

tion, work that Dalitz discusses in detail in *Reminiscences*.

Throughout these essays by Dirac's former colleagues, students and friends are comments on his life and personality. An entire section in *Reminiscences*, moreover, is devoted to Dirac's "Human Side." This section opens with a captivating account by Margit Dirac relating how she met her husband in Princeton in 1934 through her brother, Eugene Wigner, whose own recollections of Dirac follow later. Sevda A. Kursunoglu describes Dirac, in a delightful essay spiced with humor, as she knew him in Florida after he retired as Lucasian Professor of Mathematics at Cambridge in 1969. Additional contributions by J. E. Lannutti, Harish-Chandra, N. Kemmer, Rudolf Peierls, A. D. Krisch and H. E. Stanford complete the section, which taken as a whole does indeed convey a portrait of Dirac to the reader. His best known mannerism, of course, was his legendary monosyllabic mode of communication, illustrated by numerous anecdotes and perhaps traceable to the demands of a domineering father. But there is much more: We learn of his love of walking and travel, his kindness and humility, his hopes and fears. Lannutti writes that until he met him, "Dirac was not a person. Dirac was an equation, a theory of anti-matter, a delta function, a monopole or a kind of statistics." All that changed through personal association. Nevill Mott summed up his impression in a letter to his parents in 1931: "Dirac is rather like one's idea of Gandhi." Someday, hopefully, Dirac too will find his biographer.

ROGER H. STUEWER
University of Minnesota

Klaus Fuchs, Atom Spy

Robert Chadwell Williams
*Harvard U. P., Cambridge,
Mass., 1987. 267 pp.
\$25.00 hc ISBN 0-674-50507-7*

Almost 30 years after he was convicted of passing nuclear information to the Soviet Union, Klaus Fuchs continues to arouse considerable interest. Robert Williams throws new light on the Fuchs case in this carefully researched book. He makes it clearer than earlier accounts have done that Fuchs was an active and committed Communist before he left Germany in 1933. Fuchs's Communism sprang from his opposition to Nazism, and was not regarded as a serious danger by the British authorities when they allowed him to join the British atomic project in the summer of 1941. Fuchs

had been dismayed by the Nazi-Soviet pact of 1939, but after Hitler's invasion of the Soviet Union in June 1941 he decided to inform the Soviet authorities about British work on the atomic bomb. Williams publishes for the first time the two confessions Fuchs made to the British authorities; these are still classified in Britain but have been released in this country. His book also contains the confession of Harry Gold, Fuchs's espionage control when Fuchs was a member of the British team on the Manhattan Project from December 1943 to June 1946.

These confessions tell us as much as we are likely to know for some time about the information Fuchs passed to the Soviet Union. Fuchs helped the Soviets not only by informing them of the designs for the gaseous diffusion isotope separation plant and for the implosion bomb, but more importantly perhaps by alerting them to the fact that Britain and the United States took the possibility of an atomic bomb seriously. During World War II this political information was the true atomic secret, and it persuaded Stalin to initiate a Soviet atomic project in 1942.

Fuchs acted for political and ideological reasons, not because he believed that scientists should be open about their research. As the cold war developed he became less anxious to provide information to the Soviet Union. He did tell his Soviet contact about the early work at Los Alamos on the hydrogen bomb, but his period of greatest usefulness to the Soviet Union seems to have ended in 1945.

Williams mentions that Fuchs may have been, without knowing it, under the control of MI6 (the British secret intelligence service) after 1947, but he does not follow up this intriguing suggestion. This book, excellent though it is, does not answer all the questions that the Fuchs case raises.

