

History of Physics Newsletter

Volume VI, Number 1, Part I

October 1994

FROM THE [NEW] EDITOR

Two innovations mark this edition of the *Newsletter* the second, hopefully, more apparent than the first. **Albert Wattenberg**, who has been editor since 1985, has persuaded the Forum's Executive Committee that he deserves to retire from that position. In agreeing to take over as editor, my principal condition was that Al be available to offer advice, particularly during this first year. He has graciously consented to that condition, and will also continue his close involvement with the Forum as its Councillor through December 1998. I will also count on the experience, advice, and assistance of **Stephen Brush**, who has agreed to continue to serve as an associate editor. **Elizabeth Garber**, currently chair of the Forum, has announced her intention of retiring as an associate editor, effective with the next edition. *Readers who are interested in taking over her tasks, or who wish to nominate someone to do so, should contact me as soon as possible.*

The second innovation marked by this edition is that the *Newsletter* is being printed and distributed in two parts. Part I consists of news items, announcements, meetings, reports, and summaries of recent articles of interest to Forum members. Part II, entitled *Recent Publications in the History of Physics*, was compiled by Steve Brush is being issued jointly by the APS' *Forum on the History of Physics* and the AIP's *Center for the History of Physics*. Readers are invited to comment on the content and substance of either part of the *Newsletter*, and to submit material for publication in subsequent editions.

William A. Blanpied
National Science Foundation

FORUM NEWS

Nominations for Officers

The Nominations Committee would appreciate receiving the names of Forum members who are willing to serve on various committees of the Forum or of the American Physical Society. The Forum needs to elect a Vice-chair who in succeeding years will become Chair-elect and then Chair. We also need to elect a Secretary-Treasurer for a three year term, and two members of the Executive

Committee who will serve for three years. The By-laws require that we have at least two nominees for each position. Please send suggestions as soon as possible to the Chair of the Forum Nominating Committee, **Albert Wattenberg**, Physics Department, Univ. of Illinois, Urbana, IL 61801, Internet: a-wattenberg@uiuc.edu.

Election Results

John S. Rigden, of the American Institute of Physics, became Chair-Elect in April 1994 and will succeed **Elizabeth Garber** of SUNY, Stony Brook, as Chair in April 1995. **Gordon A. Baym** of the Physics Department at the University of Illinois, Urbana, was elected Vice-Chair and will succeed as Chair-

Elect in April 1995. **David Cassidy** of Hofstra University has agreed to serve as Acting Secretary-Treasurer until April 1995, to succeed **C. Stewart Gillmor** who is taking a well deserved sabbatical. **Albert Wattenberg** of the Physics Department at the University of Illinois, Urbana, was elected to a second four year term as Forum Councillor. **George L. Trigg**, retired Editor of the *Physical Review Letters*, and **Virginia Trimble** of the Physics Department at the University of California, Irvine, were elected to three year terms on the Executive Committee. **Spencer R. Weart**, Director of the AIP Center for History of Physics, continues to serve as Ex Officio member of the Executive Committee.

Forum Committees

For 1994-95, the committees of the Forum are:

Program Committee:

Elizabeth Garber (chair), **John S. Rigden**, **Gordon A. Baym**, **David Cassidy**...

Nominating Committee:

Albert Wattenberg (chair), **George Trigg**, **Virginia Trimble**, **Peggy Kidwell**.

Fellowship Committee:

John Rigden (chair)

Publications Committee/Editorial Board:

William Blanpied (chair), **Stephen Brush**, **Elizabeth Garber**, **Gloria Lubkin**, and **Spencer Weart**.

Membership Committee:

David Cassidy (chair), **Elizabeth Garber**

Nature intended me for the tranquil pursuits of science, by rendering them my supreme delight.

Thomas Jefferson, 1809

The *History of Physics Newsletter* is published by the Forum on the History of Physics of the American Physical Society. It is distributed free to all members of the Forum. Others who wish to receive it should make a donation to the Forum on the History of Physics of \$10 per volume (\$5 additional for airmail). Each volume consists of five issues. Editor: William Blanpie, Division of International Programs, National Science Foundation, 4201 Wilson Blvd., Arlington, VA 22230, (Internet: wblanpie@nsf.gov). Associate Editors: Stephen G. Brush, Department of History and Institute for Physical Sciences and Technology, University of Maryland, College Park, MD 20742 (Internet brush@ipst.umd.edu), and Elizabeth Garber, History Department, SUNY at Stony Brook, Stony Brook, NY 11794

Executive Committee

The annual meeting of the Executive Committee was held on April 19, 1994, in conjunction with the Washington meeting of the American Physical Society, chaired by **Silvan Schweber**, Chair of the Forum. **Albert Wattenberg**, Forum Councillor, reported on plans for the APS Centennial Meeting in 1999. Although these are from final, there will probably be a large, week-long meeting in Washington, DC, in March, with ceremonial sessions during the weekend prior to the technical sessions. **Judith Franz**, new Executive Secretary of the APS, announced that **Brian Schwartz**, retiring APS Associate Executive Secretary, would chair a planning committee for the centennial meeting on which she hoped the Forum would be represented.

We, who have devoted our lives to the solution of problems connected with physics, now meet together to help each other and to forward the interests of the subject which we love.

Henry Rowland, 1899

Schweber agreed to approach several individuals who might constitute a history committee for the meeting with the expectation that their early involvement in planning would be possible.

Past Chair **Gerald Holton** suggested that announcements for general APS meetings, as well as divisional and regional meetings, contain a box titled *History of Physics* so that papers could be contributed under this topic just as technical papers could be entered under other categories. Secretary-Treasurer **C. Stewart Gillmor** announced that the Forum has grown from approximately 2200 members in 1991 to over 3100 members. He noted that the Forum receives \$2.50 per member from the APS annually, in addition to a few hundred dollars from meetings revenues. Most of its budget pays for the *Newsletter* and for travel of the Executive Committee to attend the annual meetings required by our by-laws. The Executive Committee requested the Editorial Board to explore with the AIP Center for the History of Physics the feasibility of combining elements of the *Newsletter* with the AIP *History News* as a possible cost saving measure.

Holton offered a motion of thanks to Gillmor for his six years of service as Secretary-Treasurer; Executive Committee Member **Gloria Lubkin** offered a similar motion of thanks to Wattenberg for his as Councillor and *Newsletter* Editor. Both motions were passed unanimously by the Executive Committee.

APS NEWS

APS Council Meeting

At the April 23 meeting of the APS Council in Washington, the most pertinent subject for the Forum on the History of Physics was discussion of general meetings of the society. The peripatetic March meeting, which is dominated by the Division of Condensed Matter Physics, is very well attended. However, the April meeting in Washington has been losing about \$30,000 for many years. APS President **Burton Richter** and others feel that there is a need for greater unity among physicists in the various sub-disciplines, and that the best way to achieve such unity is through communication among the different divisions and forums. One previously proposed option that met with many objections was to schedule a fall General Meeting in addition to the March meeting.

The council discussed a proposal to combine the present March and April meetings into one General Meeting. However, the Divisions of Particles and Fields, Nuclear Physics, Astrophysics, Atomic, Molecular and Optical Physics, and Physics of Beams, all

expressed second thoughts about the consolidation plan. The Forum on the History of Physics felt that there had not been adequate discussion with the AAPT. Several divisions submitted statements opposing to the proposed single March meeting. Some suggested as an alternative that a general meeting should be scheduled following the end of the spring semester. The APS Executive Board voted to postpone the decision for a year. More information will be obtained from the Divisions and Forums so that the subject can be discussed again at the November meeting of the APS Council.

Harry Lustig, APS Treasurer, raised the possibility of limiting the funds that are allotted to the Forums. Their memberships have been growing rapidly and each currently receives \$2.50 per member from the APS. Lustig proposed that each Forum receive: 1) a flat \$1,000, 2) an additional \$4.00 per member for membership up to a total of 3 percent of the APS membership (at present approximately 1,300, based on the current APS of roughly 42,000), and 3) an additional \$1.50 for each additional member above the 3 percent figure. The result for the Forum on the History of

Physics would be that support under the new system would be about the same as we presently receive. However, if we continue to grow, we would receive less under the new system compared with the old one.

The proposal will be discussed further with the APS subunits.

Concepts which have proved useful for ordering things easily assume so great an authority over us that we forget their terrestrial origins and accept them as unalterable facts.

Albert Einstein, 1916

New APS Management Team

Judith R. Franz, who was designated APS Executive Secretary to succeed N. Richard Werthamer in November 1993, assumed her duties on a full time basis in April. Among her first official acts was to appoint **Neil Baggett** as Associate Executive Secretary to succeed Brian Schwartz. Although Schwartz elected to remain in New York when the APS moved to College Park, he remains active in APS affairs; in particular, he chairs a planning committee for the centennial meeting of the APS in 1999.

