Experimental limits on charge independence and symmetry of strong interactions at intermediate energy (L. Satta). Pion production in nuclei (F. Iazzi). Ultra-relativistic heavy ions physics at the CERN SPS (L. Riccati). Nuclear matter excitation by nucleus-nucleus collisions and anti-proton annihilation in nuclei (P. Boccaccio). Pion-nucleus interaction (R. Garfagnini). 4. **Instrumental and Computational Aspects.** The time-of-flight technique (T. Bressani and G. Pauli). Streamer chambers for intermediate energy physics (L. Bussio). Solid state nuclear detectors (C. Manfredotti et al). Streamer tubes: features and their use (M. Spinetti). Particle identification by detection of Cerenkov light (L. Piemontese). Internal gas target for nuclear and particle physics experiments (M. Macri). Applied superconductivity for resonant accelerating cavities (V. Palmieri). Data acquisition systems in intermediate energy physics (M. Morando). Data acquisition systems in the new generation of experiments (A. Masoni and M. Morando). Advantages and limits of using a microcomputer online (A. Masoni). Concepts and methods of software engineering: how physicists begin to develop programs differently from current practice (M. Morandini). Author index. Subject index.

Windsurfing the Fermi Sea

Proceedings of the International Conference and Symposium on Unified Concepts of Many-Body Problems, State University of New York, Stony Brook, NY, U.S.A., September 4-6, 1986

edited by T.T.S. Kuo and J. Speth

Volume I (Conference proceedings)
1987 xiv + 262 pages
Price: US \$46.25/Dfl. 95.00
ISBN 0-444-87065-2

Volume II (Symposium proceedings)
1987 x + 404 pages
Price: US \$61.00/Dfl. 125.00
ISBN 0-444-87066-0
Set Price: US \$95.00/Dfl. 195.00
Set ISBN 0-444-87064-4

This International Conference and Symposium on Unified Concepts of Many-Body Problems was organized to celebrate the 60th birthday of G.E. ("Gerry") Brown. There were four half-day sessions with invited talks, the contents of which form the first volume of these proceedings. One half-day consisted of six parallel sessions with shorter talks, which are recorded in the second volume. The success of the conference was a tribute to Brown's contributions to physics over the years. His first interest was quantum electrodynamics, but over the years his interests broadened to encompass all fields of physics in particular nuclear and intermediate energy physics and astrophysics. He is renowned as an inspiring leader of research students, and an excellent teacher of undergraduates, in whom he takes a personal interest.

Contents: Volume I - Foreword. Preface (Sir R. Peierls). Session 1 - H. Feshbach, chairman. The story of supernovae (H.A. Bethe). 2. The nuclear equation of state (S. Kahana). Session 2 - I. Talmi, chairman. 3. How nuclei change shape (G. Bertsch, F. Barranco and R.A. Broglia). 4. Recent developments in statistical nuclear theory (H.A. Weidenmüller). Session 3 - E. Lieb, chairman. 5. The problem of fluctuating valence in f-electron metals (P.W. Anderson). 6. Confinement problems in heavy fermions (C.M. Varma). Session 4 - C. Pethick, chairman. 7. Ultrarelativistic heavy-ion collisions and the quark-gluon plasma (G. Baym). 8. Effective interactions and elementary excitations in quantum liquids (D. Pines). Session 5 - J. Schiffer, chairman. 9. Magnetic properties of nuclei (A. Arima). 10. Nuclear matter at finite temperature (T.T.S. Kuo). Session 6 - V. Gillet, chairman. 11. Collective phenomena in nuclei (J. Speth). 12. Pion and nucleon structure, and nuclear implications (W. Weise). Session 7 - M. Harvey, chairman. 13. Bayron observables and color confinement (A.D. Jackson). 14. Electromagnetic currents in the Skyrme model (D.O. Riska). Session 8 - L. Castillejo, chairman. 15. Chiral symmetry and strangeness (M. Rho). 16. Symposium summary (G.T. Garvey). Subject index.