DAVID HOLLOWAY
*Center for International Security and
Arms Control
Stanford University*

The Advancement of Science, and Its Burdens

Gerald Holton
*Cambridge U. P., New York,
1986. 351 pp.
\$39.50 hc ISBN 0-521-25244-X;
\$12.95 pb ISBN 0-521-27243-2*

In this thoughtful book, Gerald Holton considers both blades of our sword of Damocles, the thought-provoking advancements and the concomitant burdens of science. Holton, a re-

nowned historian of science, takes the philosophical and historical high road on his trip from the past glories of Albert Einstein, Werner Heisenberg and Robert Oppenheimer to the burdens of the broader societal implications that scientists must consider—the bad along with the good. It is pedagogically wise for our graduate students to have this book to bridge the river of human events from those glorious achievements to the other side of burdens, at once less precise and less logical. Holton's approach works extremely well when addressing the "achievements" side of the coin, but is less satisfactory for the flip side because the burdens are more complicated than nature itself.

First, the "advancement": Both experimenters and theorists suspend their disbeliefs to jump creatively to their solutions based on intuition. Holton has examined data books to discover that Robert Millikan ignored data with "larger errors" because deep down he wanted electrons to have a unit charge. This bold, controversial stroke eliminated the fractionally charged electrons that had some support in other laboratories. Alternatively, theorists suspended various disbeliefs to create the discreteness of quantum mechanics and a relativity where time is suspect.

By using fundamental presuppositions containing elements of symmetry, causality, completeness, continuum and invariance, Einstein concluded that "the noblest aim of all theory... is to make these irreducible elements as simple and as few in number as is possible without having to renounce the adequate representation of any empirical content." Holton contends that the two-dimensional approach of combining physical phenomena and mathematical analysis must be expanded to include a third, orthogonal axis that folds in the presuppositions of symmetry, causality and so forth. This type of right-brained thinking is not strictly linear and logical in that it can require suspending disbelief and tolerating ambiguity, but it often has led to the "truth." The first two-thirds of the book contain a number of interesting quotes and insightful revelations, such as the image of Max Planck, the creator of the quantum concept, fighting its corpuscular implications in 1927 by saying, "Must we really ascribe to the light quanta a physical reality?" Or consider Wolfgang Pauli's statement in 1925 that "physics is decidedly confused at the moment; in any event it is much too difficult for me and I wish I... had never heard of it."

VERY IMPORTANT TITLES DON'T MISS!!

CHAOTIC DYNAMICS

One-Dimensional Endomorphism to Two-Dimensional Diffeomorphism

C Mira (INSA, Toulouse France)

This book should be recommended for researchers dealing with dynamical processes (or evolution phenomena) of all scientific fields (chemical kinetics, dynamics of populations, automatic control, electronic, dynamics of charged particles, etc.)

For: Applied mathematicians, engineers and other physicists.

472 pp July 87 (50-324-7)US\$60 H/C

DARK MATTER IN THE UNIVERSE

4th Jerusalem Winter School for Theoretical Physics, Jan 1987

Editors: J Bahcall (Princeton), **T Piran** (Hebrew) & **S Weinberg** (Texas)

If standard gravitational theory is correct, then most of the matter in the universe is in an unidentified form which does not emit enough light to have been detected by current instrumentation. This is a discussion of the "missing matter" problem in the universe.

For: Astrophysicists, high energy physics and advanced students.

240 pp (app.) Mar 88 (50-535-5)US\$42 H/C (50-536-3)**US\$25 S/C

FOUNDATIONS OF QUANTUM CHROMODYNAMICS

Introduction to Perturbative Methods in Gauge Theories

T Muta (Hiroshima)

A comprehensive introduction to gauge field theories with techniques of perturbative QCD in great pedagogical detail. An ideal textbook on QCD and is a must for researchers and graduate students in high energy physics, nuclear physics and mathematical physics.

450 pp July 87 (950-40-5)US\$86 H/C (950-41-3)US\$44 S/C

HIGHEST WEIGHT REPRESENTATIONS OF INFINITE-DIMENSIONAL LIE ALGEBRAS

V Kac (MIT) & **Raina** (Tata Inst. India)

The lectures focus on the idea of highest weight representation, through four different incarnations which is very useful for mathematicians and physicists.

250 pp Mar 88 (50-395-6)US\$55 H/C (50-396-4)US\$28 S/C

INTRODUCTION TO SUPERSYMMETRY AND SUPERGRAVITY

P West (London)

By one of the leading researches in the field, it succeeds as an excellent bibliography. Over 200 key references provide readers with ample access to further reading. This book excels in its purpose as an introduction. It is a delight and should become a classic in the field.