Franz, a condensed matter physicist, received her PhD from the University of Illinois in 1965. She has held faculty appointments at a number of universities, most recently as Professor of Physics at the University of Alabama in Huntsville. Franz has been active in APS affairs, having served as Chair of the Division of Condensed Matter Physics and of the Committee on the Status of Women in Physics. She is also a past president of the American Association of Physics Teachers.

Baggett, a high energy physicist, received his PhD from the University of Maryland in 1969. He has held high energy physics-related positions at the Department of Energy in Washington, DC, and at Brookhaven National Laboratory, and most recently was associated with the Superconducting Super Collider Laboratory in Dallas, Texas.

ANNOUNCEMENTS

NEH Programs

The National Endowment for the Humanities' *Humanities, Science, and Technology* grants support research that brings the knowledge, methods, and perspectives of the humanities to bear on the subjects of science, technology, and medicine. Both historical research and research that deals with fundamental current issues in which the humanities play a central role are eligible.

For additional information, contact the Division of Research Programs, National Endowment for the Humanities, 1100 Pennsylvania Avenue, N.W., Washington, DC 20506. Internet: nehres@gwuvvm.edu.

NSF Programs

The National Science Foundation's *Science, Technology and Society* Program, described in publication NSF 91-109, considers proposals for research about the intellectual and value contexts that govern the development and use of science and technology. Within this framework, the program awards grants for research and related activities in the history of science, in addition to interdisciplinary studies that examine ethical and value implications associated with science and technology. Although of less direct interest to historians, readers of this *Newsletter* may also be interested in research opportunities offered through NSF's small (10-15 grants per year) *Research on Science and Technology* Program. It is essential that potential applicants read NSF 92-37 concerning scope, focus, guidelines, and special requirements of this program.

The above-referenced brochures may be obtained from the NSF's Forms and Publications Unit, 4201 Wilson Blvd., Arlington, VA 22230, phone: (703) 306-1130, internet pubs@nsf.gov.

HHS Committee on Education

The History of Science Society (HHS) has appointed a Committee on Education that has initiated a project entitled, *Using Images and Sound to Teach the History of Science*. During the project's first phase, the committee will compile an inventory of audio-visual resources suitable for teaching the history of science or mathematics. Many of these materials may also be appropriate for science, mathematics, social studies, and humanities courses. The inventory will include items such as slide collections, films, video and audio tapes, CD ROM's, traveling exhibits, transparencies, posters, and multi-media resources. The committee is interested in learning about items in private collections as well as materials in the public domain. It also plans to develop a topical sourcebook to evaluate selected items in the inventory and suggest ways that these resources can be used in different courses at the secondary and undergraduate levels.

Additional information, as well as suggestions for items, topics, or techniques to be included in the inventory and/or source books, should be sent to Professor Marjorie Malley, HHS Committee on Education, 1934 Dewey Avenue, Bartlesville, OK 74003.

Dibner Institute Awards

The Dibner Institute for the History of Science and Technology in Cambridge, Massachusetts, has announced the recipients of its Graduate and Resident Fellowship awards for 1994-95.

Three of the seven Dibner Graduate Fellows are pursuing research in the history of physics: **Evangelos Geronicolos** is following his first Ph.D. in Physics with a second at Boston University's Center for Philosophy and History of Science. His doctoral dissertation, "A Bayesian Analysis of Case Studies in the History of Science," focuses on an explanation of sunspots in terms of the theory of magneto-hydrodynamics, and the hidden variables theory of quantum mechanics. **Christoph H. Luthy** is a Ph.D. candidate in the Department of the History of Science at Harvard University. His dissertation is entitled, "Atoms, Microscopes, and Causality: 'Visual Reductionism' in the 17th Century," will explore two prominent components of the "Scientific Revolution" of the 17th century: the victory of atomistic theories of matter and the discovery and development of microscopes. **Babak Razzaghe-Ashrafi** received a Ph.D. in Physics from the State University of New York at Stony Brook in 1993. In 1993-94, he was a teaching assistant for the course in the history and philosophy of twentieth century physics at Harvard University.

The gods were favorable to me by letting me work with Wigner, so I shall from now on, whatever paper I write and with whatever man, I shall always stick to the alphabetical order of authorship.

Victor Weisskopf, ca 1930

Five senior historians of physics are among the Dibner Resident Fellows for 1994-95: **Daniel L. Goroff** is Senior Lecturer in the Department of Mathematics at Harvard University and Associate Director of the Bok Center for Teaching and Learning. He plans to expand upon an earlier essay, "Henri Poincare and the Birth of Chaos Theory" in a book entitled, *Henri Poincare, George David Birkhoff, and the Discovery of Chaos*. **Helge Kragh** is Senior Researcher in the History of Technology in a project investigating the history of Danish technology. He is writing about the development of cosmology from a branch of mathematics into a physical science. **Domenico Bertoloni Meli** is a Research Fellow at the Wellcome Institute, London, and had previously been Research Fellow, Jesus College, Cambridge University. At the Dibner Institute he will continue his research activities on Giovanni Alfonso Borelli and his influence on the Italian intellectual and political scene from the 1640s through the 1670s. **Edith Sylla** is Professor of History at North Carolina State University. At the Dibner Institute she will work on a book tentatively entitled, *Leibniz Looking Back: Alternative Perspectives on the Scientific Revolution*. **Andrew Warwick** is Lecturer in the History of Science at Imperial College, London. The title of his project is,

Writing a Social History of Mathematical Physics, in which he will relate the development of mathematical physics to broader cultural changes in Western Europe.

The deadline for receipt of applications for the institute's Graduate and Resident Fellowships for the 1995-1996 academic year is January 1, 1995. Fellowship recipients will be announced in March, 1995. Requests for further information and application forms should be sent to:

Trudy Kontoff, Program Coordinator
Dibner Building, MIT E56-100
38 Memorial Drive
Cambridge, MA 02139

Dudley Observatory Awards

The Dudley Observatory in Schenectady, New York, has announced the recipients of its 1994 Herbert C.

Pollack Awards in the History of Astronomy and Astrophysics. They are: **Joann Eisberg**, whose project is, *Beatrice Tinsley - A Scientific Biography*, **Ian R. Barky**, whose project is, *Arbiters of True Time: American Observatories in the Nineteenth Century*, and **James A. Voelkel**, *Translation of the Complete Kepler-Fabrizius Correspondence*.

The deadline for applications for the 1995 award is December 1, 1994. For additional information, contact Dr. Ralph A. Alpher, Dudley Observatory, 69 Union Avenue, Schenectady, NY 12308.

Cultural History of Swedish Science

A new research project on the cultural history of Swedish science, 1870-1970, has been initiated by **Svante Lindqvist** (Royal Institute of Technology) and **Sven Widmalm** (Uppsala University). The project, funded by a private foundation, *Axel och Margaret Ax: son Johnsons stiftelse*, is part of a larger research program in the history of modern Swedish science led by **Tore Frängsmyr**, Uppsala University. It includes a collaboration with the Department of History and Philosophy of Science and the Shipple Museum at the University of Cambridge - in particular, its Physics History Group and its Group for the History of Natural History and the Environmental Sciences. Three important themes to be explored are: (1) the relationship between science and technology; (2) the international status of Swedish science, and (3) the material culture of science. Over the next four years, the project will result in a number of historical monographs, along with a shorter and more programmatic book on the implications of the modern history of science for science policy.

For further information, contact **Sven Widmalm**, Department of History and Philosophy of Science,

University of Cambridge, Cambridge CB2 3RH, England, or Svante Lindqvist, Department for the History of Science and Technology, S-100 44 Stockholm, Sweden.

NASA History: News and Notes

The editor of the quarterly NASA History: News and Notes, welcomes brief news items bearing on air and space history. These should be submitted to Roger D. Launius, NASA History, Code ICH, NASA Headquarters, Washington, DC 20546.

MEETINGS

History of Science Society: 1994 and 1995

The History of Science Society held its 1994 meeting jointly with the Philosophy of Science Association and the Society for the Social Studies of Science in New Orleans, Louisiana, from October 12-15., 1994. Its 1995 meeting will be held from November 2-5 in Minneapolis, Minnesota.

Society for the Social Studies of Science: 1995

The 1995 meeting of the Society for the Social Studies of Science will be from October 19-22 in Charlottesville, Virginia

British Society for the History of Science

The British Society for the History of Science is planning a meeting on the History of X-Rays, Radiology Radiotherapy and Medical Imaging June 13-14, 1995, at the International Exhibition Centre in Birmingham. The meeting commemorates the centenary of Röntgen's discovery of x-rays.