Volume II - Sections: Nucleon-Nucleon Interaction and Many Body Problems. Papers by - R.A. Broglia

and B. Lauritzen; K. Holinde; H. Muther; S.A. Moszkowski; M. Bolsterli; R. Blümel and K. Dietrich; B.L. Friman. **Structure of the Nucleon (I).** Papers by - C.W. Wong; C.E. Carlson; M.F. Gari; J.V. Noble; I. Zahed; C.B. Dover; W.D. Heiss and J.F.H. Quick; F. Myhrer. **Structure of the Nucleon (II).** Papers by - R. Vinh Mau; E.M. Nyman; K.-F. Liu; G. Ripka; V. Vento; J. Wambach et al; T.H. Hansson; D. Klabučar and I. Zahed. **Nuclear Structure.** Papers by - I. Talmi; L. Zamick; B.R. Barrett; P.J. Ellis; D. Vautherin and N. Vinh Mau; M. Brack; E. Osnes; H.H. Wolter; Q.-Y. Zhang and A. Klein. **Medium Energy Nuclear Physics.** Papers by - R.R. Silbar; B. Frois; M.B. Johnson; E. Hadjimichael; E. Hernández and E. Oset; C.-Y. Wong; B.K. Jennings; C.M. Ko; J.P. Vary; A. Harindranath and K.E. Lassila; V.K. Mishra. **Condensed Matter and Astrophysics.** Papers by - J. Applegate; J. Cooperstein; M. Prakash et al; T.L. Ainsworth; K.F. Quader. Author index. Subject index.

Lasers for Ultrashort Light Pulses

by Joachim Herrmann and Bernd Wilhelmi

Co-publication with Akademie-Verlag, Berlin, G.D.R.

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1987 302 pages
Price: US \$85.25/Dfl. 175.00
ISBN 0-444-87055-5

The rapid development of picosecond lasers and picosecond light pulse diagnostics has led to enormous progress in the entire field of ultrafast measuring techniques during the last 15 years. Ultrashort light pulses permit novel investigations of extremely rapid physical, chemical and biological phenomena on the picosecond and even femtosecond time scale. The high time resolution attained using picosecond lasers allows new and deeper insights into the nature and especially into the temporal evolution of some extremely fundamental processes in materials, most of which occur on a picosecond time scale. Among the fundamental processes that have been measured are the free decay of molecular vibrations and of orientational fluctuations in liquids, relaxation processes in small and large molecules, phonon decay, exciton decay and energy migration in solids. Moreover picosecond technology has provided new capabilities both for the manipulation of photophysical and photochemical processes and for making extremely fast electro-optical components such as switches, modulators and receivers.

The present rapid expansion of research work on picosecond lasers and their application makes it difficult to survey and comprehend the large number of publications in this field. This book aims to provide a thorough introduction to the field starting with the very basic and moving on to an advanced level.

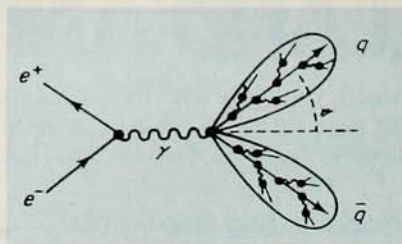
The authors have provided a guide for physicists, chemists, biologists and engineers as well as for students in these fields who wish to become familiar with the generation and measurement of ultrashort light pulses and their application.

fields, an important question arises in teaching graduate students with a research inclination toward elementary-particle theory: How much time should one devote to teaching non-gauge field theories and canonical quantization methods before proceeding to gauge theories and path integrals? The answers to this question suggested by the three books under review range from one entire year to complete omission. Clearly, there is no consensus, and a given teacher's inclination on this question will likely determine which of these excellent textbooks to choose.

The book by de Wit and Smith is the first volume of a projected two-volume work on field theory. Because discussion of gauge theories is delayed until the second volume, these authors answer our question with "up to a year of lectures." Their comprehensive coverage of kinematics includes the calculation of cross sections and decay rates. The Feynman rules for spins 0, $\frac{1}{2}$ and 1 are discussed; for example, the Proca formalism for massive spin-1 particles is explained. Slightly more sophisticated topics, such as dimensional regularization and minimal subtraction, are introduced near the end of the book. The pace is slow and thorough, and I eagerly await the second volume for an equally careful treatment of gauge theories.