For: High energy physicists.

300 pp July 86 (50-027-2)US\$37 H/C (50-028-0)US\$22 S/C

PHYSICS OF QUASICRYSTALS

P- Steinhart & **S Ostlund** (Pennsylvania)

An introductory lecture outlining basic concepts and challenges in the field followed by reprinted articles important in understanding the subject, this volume has long-lasting as well as immediate value to physicists, crystallographers, metallurgists and mathematicians.

600 pp Jan 88 (50-226-7)US\$97 H/C (50-227-5)US\$56 S/C

PLASMA PHYSICS

1987 Int'l Conference on Plasma Physics, Kiev, USSR April 1987

Editor: A Sitenko (Kiev, USSR)

Speakers: A Sitenko, P Sosenko, A Hasegawa, H Wilhelmsson, S Vukovic, S Kuhn, F Chen & M Srivastava.

800 pp Sept 87 (50-387-5)US\$175 per set

PROGRESS IN HIGH TEMPERATURE SUPERCONDUCTIVITY

VOL. 1: ADRIATICO RESEARCH CONFERENCE

ICTP, Trieste, Italy July 1987

Editors: S Lundqvist (Chalmers) **E Tosatti** (SISSA/ICTP), **M Tosi** (ICTP) & **Yu Lu** (Beijing/ICTP)

The focus will be on latest experimental discoveries; theoretical interpretations and technical applications.

For: Solid state physicists, material scientists and electrical engineers.

650 pp (app.) Jan 88 (50-399-9)US\$83 H/C (50-400-6)**US\$39 S/C

VOL. II: BEIJING INTERNATIONAL WORKSHOP

China, June/July 87

Editors: Z Gan & **G Cui** (Beijing)

This proceedings covers a wide range of research field for the recent development of high T_c superconductivity.

For: Solid state physicists, material scientists and electrical engineers.

500 pp (app.) Sept 87 (50-401-4)US\$78 H/C (50-402-2)**US\$39 S/C

VOL. III: DREXEL INTERNATIONAL CONFERENCE

Philadelphia, Pennsylvania July 1987

Editors: S Bose & **S Tyagi** (Drexel)

A startling breakthrough of the 1980s has prompted front line researchers together to discuss the latest developments in superconductivity.

For: Solid state physicists, materials scientists and electrical engineers.

600 pp Feb 88 (50-410-3)US\$78 H/C (50-411-1)**US\$39 S/C

VOL. IV: 2ND SOVIET-ITALIAN SYMPOSIUM

Naples, Italy May 1987

Editors: A Barone (Napoli) & **A Larkin** (Landau)

The contents span over a wide range of theoretical and experimental aspects of the Josephson Effect plus results by Russian and Italian Scientists.

For: Physicists, engineers and material scientists.

420 pp Feb 88 (50-504-5)US\$65 H/C

QCD VACUUM, HADRONS AND SUPERDENSE MATTER

E V Shuryak (Novosibirsk)

Probably the only available that gathers QCD, many-body theory and phase transitions in one volume. The presentation is pedagogical and readable with materials interesting to students/researchers of astro, nuclear and high energy physics.

480 pp May 88 (978-32-6)US\$92 H/C (978-33-4)US\$46 S/C

SPIN GLASS THEORY AND BEYOND

Introduction to the Replica Method and Its Applications

M Mezard (Paris), **G Parisi** & **M Virasoro** (Roma)

A detailed and self-contained presentation of the replica theory of infinite range spin glasses. About two-thirds of the book are a collection of most interesting and pedagogical articles on the subject.

For: Physicists, mathematicians and biologists.

550 pp (app.) Sept 88 (50-115-5)US\$86 H/C (50-116-3)US\$48 S/C

** Soft cover editions of proceedings and advanced series for all individuals and developing countries only. Prices are subject to change without notice.