For additional information contact David Cantor or John Pickstone, CHSTM, University of Manchester, M13 9PI.

Emergence of Modern Physics

A conference on the Emergence of Modern Physics will be held in Berlin, Germany, March 20-24, 1995. This three day meeting will commemorate the centenary of the fundamental discoveries in experimental

physics (x-rays, Zeeman effect, radioactivity, the electron) and the debates surrounding them that opened up and shaped modern physics. It will take place in conjunction with the annual meeting of the German Physical Society celebrating the 150th anniversary of its founding. The conference is being jointly organized by the Division of the History of Physics of the German Physical Society, the Interdivisional Group on History of Physics of the European Physical Society, and the Commission on the History of Modern Physics of the International Union on the History of Science. The languages of the conference will be English and German.

For further information, contact Professor Roger Stuewer, School of Physics and Astronomy, University of Minnesota, Minneapolis, MN 55455.

History, Philosophy and Science Teaching

The Third International Conference on History, Philosophy and Science Teaching will be held in Minneapolis,

Minnesota, October 29-November 2, 1995. International and national groups that have interests in the role of the

Science cannot live by science alone. Research needs education, just as education thrives when it is conducted in an atmosphere of inquiry and discovery.

Neal F. Lane, 1994

history and philosophy of science in science, mathematics, and history teaching are encouraged to use the conference as an occasion to present their work and to consolidate networks. Scholarly papers and teaching materials are encouraged. For additional information, contact Professor Fred Finley, Department of Curriculum and Instruction, University of Minnesota, Minneapolis, MN 55455-0208 (Internet: finleyfn@vx.cis.umn.edu)

History of Geophysics and Global Change

A symposium on the History of Geophysics and Global Change will be held in Boulder, Colorado, in August 1995. Topics will include all subjects in the history of geophysics and related disciplines and the sun and history. The deadline for submission of papers for presentation at the conference is January 31, 1995. A symposium volume is planned for publication late in the years.

For additional information contact Professor Michele Colacion, Instituto Fisica dell'Atmosfera, P.Le. Sturzo, 31, I-00144, Rome, Italy, or Dr. Wilfried Shröder, Beophysical Station, Hechelstrasse8, D-28777, Bremen, Germany.

REPORTS

APS Invited Session

At the 1994 Joint April meeting of the APS and AAPT, the Forums on the History of Physics and on Physics and Society co-sponsored a session of invited papers on *Science Advice to the Government*. The intention of the organizers was to broaden consideration of the government beyond the White House.

In his opening remarks Gerald Holton, as moderator, noted that science advice to governments did not begin in World War II. That point were reinforced in Michael Dennis's "Vannevar Bush and the Historical Problem of Science Policy." Because of the ultimate success of Bush's Office of Scientific Research and Development (OSRD), bureaucratic fights to take over its mandate and alternate policy possibilities have been forgotten. So is Bush's vision of the appropriate relationship between scientists, government and the military.

What Bush strove for after WWII and in *Science the Endless Frontier* was to take control of science policy be out of the hands of the military so that the military's enthusiasm for research and development would not dictate the future directions of research.

Holton read Harvey Brooks', "Survey of Science Advice to the Government Since World War II," an essay on the perennial problems in formulating and implementing both science for policy and policy for science. His paper also dealt with the problems of funding small versus large science. In a crunch small science loses out. Being a physicist necessarily includes being politically involved in educating the public and congress about science and the choices to be made in the funding process. In the former case, this was done successfully in the anti-ABM campaign of the early 1970s.

Kurt Gottfried ("Physics After the Cold War") continued with some of these same themes. With the end of the Cold War, the rules that determined relations between science and government have changed. Physicists must educate the public, otherwise someone else will. Drawing on personal experience, Gottfried reminded the audience that although Congressmen may begin their terms ignorant of science, they frequently do educate themselves on many arcane science policy issues. For example, the APS report on Star Wars had enormous impact in Congress, and was taken as science advice. Even though the Cold War is over and political and economic instability have increased, Gottfried emphasized that science enjoys considerable public popularity.

Neal F. Lane, Director of the National Science Foundation, NSF spoke on, "The New Paradigm for

Science and for Science Advice." Although the balance between support for research as a basis for national security and for economic competitiveness has shifted decisively, both goals remain viable. NSF must be mindful of the need to take these goals seriously. However, it intends to continue to support research on a broad front and to maintain its core principles for that support, building on current strengths in research and education, with an emphasis on excellence and creativity. Lane described the newly created (November 1993) National Science and Technology Council, but was not entirely clear about how this body proposed to address a principle goal of strengthened cooperation between universities, government and industry.

In her summation, Mildred Dresselhaus spoke to the survival of the discipline in a world whose priorities had changed and whose resources were limited.

Students are a major concern: attracting them into physics so that the discipline can have a future, while altering the model of physics and the life of physicists that we

present to them. Physicists must become involved in reaching out to society, not merely content to stay in their laboratories and teach in the same old ways.

In the question period, which was lively, Dresselhaus detailed some of the changes that needed to be made. In particular our assumptions of where physicists might work after graduate school, and hence how we teach our students, must change. In an era of diminishing enrollments, women have become a valued resource so that the discipline has to take their particular needs into consideration in structuring professional pathways and assessment.

Memoirs of a "Spymaster"

Associate Editor Elizabeth Garber writes: *Living in New York, literary storms, major and minor tend to be reported assiduously and with acidic relish in the local press. The one of interest this year was the appearance of Pavel Sudoplatov's Special Tasks, hyped as the memoirs of a "spymaster" who really "knew" what was going on with Soviet efforts to recruit spies especially to obtain the secrets of the atomic bomb. Among his other claims, or as it turns out, the way he was translated, was that every big name in the Manhattan Project from Oppenheimer on down were on the Soviet payroll. This got air-time on Macneill Lehrer, and only after concerted efforts were rebuttals offered in April. It is pleasant to announce that the print media were not so gullible. The "Op Ed" page of the New York Times carried, again in April a skeptical appraisal by Mark Walker, and the book got a serious review in the New York Review of Books, June 9, 1994 by Thomas Powers. The edifice crumpled.*

Since the war years, both Congress and the different administrations have shared the conviction that support of research in the nation's universities and industries represented an investment in the national future.

D. Allan Bromley, 1994

This was a nice analysis of the argument ("lousy") and the translation ("misleading to bad at best"). The June 23rd issue also carried a short article on the improbability of Oppenheimer being a spy by George Kennan. All in all the book was a damp squib which, hopefully, the press lost money on!

Science and Engineering Indicators

Science and Engineering Indicators - 1993, the latest of a series of biennial reports that have been prepared since 1972 under the guidance of the National Science Board, was transmitted to the Congress by President Clinton in February 1994. Long recognized as a unique and invaluable source of data and analysis in science policy, the *Indicators* series, as Gerald Holton suggested almost from the outset, can also be used to good advantage by historians of contemporary science.

The "Introduction" to the most recent report recounts the original goals of the series, as stated by Roger Heyns of the National Science Board in hearings before a House of Representatives Committee in May 1976. Although these goals continue to guide planning and preparation of the reports, their content and coverage have continued to evolve and expand. The detailed evolution and expansion of the *Indicators* reports comprise intriguing *historical* indicators of the changing character of science, science policy, and scientific information during the past two decades. In particular, *Science and Engineering Indicators - 1993* contains data trends by discipline -- including physics and astronomy -- on, e.g., federal funding, personnel training and employment, and publications.

Consistent with the desirability of maintaining currency not only in the substance but also the presentation of the information in these reports, Jennifer Bond of the National Science Foundation's Science Resources Division, who supervises their preparation on behalf of the National Science Board, has announced that *Science and Engineering Indicators - 1993* will shortly be available in hypertext form via *Mosaic*.

Science in the National Interest

Historians of contemporary science and science policy should also be interested in various aspects of

Science in the National Interest, the Clinton Administration's "white paper" on science policy, which was released on August 3, 1994, at a press conference presided over by Vice-President Gore.

Predictably, perhaps, the first chapter of the report, entitled "Science: the Endless Resource," opens with a quotation from Vannevar Bush on the need for government to accept new responsibilities for science and science education. While *Science in the National Interest* has been criticized as being long on rhetoric and short on specifics, it differs from previous government science policy statements in attempting to enunciate a long-term, integral vision encompassing something more than the need to support basic research in academia. A notable feature of the "white paper" is a set of one-page "cases" intended to illustrate the social impacts of contemporary advances in science and technology. Among these, seven make use of historical notes in tracing the evolution of the respective advances.

Science in the National Interest, based in part on a *Forum on Science in the National Interest* held at the National Academy of Sciences on January 31 and February 1, 1994, was drafted by Ernest Moniz, Chair of the Physics Department at MIT, who also arranged for the one-page historical cases.