Ryder's book steers a middle course. It neatly intertwines discussions of canonical quantization and path integrals; similarly, it provides parallel treatments of non-gauge and gauge theories. There are thoughtful expositions of the quantization and renormalization of gauge fields and of relativistic wave equations and canonical quantization. Some exercises would have been helpful for those who plan to use the book as a text. Ryder devotes little space to applications of the theory to the standard electroweak theory or quantum chromodynamics. Overall, the book is an excellent introduction to the formalism of field theory. I like its layout, especially the chapter summaries, and the parts I read in detail were carefully and pedagogically presented.

As its title suggests, the book by Becher, Böhm and Joos (translated from German) contains no warm-up discussions on non-gauge field theory or canonical quantization. It begins with a survey of the phenomenological basis for the standard gauge theory of strong and electroweak interactions, including quark colors and flavors, and the parton model. In chapter 2 follows the formulation of



Electron-positron annihilation in hadrons creates a quark-antiquark pair via a virtual photon. These primary quarks radiate mostly soft, almost collinear gluons, which together with the primary quarks, hadronize in two jets. Jet axes are therefore determined by the direction of the primary quark pair. (Reproduced from *Gauge Theories of Strong and Electroweak Interactions* by permission of the publisher.)

chromodynamics and its quantization, renormalization and renormalization group properties, as well as discussion of the lattice approach, instantons and applications of perturbative QCD. Finally, in chapter 3, the Glashow-Salam-Weinberg electroweak theory is formulated, followed by a brief outline of grand unification. This book is more advanced than the other two and provides an excellent perspective on modern gauge theories, including most of the key formal and phenomenological aspects.

Writing out lecture notes for advanced-level classes is a time-consuming business. Polishing the notes into book form takes even longer and is a selfless task—not, as a general rule, proportionately rewarded either in remuneration or in peer recognition. (My colleague Eugen Merzbacher is the perfect exception to prove this rule.) Thus, I wish to applaud the labors of all six authors involved in creating these three books. They have set a high standard in didactic writing and scientific soundness.

PAUL H. FRAMPTON
University of North Carolina,
Chapel Hill

Hot-Electron Transport in Semiconductors

Edited by Lino Reggiani
Springer-Verlag, New York,
1985. 275 pp. \$52.00 hc
ISBN 0-387-13321-6

The effects of hot electrons (that is, electrons accelerated by large electric fields) in semiconductors have been interesting subjects for research for several decades because they allow us to investigate situations extremely far from equilibrium. With the recent advent of submicron fabrication

techniques, hot-electron transport has taken on new life. Modest voltages produce large electric fields in submicron structures, and hot-electron effects are unavoidable. *Hot-Electron Transport in Semiconductors*, which summarizes and tabulates many of the basic results in hot-electron physics, is particularly welcome in this rapidly growing field.

The book contains seven review articles, by internationally prominent, longtime workers in the hot-electron field. The emphasis is on properties of bulk semiconductors rather than inhomogeneous or submicron systems. This emphasis is a strength because the book carefully explains the physics of basic transport quantities (drift velocity and diffusivity), but a weakness because the book mentions the most interesting developments of recent years only briefly. Updating the classic book by Esther Conwell, *High-Field Transport in Semiconductors* (Academic, New York, 1967), *Hot-Electron Transport in Semiconductors* contains more information about noise, compound semiconductors and the large amount of information gained from Monte Carlo simulation. Though it covers fewer topics than *Physics of Nonlinear Transport in Semiconductors* (Plenum, New York, 1980), edited by David Ferry, John Barker and Carlo Jacoboni, Reggiani's book is both more systematic and more pedagogic.

Three sections of the book contain particularly good pedagogic reviews. First, Reggiani's own section on the theory of hot electrons emphasizes diffusion, noise and the Monte Carlo method (his specialty). Reggiani systematically presents both the formal aspects of the theory and the nuts and bolts of how to do a homogeneous-field Monte Carlo calculation for a real semiconductor. Unfortunately the article includes few actual numerical results of the Monte Carlo technique. And plots of the fundamentally important distribution function are not included at all. Second, Claudio Canali, Filippo Nava and Reggiani review the use of time-of-flight measurements to determine drift velocity and diffusion coefficients; their chapter contains ample experimental details on Si, Ge and GaAs as well as several other materials. Finally, in his survey of microwave measurements of transport parameters, Yuras Pozhela emphasizes results obtained for relaxation times from the conductivity and for diffusivity from the noise.

Apart from the basic physics of hot-electron transport, numerous fascinating but complex phenomena occur in semiconductors with hot electrons.