 **World Scientific**

For information in America, contact World Scientific toll free:

1 800 227 7562 or (201) 837-8858

Telefax: (201) 837-8859 687 Hartwell Street, Teaneck, NJ 07666, USA

In other parts of the world:

Cable: COSPUB Telex: RS 28561 WSPC Telefax: 2737298, Tel: 2786188
Farrer Road, P O Box 128, Singapore 9128

Second, the "burdens": From the well-defined high ground of achievement, Holton is forced to descend into the less precise regime of burdens, where we do not have the friendly guideposts of symmetry and invariance to help us find our way. Linear, logical thinking will need more than a third axis if we are to succeed here because issues such as the arms race are driven by vague, less clearly defined driving forces such as mirror

imaging, deterrence, marginal cost, countermeasures, hidden agendas and governmental debates that often are too politically pragmatic. However, Holton gets very high marks for leading the deeply philosophical into thinking about the responsibility of being a scientist. Certainly Einstein felt his burdens in his own end game, the manifesto he wrote with Bertrand Russell in 1955, in which he encouraged us to consider our burdens by

stating: "We have to learn to think in a new way. We have to learn to ask ourselves, not what steps can be taken to give military victory to whatever group we prefer; for there no longer are such steps." These words stimulated the establishment of the Pugwash movement, through which the international science community has considered its collective burdens. My guess is that Einstein would consider the Pugwash legacy equivalent to his trio of papers from 1905. The real question is, how can we do better to ensure the good uses of science and to avoid the bad uses of science? One possibility that has occurred to me is a science court—with penalties for errors of commission and omission. Holton suggests the use of "combined mode" research to expand the study of basic concepts along with their implications. In fact, this approach is the hallmark of studies produced by the Congressional Office of Technology Assessment, but unfortunately only a few universities have really taken up this call since professional rewards come from digging deep rather than broad. I was encouraged to read in Jan Beyea's letter in *PHYSICS TODAY* (October, page 152) that he is drawing up a list of possibilities for physicists who wish to devote 10% of their time to applying physics to societal problems—much in the manner of lawyers doing *pro bono* work. With some hard work, we might yet agree with Einstein and remove some of the dice-playing in our universe.

In summary, Holton's book on the advancements and burdens of science is a good supplemental and broadening text for first-year graduate students (as well as more mature practitioners). By staying on the philosophical high road, Holton avoids the politization of discussing specific burdens, thus making it more likely that his book will be used as a starting point in graduate courses.

DAVID HAFEMEISTER

California Polytechnic State University

BOOK NOTES

Uranometria 2000.0, Volume 1: The Northern Hemisphere to -6°

Wil Tirion, Barry Rappaport
and George Lovi
Willmann-Bell, Richmond,
Va., 1987. 43 pp. + 259 charts.
\$39.95 hc ISBN 0-943396-14-X

The discovery of the planet Neptune in 1846 from an analysis by Urbain

8,500 c/sec.

.01 sec.

1 sec.

100 sec.

Create Images by detecting and locating individual photon events.

What is your application for extremely low-light-level image detection? Reaching for the incredibly faint spectra from galaxies billions of light years away? Probing the properties of molecular films on the face of semiconductors? Point source tracking for active optical systems?

Whatever your application, putting an ITT Position-Sensing Photomultiplier Tube in your imaging system lets you detect and locate individual photon events over wavelengths from 120 to 800 nm, at rates from 10 to 10^6 photons per second over the field of view.

Here are just a few of the fields for which ITT has provided these devices:

- Astronomical Echelle Spectroscopy

- Photon Counters with Position Sensing
- Raman and Time-Resolved Raman Spectroscopy
- Single Molecule Laser Tracking
- X-Ray Scintillation Pinhole Cameras

ITT offers a wide range of photocathode responses and position-sensing anodes in both catalog and custom configurations.

Contact us about your application. A standard line of products is also available. Ask for our catalog.

ITT Electro-Optical Products Division
P.O. Box 3700 • Fort Wayne, IN 46801
(219) 423-4341 • TWX: 810-332-1413,
Telex: 23-2429



ELECTRO-OPTICAL PRODUCTS DIVISION

ITT

Circle number 32 on Reader Service Card