The [science indicators] volumes already mark the significant beginning of an important enterprise that will have repercussions on science policy, on scholarly work in the history and sociology of science, and above all on the life of science itself.

Gerald Holton, 1978

RECENT ARTICLES

Historians are becoming much more interested in experiments and their role in physics. This is reflected in the articles reported below. The scientific instrument trade and available technology and its impact on what can be observed and measured, and theorized about are subjects also under scrutiny again.

American Journal of Physics.

1993, vol. 61 "Philosophical Midwifery and the Birth Pangs of Modern Cosmology," George Gale and John Urani, 66--73. "Galileo, Einstein and the Church," Hassan F. Zandy, 202. "My Experience Teaching Physics," Hans Bethe, 972--973. This is Bethe's speech in acceptance of the Oersted Medal of the AAPT.

American Philosophical Society.

1993, vol. 137 "Mathematics at Harvard in the 1940s," Garrett Birkhoff, 268--272. "Edwin Matteson McMillan, 1907--1991," Glen T. Seaborg, 287--291.

Since reading the account before given of Mr. Faraday's method of producing electrical currents I have attempted to combine the effects of motion and induction.

Joseph Henry, 1832

American Scholar.

1993, Summer "The Ladies of Observatory Hill: Annie Jump Cannon and Cecilia Payne-Gaposchkin," George Greenstein, 437--446.

American Scientist.

1993, vol. 81 "The Crisis in Russian Physics," Paul R. Josephson, 571--579.

Annals of Science.

1993, vol. 50. "Science and Liberty: The Scientific Instruments of Kings College and Columbia College in New York," S. A. Bedini, 201--228. "The Early Development of the Magneto-Electric Machine," Brian Gee, 101--134.

1994, vol. 51. "Early Reception of Einstein's Relativity in the Arab Periodical Press," Adel A. Ziadat, 18--35. "Percival Lowell, W. H. Pickering and the Founding of the Lowell Observatory," David Strauss, 37--58. "Prediction of the Nature of Hafnium from Chemistry, Bohr's Theory and Quantum Theory," Eric R. Scerri, 137--150.

Annual Reviews of Nuclear Particle Sciences

1993, vol. 43. "Reminiscences from the Cavendish Laboratory in the 1930s," Maurice Goldhaber, 1--25.

Archive for History of the Exact Science

1992, vol. 44. "Möller Scattering: A Neglected Application of Early Quantum Electrodynamics," Xavier Roqué, 197--264.

Berichte zur Wissenschaftsgeschichte

1993, vol. 16. "Physikalische Prinzipien und Praktischer Maschinenbau im industriellen Zeitalter," Gerhard Zweckbronner, 195--202. "Die Technisierung der Strahlenforschung und Hochenergiephysik als Durchsetzungsstrategie," Maria Osietzki, 203--216.

British Journal for the History of Science

1993, vol. 26. "The History of Measurement and the Engineers of Space," Andrew Barry, 459--469.

1994, vol. 27. "Making a Meal of the Big Dish: the Construction of the Jodrell Bank Mark 1 Radio Telescope as a Stable Edifice, 1946--57," Jon Agar, 3--21. "Kepler's Invention of the Second Planetary Law," William H. Donahue, 89--102. "The 'Einstein-Laué' Discussion," W. Schroder and H.-J. Treder, 113--114. "Bringing the Human Actors back on Stage: the Personal Context of the Einstein-Bohr Debate," David Kaiser, 129--152. "Institutional Innovation in *fin de siècle* Germany," Jonathan Harwood, 197--211.

Bulletin of American Meteorological Society.

1992, vol. 73. "Battles in the Heavens: Military Metaphors and 'Fronts' in the Early 18th Century," James R. Fleming, *05.

Bulletin of Scientific Instruments.

1993, vol. 36. "Elliott, Instrument Makers of London: Products, Customers and Development in the Nineteenth Century," H. R. Bristow, 8--11.

1993, vol. 37. "Make Glasses to see the Moon Large: An Attempt to Outline the Early History of the Telescope," Joachim Rienitz, 7--9. "There was no Elizabethan Telescope," Gerard G. L'E. Turner, 3--5.

Daedalus.

"Foundations, Universities and Trends in Support for the Physical and Biological Sciences, 1900--1992," Daniel Kevles, 195--235.

Eos.

"T. C. Chamberlin and H₂O Climate Feedbacks: A Voice from the Past," James R. Fleming, 505, 509.

English History Review.

1993, vol. 108. "Reforming British Weights and Measures, 1660--1824," Julian Hopper, 82--104.

European Journal of Physics.

1993, vol. 14. "Maxwell and Faraday," Peter M. Harman, 148--154.

History and Technology.

1994, vol. 11. The first issue in this volume is devoted to the history of information technology including articles on short-wave radio and international communication, the development of analog computers, and the development of computer communications concepts.

History of Science.

"Biography, Culture and Science: The Formative Years of Robert Boyle," Malcolm Oster, 177--226.

Historical Studies in the Physical and Biological Sciences.

1994, vol. 24. "Elastic *Nachwirkung*, Brownian Motion and the Tide against Determinism: 1835--1920," Maria Grazia Ianniello, 1--40. "The Mirage of the 'World Accelerator for World Peace' and the Origins of the SSC, 1953--1983," Adrienne Kolb and Lillian Hoddeson, 41--100. "The Bellevue *grand électroaimant*, 1900--1940: Birth of a Research-Technology Community," Terry Shinn, 157--188. "Controlling German Science, I: U.S. and Allied Forces in Germany, 1945--1947," David Cassidy, 197--236. "From Berlin to Jerusalem: Ladislaus Farkas and the Founding of Physical Chemistry in Israel," Michael Chayut, 237--264. "The Electron Theories of

Larmor and Lorentz: A Comparative Study," Olivier Darrigol, 265--336. "Artificial Eclipses: Bernard Lyot and the Chronograph, 1929--1939," 337--394.

"Science, National Socialism and the *longue durée*," Mark Walker, 395--402. An important essay-review of recent publications on physics and physicists, mathematics and early computing and the aircraft industry in the Third Reich. Among the books reviewed are David Cassidy's biography of Heisenberg, John Heilbron on Max Planck, and Herbert Mehrtens on mathematics and the impact of the Third Reich on that discipline.

This volume also contains a review article by Alice Walker on public science and a bibliography of recent works in the history of physics since the seventeenth century. Many entries describe the contents of the books.

1994, vol. 24, Supplement. "Weighing Imponderables and Other Quantitative Science around 1800," John Heilbron, 320 pps with Index.

Isis.

1993, vol. 84. In the December issue there is a section devoted to "Science in Film" Rima D. and Michael W. Apple, 750--774. Also of interest are reviews of two films on mechanics by Edward B. Davis.

1994, vol. 85. "The Atomic Energy Commission and the Politics of Radiation Protection, 1967--1971," J. Samuel Walker, 57--78. "Two Cultures or One? A Second Look at Kuhn's *The Copernican Revolution*," Robert S. Westman, 79--115. "Wheat and Chaff: The Harvest of the Faraday Bicentenary," L. Pearce Williams, 120--124. Essay review of books on Faraday, his science and religion and the Royal Institution. "A Trial of Galileos," Nicholas Jardine, 279--283. An essay review of the recent crop of studies of Galileo's ideas, methods and place in the court and culture of Florence. "Recent Biographical Studies in the Physical Sciences," Cathryn Carson and Silvan S. Schweber, 284--292. An essay review of the recent biographies of Heisenberg by David Cassidy, of Simon Newcomb by Albert Moyer, and Harriet Brooks by M. F. and G. W. Rayner-Canham and, of Lawrence Bragg's papers and Victor Weisskopf's autobiography.

Journal of Royal Astronomical Society of Canada.

1993, vol. 87. "The Canada-France-Hawaii Telescope and George Willis Ritchey's Great Telescope of the Future," Donald E. Osterbrock, 51--63.

Journal for the History of Astronomy.

1993, vol. 24. "William H. Pickering in Jamaica: The Founding of Woodlawn and the Study of Mars," Howard Plotkin, 101--122.

1994, vol. 25. "Getting the Wide Picture: Wide-Field Astronomical Photography from Barnard to the Achromatic Schmidt, 1888--1992," Donald E. Osterbrock, 1--14.

Journal of the History of Ideas.

1994, vol. 55. "Scientific Models in Optics: From Metaphor to Metonymy and Back," Stuart Peterfreund, 59--73.

New York Review of Books.

1994, March 24. "Eye on the Prize," Jeremy Bernstein, 19--22. Review of Emilio Segré's autobiography.

1994, June. "The Richest Vagabond," Michael Meyer, 26--27. Review of *Alfred Nobel: A Biography*, by Kenne Fant.

1994, July 14. "The Quiet American," Louis Mennand, 16--21. This is a long review of James G. Hershberg *James B. Conant: Harvard to Hiroshima and the Making of the Nuclear Age*. Conant was very influential during WWII and in the shaping of higher education afterwards. He also encouraged the history of science at Harvard where the first PhD in this discipline was awarded in the 1950s. This biography was also reviewed in June in the *New York Times Book Review* by Philip Morrison.

North Carolina Historical Review.

1992, vol. 69. "A Question of Loyalty: Frank Porter Graham and the Atomic Energy Commission," Julian M. Pleasants, 414--437.

Notes and Records of the Royal Society.

1993, vol. 47. "Newton's Description of the Reflecting Telescope," I. Bernard Cohen, 1--9.

Perspectives in Biology and Medicine.

1992, vol. 36. "Curies, Cure and Culture," Samuel Hellman, 39--45.

Perspectives on Science.

1993, vol. 1. "Experimental Questions," Allan Franklin, 127--146. An important essay review of recent work on experiment and its place in science. Much of this work has focused on physics.

"Was Einstein a Realist?" Don Howard, 204--251. "Discovery, Pursuit and Justification," Allan Franklin, 252--284. "Prediction and Theory Evaluation: Cosmic Microwaves and the Revival of the Big Bang," Stephen G. Brush, 565--602. [See "Summaries" section, below.] "*Corpore cadente ...*: Historians Discuss Newton's Second Law," Stuart Pierson, 627--658.

1994, vol. 2

"Two Mathematics, Two Gods: Newton and the Second Law," Stuart Pierson, 231--253.

In this issue there is a list of errata for Roger Stuewer's article, "The Origin of the Liquid-Drop Model and the Interpretation of Nuclear Fission." [See "Summaries" section, below.]

Physics News.

1994, May Supplement. "The German Atomic Bomb," "Publications on the History of Physics," Stephen G. Brush

Physics Today.

1994, January. "The Golden Age of Optical Fiber Amplifiers," Emmanuel Desurvire, 20--28.

1994, July. "Recollections of Lev Davidovitch Landau," Alexander I. Akhiezer, 35--43. "Yakov Il'ich Frenkel," Rudolf Peierls, 44--49.

1994, August. "Of Love, Physics and Other Passions: The Letters of Albert and Mileva, I," Gerald Holton, 23--29. "Einstein and the Press," Abraham Pais, 30--37.

Physis.

1992, vol. 29. "Mathematics and Method in Faraday's Experiments," David Gooding, 121--147. "From Chemical Constant to Quantum Statistic: A Thermodynamic Route to Quantum Mechanics," Agostino DeSalvo, 465--537.

Rivista di Storia della Scienza.

1993, vol. 1. "Acceleratori di particelle e laboratori per le alte energie: Roma e Parigi negli anni Trenta," I. L. Gambaro, 105--154.

Science, Technology and Human Values.

1994, vol. 19. "The Political Construction of Space Satellite Technology," W. Henry Lambright, 47--69. "Democracy and Super Technologies: The Politics of the Space Shuttle and Space Station *Freedom*," W. D. Kay, 131--151.

Scientia Canadenis.

1992, vol. 1. "De la physique des plasmas à la fusion nucléaire: Émergence et développement d'une spécialité," Michel Tr'epanier, 25--59.

Scientific American.

1993, February. "Redeeming Charles Babbage's Mechanical Computer," Dorothy D. Swade, 86--91. "Germany and the Bomb: New Evidence," David Cassidy, 120. An essay on the impact of the Farm Hall tapes and other recently available evidence on interpretations of the German efforts to build an atomic bomb during WWII.

1993, March. "The Lonely Odyssey of Particle Physics: A Profile of Murray Gell-Mann," John Horgan, 30--33. An interview with Gell-Mann.

1993, May. "P. A. M. Dirac and the Beauty of Physics," R. Corby Hovis and Helge Kragh, 104--109.

1993, July. "Edwin Hubble and the Expanding Universe," Donald E. Osterbrock, 84--89.

1993, August. "Perpendicular to the Mainstream: A Profile of Freeman Dyson," John Horgan, 27--28. "The Great Radium Scandal," Roger M. Macklis, 94--99.

1993, November. "A Lab of her Own," Marguerite Holloway, 94--103. The problems of women in establishing careers in science from the nineteenth-century to the present.

Social Studies of Science.

"Reaping the Benefits of Collaboration while Avoiding its Pitfalls; Marie Curie's Rise to Scientific Prominence," Helena M. Pycior. "The Matthew Matilda Effect in Science," Margaret W. Rossiter, 325--341.

Vistas in Astronomy.

1992, vol. 35. "Doppler and Vogel: Two Notable Anniversaries in Stellar Astronomy," J. B. Hearnshaw, 157--177.

1993, vol. 36. "An Occupation for an Independent Gentleman: Astronomy in the Life of John Herschel," Allan Chapman, 71--116.

*Whoever wishes,
May he sit in meditation
With eyes closed
To verify if the universe be true
or false*

*I, in the meanwhile,
Shall sit with insatiate eyes
To see the universe
While the light lasts.*

Rabindrinath Tagore, 1937

SUMMARIES

Authors of books and articles on the history of physics are invited to send summaries for publication in this section. Suggested maximum length: 75 words for articles, 150 words for books. In addition, for articles, please give the author's mailing address and indicate whether reprints are available; for books published outside the United States, indicate the U.S. distributor (if any) or complete mailing address of the publisher. Publication will be expedited if each summary is submitted in both hard copy (with each summary typed on a separate page) and electronic form, in the format of the summaries below. Discs submitted with hard copy will be returned on request.

Summaries should be sent to Elizabeth Garber, History Department, SUNY, Stony Brook, NY 11794.

Johannes Kepler

A. E. L. Davis *Kepler's Resolution of Individual Planetary Motion*, Centaurus, 1992, 35: 1-192.

Kepler's "Distance Law"- Myth not reality: Kepler's innovative approach to planetary motion in *Astronomia Nova* (1609) did not involve the velocity in orbit: the so-called "distance law". Instead, he identified the particular component of velocity which is precisely perpendicular to the sun-planet line, and therefore entails motion instantaneously in a circle round the sun; this is exactly equivalent to the area law. Moreover, no other interpretation would have been compatible with Kepler's Aristotelian principles.

Grading the Egg: (Kepler's sizing-procedure for the Planetary Orbit) Kepler's investigation of Mars in *Astronomia Nova* comprised three stages, each associated with an "ovoid" curve of a particular grade (the egg-metaphor originated with Kepler himself). By a geometrical justification of the optimum position of Earth (which acted as a mobile observing-platform), he was able to make an observational assessment of the required ovoid accurately enough to determine its correct grade, while temporarily disregarding details of shape.

Kepler's Road to Damascus: Kepler's synthesis (in *Astronomia Nova*) of the two laws governing the motion of an individual planet depended on the methods of Euclidean geometry, involving circles and straight lines alone. His first flash of enlightenment was sparked by his discovery of a general construction-rule for the curve he was seeking; the second, by his realization that this rule would produce a perfect ellipse, described according to the Keplerian version of the area law. So the observationally-satisfactory solution gained conviction from the exactness of that curve-time correlation.

Kepler's Physical Framework for Planetary Motion: In *Epitome* (1620-21) Kepler demonstrated that each of his two laws of planetary motion was associated with a specific component of planetary velocity obtained by resolving perpendicular to, and along, the sun-planet line. Then, as demanded by Aristotelian principles, Kepler identified - and also quantified - the two separate causes of these component velocities: the single rotating solar force, and an individual planetary magnetism. Finally, his two-cause explanation of planetary motion was mathematically complete and achieved its resolution at a level of exactness consistent with modern standards.

Comets - 17th Century

Roger Ariew *Theory of Comets at Paris during the 17th century*. Journal of the History of Ideas, 1992, 53: 355-372

The paper is an account of the resiliency of traditional Aristotelian cosmology against the new astronomy. It is based on what was taught around Paris during the seventeenth century about the astronomical novelties discussed by Galileo, especially comets, but also including mountains on the moon, phases of Venus, moons of Jupiter and Saturn, and sunspots. The authors surveyed are Catholic and Protestant writers of textbooks who taught at Jesuit and non-Jesuit colleges around Paris, as well as writers of textbooks who tutored the nobility.

Isaac Newton

Herman Erlichson *Newton and Hooke on Centripetal Force Motion*, Centaurus, 1992, 35: 46-63.

The majority verdict of historians of science is that Newton owed a considerable debt to Robert Hooke in the matter of the analysis of centripetal force motion. This runs counter to Newton's own statement that he owed nothing to Hooke on this topic, and that Hooke's only role had been to motivate his interest in the problem of planetary motion. The core of the misunderstanding concerns Newton's early views on circular motion. Newton used two models for circular motion, a model in a rotation frame and a model in the inertial frame. In the rotating frame the body (executing circular motion in the inertial frame) is at rest under the action of the centripetal force and the equal and opposite inertial "centrifugal force". In the inertial frame, Newton correctly used a combination of inertial motion along the tangent and centripetal motion towards the force-center. Newton used both viewpoints correctly from the very beginning and did not owe anything to Hooke in the matter of the conceptualization of centripetal force motion. He did owe a considerable debt to Hooke in that it was the correspondence with Hooke in winter 1679-80 which put him on to the direct problem of centripetal forces. His solution of this problem for the ellipse with the force center at the focus, plus the later involvement of Edmund Halley with Newton on this problem, led ultimately to the mighty *Principia*.

Reprints available from author: Department of Applied Sciences, The College of Staten Island, 2800 Victory Boulevard, Staten Island, NY 10314.

Alan E. Shapiro *Fits, Passions, and Paroxysms: Physics, Method, and Chemistry and Newton's Theories of Colored Bodies and Fits of Easy Reflection*. Cambridge, Cambridge University Press, 1993.

Starting from his pioneering investigation of the colors of thin films, Isaac Newton developed two influential theories: one, which is actually a theory of matter, explained that the colors of bodies are caused by the transparent corpuscles composing them in exactly the same way as colors are formed in thin films; and the other, his theory of fits, described the periodicity of light. Utilizing Newton's unpublished manuscripts, Shapiro analyzes the experimental foundation of these theories and also shows the essential role that Newton's methodology played in their formulation and reception.

The second part of the book describes a major controversy over Newton's theory of colored bodies waged between physicists and chemists from about 1775 to 1830. Shapiro's analysis of this previously unknown dispute (which involved the discovery of absorption spectroscopy) and of the reasons for chemist's attack on Newton's theory illuminates the nature and relation of physics and chemistry during this seminal period of their development.

Alexis-Claude Clairaut

Curtis Wilson *Clairaut's Calculation of the Eighteenth-Century Return of Halley's Comet*. Journal for the History of Astronomy, 1993, xxiv, 1-15.

In the first large-scale numerical integration ever performed, Clairaut, aided by Lalande and Mme N.R. Lepaute, determined that Halley's Comet would reach perihelion in mid-April 1759, give or take a month. The actual date was 13 March, and d'Alembert, in particular, argued that the error was large. A comparison with a recent integration (T. Kiang, 1972) shows that canceling errors contributed significantly to the goodness of Clairaut's result. But d'Alembert's criticism, it is argued, misses the mark.

Johann Listing

Ernst Breitenberger *Gauss und Listing: Topologie und Freundschaft*. Mitteilungen der Gauss-Gesellschaft, 1993, Nr. 30: 2--56.

Johann Benedikt Listing (1808--1882) was a member of Gauss' inner circle, and a minor universalist. Successor to the expelled Wilhelm Weber as professor of physics in Göttingen, he coined the word "topology" and wrote the first monograph on the subject. He became the founding father of modern physiological optics, made major contributions to instrumental optics and to geophysics, and contributed in other areas. Here his life is outlined and his close relation to Gauss is elucidated.

Reprints available from the author: Department of Physics, Ohio University, Athens, OH 45701-2979.

Canadian Arctic Exploration

Trevor H. Levere *Science and the Canadian Arctic: A History of Exploration 1818-1918* xiv + 438 pp., New York, Cambridge University Press, 1993.

Scientific exploration of the Canadian Arctic was renewed after the Napoleonic Wars, and some eighty expeditions during the next hundred years made significant contributions, principally to geomagnetism and zoology, but also to atmospheric, auroral, and oceanographic science. This book looks at the role and nature of science in key expeditions, including John Franklin's three ventures, the Greeley expedition, the first International Polar Year, and the Canadian Arctic Expedition of 1913--18. Many of the expeditions began as British, Russian and American goals in the North came gradually into conflict with Canada's emerging nationhood, and with the growth of internationalism in science. Also in competition were notions of the Arctic as a source of knowledge, and as a resource base. Arctic science today, in itself and in its political, social, military, and economic contexts, is built on the pioneering work discussed in this book.

August Kundt

Stefan L. Wolff *August Kundt (1839--1894): Die Karriere eines Experimentalphysikers* Physis 1992, 29: 403--446

Kundt's career illustrates many aspects of the development of experimental physics in Germany during the 19th century. He began his research as a student in the private laboratory of Magnus in Berlin in the 1860s. A decade later he was able to realize his ambition to found a "school" at the new university of Strassburg by coordinating the various investigations of his collaborators and integrating them into a program. The characteristic feature of his research was to look for a new phenomena. In 1888 he became professor in Berlin, and as the successor of von Helmholtz

had the most prestigious position in German physics.

Joseph Henry

Albert Gerard Gluckman *Joseph Henry's 1841 and 1843 Out-of-Doors Electrical Transmission Signal Experiments*, Journal of the Washington Academy of Sciences, 1992, 82: 111--131.

Ever since G. Marconi first perfected his radio transmission apparatus in 1896, there has been controversy as to whether Joseph Henry had transmitted and detected wireless electrical signals at a distance in 1842 and 1843. Evidence is presented to show that these signals were produced by a transient electromagnetic field alternating at about 3.5×10^5 Hz (i.e., cycles per second). Both the unpublished recorded and published evidence of Henry's out-of-doors electrical signal transmission experiments of October 1842 and October 1843 are discussed. Mention is made of the destruction by fire of his records in January 1865, and of the later published remarks about Henry's experiments made by Ernest B. Rutherford in 1894. The wiring of Henry's primary and secondary circuits, and the construction of his magnetic coil signal detector that he attached into the loop of the secondary wire are also discussed.

Hermann von Helmholtz

David Cahan *Hermann von Helmholtz and the Foundations of Nineteenth-Century Science* Los Angeles, London, University of California Press, 1993.

Hermann von Helmholtz was a nineteenth-century polymath of dazzling intellectual range and energy. Renowned for his co-discovery of the first law of thermodynamics and his invention of the ophthalmoscope, Helmholtz made many other important contributions to physiology, physics, philosophy of science and mathematics and aesthetic thought. The editor has assembled an outstanding group of historian and philosophers of science to write a critical, collective intellectual biography. In addition to studies of Helmholtz's work on the ophthalmoscope and the principle of the conservation of energy, the volume provides analyses of Helmholtz's work in nerve and muscle physiology, color and vision theory, physiological acoustics, electromagnetic theory and chemical thermodynamics, the mechanical foundation of thermodynamics, non-Euclidean geometry, and the philosophical foundations of science, including its relations with art, culture and society.

Cryogenics

Ralph G. Scurlock *History and Origins of Cryogenics*, 653 pp. Oxford University Press, 1993.

From the first demonstrations in 1877 of the liquefaction of oxygen by Cailletet in Paris and Pictet in Geneva, the expanding science and

technology of low temperatures, or cryogenics, has developed an international identity of its own. This book describes the origins and history of this development through the eyes of national leaders in the science and technology of cryogenics, authors contributing their own national stories to the book through the collaboration of the *International Cryogenic Engineering Committee* and the *British Cryogenics Council*. The book offers unique, world-wide coverage of all the developments in cryogenics since 1877, providing a much more comprehensive coverage than a single-author volume could have achieved. An introductory chapter by the editor creates a framework for the rest of the volume, which has a wide variation in flavor from chapter to chapter, with considerable anecdotal content and a wealth of photographs from national archives.

Stokes' Law of Fluorescence

Marjorie Malley *A Heated Controversy on Cold Light*, Archive for History of Exact Sciences, 1991, 42: 173--186.

This article examines the late nineteenth century controversy over the validity of Stokes' law of fluorescence. The controversy shows how scientists grappled with a new phenomenon in terms of current theories and experimental techniques, while influenced by social, economic, and personal factors. A complete reversal of the roles of experiment and theory in deciding the fate of Stokes' law occurred between the late nineteenth and early twentieth centuries.

Thermodynamics and Optical Luminescence

Marjorie Malley *Thermodynamics and Cold Light*. Annals of Science, 1994, 51: 203--224.

This paper examines the late nineteenth and early twentieth century attempts to incorporate fluorescence and phosphorescence into thermodynamics. The study reveals the persuasiveness of heat concepts for both experimental and theoretical physics of the time. This orientation prevented development of a broadly accepted theory of cold light, while providing a matrix for the origins of quantum theory. The anomaly of cold light influenced the conceptual transition from classical to quantum theory.

Zeeman Effect

Theodore Arabatzis *The Discovery of the Zeeman Effect: A Case Study in the Interplay between Theory and Experiment*. Studies in History and Philosophy of Science, 1992, 23: 365--388.

This paper concerns the discovery and initial explanation of the Zeeman effect - the splitting of spectral lines when their source is placed in a magnetic field - and aims to show

the exploratory character of Zeeman's experimental practices and their autonomy from the electromagnetic theories of his time. It is argued that the theoretical and experimental reasons which established the validity of Zeeman's experimental results were independent from the explanatory theories that accounted for his discovery.

Quantum Electrodynamics and Renormalization

Laurie M. Brown editor, *Renormalization: from Lorentz to Landau (and beyond)*, vii + 186 pps., index, New York, Springer-Verlag, 1993.

These are essays on renormalization in classical and quantum field theories. R. S. Mills gives a short and very simple "tutorial", showing how the renormalization technique renders field theory finite in the case of Quantum Electrodynamics (QED). M. Dresden describes how the concept, originating in 19th century hydrodynamic theory was applied by Lorentz in classical electron theory and was extended by H. A. Kramers to QED in the early 1940s. L. M. Brown shows how these ideas were applied to give a consistent divergence-free QED by Richard Feynman, Julian Schwinger, Shinichiro Tomonaga, and others. S. S. Schweber and T. Y. Cao discuss further developments, including the renormalization group, symmetry breaking, and modern effective field theories. An appendix by D. V. Shirkov discusses parallel developments by Soviet physicists, including himself, N. N. Bogolioubov, and L. Landau.

Silvan S. Schweber *QED and the Men who Made It*. Princeton University Press, 1994.

Schweber's book presents a history of the developments of Quantum Electrodynamics (QED) from its beginnings in 1927 to the early 1950s, with an emphasis on the post war period. It provides a description of the experimental and theoretical advances and situates these within the context of the technical developments made during the 1930s and during World War II. The book provides a detailed account of the Shelter Island, Pocono and Oldstone conferences that provided the stimulus for the advances. It also presents biographies of the young Tomonaga, the young Schwinger, the young Feynman and the young Dyson as introductions to the exposition of their work.

Richard Feynman

Laurie M. Brown and John S. Rigden editors *"Most of the Good Stuff" -- Memories of Richard Feynman*, 170 pps., biblio., American Institute of Physics, 1993.

Richard P. Feynman was called by Freeman Dyson "the most original mind of his generation" and he has been widely hailed as a genius. This book consists of prose sketches of Feynman: the man, the theoretical physicist, and the teacher, by many people who knew him well. Some were presented at a joint memorial session

of the APS and the AAPT held at San Francisco in January 1989 a year after his death. Others were written specifically for this volume. Contributors include Dyson, J. A. Wheeler, H. A. Bethe, J. Schwinger, M. Gell-Mann, J. Feynman, and eight others, including the editors.

Rudolf Peierls - Early Solid-State Theory

Rudolf Peierls *Early Work on Solids; Mainly in the Thirties* Review of Modern Physics, 1993, 65: 251-256.

The article reviews the main steps in the development of solid-state theory, from the pioneering work of Wolfgang Pauli and Arnold Sommerfeld to the complete understanding of electric and thermal conduction, the stability of structures, and the beginnings of the theory of cohesion.

A Woman in Nuclear Physics

Fay Ajzenberg-Selove *A Matter of Choices. Memoirs of a Female Physicist* Rutgers University Press, 1994.

In this engaging memoir, Fay Ajzenberg-Selove writes candidly about her difficult journey to international recognition in physics. She is frank about the ways being a woman has made a difference in her opportunities and choices as a scientist -- and how, by being a woman, she has made a difference in the world of physics. During her early career, Ajzenberg-Selove was shielded by her male mentors from experiencing much of the discrimination directed against women in science. Her simultaneous battles to become a tenured professor and to overcome breast cancer opened her eyes and confirmed her as a feminist.

The lay reader and the scientist alike will be fascinated by Ajzenberg-Selove's portrayal of her interlinked lives as physicist, teacher, wife of particle physicist Walter Selove, and a woman who relishes both competition and friendship in a male-dominated field.

The book is distributed via (800) 446-9323.

German Emigrants

Klaus Fischer *Changing Landscapes of Nuclear Physics: A Scientometric Study on the Social and Cognitive Position of German-Speaking Emigrants within the Nuclear Physics Community 1921-1947*, 256p., Berlin Heidelberg, Springer-Verlag, 1993.

Between 1921 and 1947 it was nuclear physics, more than any other science, that shaped both the political landscape of our century and public opinion on physics research. Using quantitative scientometric methods, the author focuses on the development of nuclear physics in these formative years, paying special attention to the impact of German emigrants on the evolution

of the field as a cognitive and social unity. The book is based on a thorough evaluation of various citation analyses, thus producing results that should be both replicable and objective. The scientometric techniques should complement the more qualitative approach usually applied in historical writing. This makes the text an interesting study also for historians in general.

Stefan L. Wolff *Das ungarische Phänomen - ein Fallbeispiel zur Emigrationsforschung* Deutsches Museum. Wissenschaftliches Jahrbuch, 1991(1992): 228-245.

In the 1920s a number of Hungarians became eminent scholars in Germany. Most of them were of Jewish descent and had to emigrate after 1933. Biographical sketches of Leo Szilard and Eugene Wigner are used to illustrate the influence of the different surroundings in Berlin and the USA on their research.

Scientific Research in Nazi Germany

Kristle Mackrakis *Surviving the Swastika: Scientific Research in Nazi Germany* 320 pp, Oxford University Press, 1993.

This book examines scientific research under National Socialism through the prism of the Kaiser Wilhelm Society and provides a full-scale analysis of the Society's development within the social and political context of National Socialist Germany. A spectrum of responses to National Socialism existed there, from moral probity to accommodation and opportunism. Mackrakis uncovers this differentiated scientific and social landscape by treating topics ranging from Max Planck's failed negotiations with recalcitrant government officials regarding the expulsion of Jews and Communists, to his success in securing a thriving community for basic biological research in Berlin-Dahlem; from the practice of nuclear power research, to institutional growth.

Based on a trove of previously untapped archival sources in the former East and West Germany and numerous interviews with scientists, a totalitarian regime is portrayed as a montage of rival power blocks allowing the survival of scientific research at an unusual institution.

Stefan L. Wolff *Vertreibung und Emigration in der Physik*, Physik in unserer Zeit, 1993, 6: 267-273.

The political events of 1933 destroyed large parts of the intellectual life in Germany. This survey treats some of the consequences in physics. Besides statistical considerations, which represent only limited evidence, judgments and statements of German physicists are analyzed. In this context a visit of Ehrenfest in Berlin in May 1933 and his report on the situation is of special interest.

Rocket Pioneers and Atomic Energy

William A. Reupke *The Rocket Pioneers and Atomic Energy* Journal of the British Interplanetary Society, 1992, 45: 297-304.

Writings of the rocket pioneers -- Konstantin Tsiolkovsky, Robert Goddard, Robert Esnault-Pelterie and Hermann Oberth -- beginning at the turn of the century, shortly after the discovery of radioactivity, and continuing into the 1930s, just before the discovery of nuclear fission, show that each of the pioneers, although concluding that the immediate application of atomic energy to rocket propulsion appeared impractical held out the possibility of dramatic future advances in rocketry and space travel through the harnessing of this new force.

Nuclear Science in the 1930s

Roger H. Stuewer *The Origin of the Liquid-Drop Model and the Interpretation of Nuclear Fission*, Perspectives on Science, 1994, 2

This article addresses the historical problem of how it was possible for Lise Meitner and her nephew Otto Robert Frisch to arrive at their novel interpretation of nuclear fission at the end of 1938. To understand this requires an analysis of the origin and subsequent development of the liquid-drop model of the nucleus. The paper begins by discussing George Gamow's conception of the liquid-drop model in 1928 and then explore its extension, particularly by Werner Heisenberg and Carl Friedrich von Weizsäcker, between 1933 and 1938. It argues that these two stages in the development of the liquid-drop model focused on two distinctly different features of the model, its static and dynamic characteristics, which were employed to understand two distinctly different phenomena, nuclear mass defects and nuclear reactions and excitations. The liquid-drop model thus became embedded in two distinctly different scientific traditions. The paper concludes by showing how these two traditions merged in the minds of Meitner and Frisch, leading them to their interpretation of nuclear fission.

Roger H. Stuewer *Mass-Energy and the Neutron in the Early Thirties*, Science in Context, 1993, 6: 195-238.

Einstein's mass-energy relationship was not confirmed experimentally until 1933 when Bainbridge showed that the Cockcroft-Walton experiment afforded a test of it. Earlier, however, it had been used constantly in the analysis of nuclear reactions, as can be seen in those involved in the determination of the mass of the neutron. In 1932 James Chadwick was convinced that the neutron was about 1.0067 amu (atomic mass units), indicating that the neutron was a proton-electron compound, since that figure was less than the sum of the proton and electron masses. Chadwick's value was challenged in 1933 by Ernest Lawrence, who proposed a much lower value of 1.0006 amu,

and by Curie and Joliot, who proposed a much higher value of 1.011 amu. Much controversy ensued: eventually, Chadwick and Maurice Goldhaber showed in 1934 that the neutron mass was about 1.0080 amu, greater than the sum of the proton and electron masses, proving that the neutron was a new elementary particle (which could decay spontaneously), and providing conclusive experimental support for excluding electrons from the nucleus. These results remained unchanged with further refinements in the last decimal place. The entire pursuit of which provided still further vindication of Einstein's mass-energy relationship.

Early Los Alamos and "Big Science"

Lillian Hoddeson, Paul W. Henriksen, Roger A. Meade and Catherine Westfall *Critical Assembly: A Technical History of Los Alamos during the Oppenheimer Years, 1943-1945* 509 pp., Cambridge University Press, 1993

Unlike earlier histories of Los Alamos, this book treats in detail the technical history of the research and development that led to the implosion and gun weapons; the research in nuclear physics, chemistry and metallurgy that enabled scientists to design these weapons and the conception of the thermonuclear bomb, the "Super". This is the first to study the role of Los Alamos in the rise of the methodology of "big science" as carried out in large national laboratories. After a synopsis of the prehistory of the bomb project, from the discovery of nuclear fission to the start of the Manhattan Engineer District, and an overview of the early materials program, the book examines the establishment of the Los Alamos Laboratory, the implosion and gun assembly programs, nuclear physics research, chemistry and metallurgy, explosives, uranium and plutonium development, confirmation of spontaneous fission in pile-produced plutonium, the thermonuclear bomb, critical assemblies, the Trinity test, and delivery of the combat weapons. New details in the development of the atomic bomb are described.

This volume is a crucial resource for understanding the underpinnings of contemporary science and technology as it is based on the full documentation now available.

Arms Control

Sidney D. Drell *In the Shadow of the Bomb, Physics and Arms Control* American Institute of Physics, 1993

The book opens with several essays on the frontiers of particle physics followed by Drell's personal reminiscences of friends and colleagues in the physics community (W. L. H. Panofsky, T. D. Lee, Victor F. Weisskopf, Murray Gell-Mann and Amos de-Shalit). Several essays are devoted to Andrei Sakharov with whom Drell enjoyed a close friendship. In the remaining two-thirds, Drell probes theoretical

constraints that underlie policy questions, addresses past and developing themes in the arms control and national security debates, and discusses the underpinnings and morality of nuclear deterrence. He charts the history of disarmament efforts from the chilling concepts of mutual assured destruction, to the ABM and START Treaties to Star Wars and the current debate on a comprehensive test ban.

In the preface Drell writes: "As a physicist, I have tried to understand nature's mysteries. As a citizen, I have worked to decrease the dangers posed by the nuclear weapons of mass destruction that are one of the consequences of scientific progress. Since 1960, my life has been divided between pursuing the dream of discovery and working to avoid the nightmare of a nuclear holocaust. The essays, speeches, and Congressional testimony in this collection touch on both endeavors."

Influence of Research Funding on Universities

Darwin H. Stapleton *The Faustian Dilemmas of Funded Research at Case Institute and Western Reserve, 1945-1965* Science, Technology and Human Values, 1993, 18: 303-314.

The postwar history of Case Institute of Technology and Western Reserve University illustrates how industrial, government and foundation funders of science and technology can alter the development of an entire institution. While countered by faculty resistance to classified projects and the results-oriented nature of outside funding, the growing commitment to sponsored research at both institutions eventually gave the funding organizations the power to require reorganization and federation of Case and Western Reserve in 1967.

High Temperature Superconductivity

Ulrike Felt and Helga Nowotny *Striking Gold in the 1990s: The Discovery of High-Temperature Superconductivity and Its Impacts on the Science System* Science, Technology, and Human Values, Autumn 1992, 17.

The article retraces the social and institutional circumstances that, in 1986, led two researchers at the IBM laboratory near Zurich, Alex Müller and Georg Bednorz, to discover high-temperature superconductivity. After confirmation of the unexpected breakthrough an unprecedented, simultaneous mobilization of research groups all over the world took place, while high-temperature superconductivity turned into a subject of intense media interest. The authors discuss these events under three perspectives: the closer interlinkage capacity of researchers, the relationship between the social organization of research, and unforeseen cases of scientific creativity.

The Response to Predictive Theory

Stephen G. Brush *Prediction and Theory Evaluation: Subatomic Particles* Rivista di Storia della Scienza, serie II, Dicembre 1993, 1: 47--152.

It is often assumed that successful prediction of a new phenomenon encourages the acceptance of the theory that led to the prediction, but few historians have systematically collected evidence to test that assumption. This paper surveys the response of physicists to three theories that predicted previously-unknown particles: Dirac's relativistic quantum theory of the electron (the positron), Yukawa's theory of nuclear forces (the meson), and Gell-Mann's SU(3) symmetry-group theory (the Ω^-). The balance between this empirical evidence and

other arguments used to evaluate the theories is discussed.

Stephen G. Brush *Prediction and Theory Evaluation: Cosmic Microwaves and the Revival of the Big Bang* Perspectives on Science, 1993 1: 566-602.

Are theories judged on the basis of empirical tests of their predictions, as proposed by Karl Popper and others, or are new theories adopted by younger scientists while old theories fade away when their advocates die, as Max Planck suggested? A famous historical episode, the rejection of steady state cosmology and the revival of the big bang cosmology following the 1965 discovery of the cosmic microwave background radiation, is examined to determine whether the scientific community followed Popper's or Planck's principle. It is found that

by 1975 almost all supporters of the steady state had either switched to the big bang or stopped publishing on cosmology (although a few of them later tried to revive the steady state). This case therefore seems to exemplify Popper's principle, although it should be noted that two of the founders of steady state cosmology had strongly proclaimed their adherence to that principle. The case does not support the Popperian claim that successful novel predictions provide better evidence for a theory than deductions of known facts.

Reprints available; write to S. G. Brush, Institute of Physical Science and Technology, University of Maryland, College Park, MD 20742-2431

RECENT PUBLICATIONS ON THE HISTORY OF PHYSICS

*A supplement to the Newsletters of The AIP Center for History of Physics
and The Forum for History of Physics, American Physical Society*

□ BOOKS

Compiled by Stephen G. Brush, University of Maryland, and the staff of the Niels Bohr Library

The establishment of the American Center for Physics in College Park, Maryland, has provided the impetus for this cooperative project of the AIP Center for History of Physics and the University of Maryland at College Park. This list, which we hope to produce annually, will incorporate part of the accessions list of the Center's Niels Bohr Library and the information about recent books that has previously been included in the *History of Physics Newsletter* published by the APS Forum on History of Physics.

We list books on the history of physics and related topics (including astronomy, geophysics, and physics in medicine) published in 1993 or later. We concentrate on the history of "modern" physics (since the 15th century); books dealing entirely with earlier periods will generally not be included. For more comprehensive coverage of publications on the history of science, consult the annual *Current Bibliography in Isis* (published by the University of Chicago Press for the History of Science Society).

We suggest that you use this list to recommend books for your institutional library; ISBN numbers are given for this purpose. Prices (which are for hardcover editions unless otherwise indicated) are subject to change by the publisher.

This list is based primarily on books available in College Park. Future lists will include other 1993 titles as well as later ones. We urge publishers to send new books on history of physics to the Niels Bohr Library, American Center for Physics, One Physics Ellipse, College Park, MD 20740. Be sure to state the *price in U.S. dollars* since this information usually cannot be found in the book itself.

Single copies of *Recent Publications on the History of Physics* are free on request to the Center for History of Physics at: One Physics Ellipse, College Park, MD 20740-3843. Permission is hereby granted to copy freely all or part of this list for any educational purpose.

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■ PHILOSOPHY OF SCIENCE

Horwich, Paul (ed.) *World Changes: Thomas Kuhn and the nature of science*. vi + 356 pp., index. Cambridge, MA: MIT Press, 1993. ISBN 0-262-08216-0. \$45.

Includes "A mathematicians' mutiny, with morals" [in the 18th century "mathematics included parts of what we now call "physics" or "astronomy"], by J. L. Heilbron, 81-129; "Science and humanism in the Renaissance: Regiomontanus's oration on the dignity and utility of the mathematical sciences" by N. M. Swerdlow, 131-68; "Design for experimenting" [in 19th century optics and electricity] by J. Z. Buchwald, 169-206; "Mediations: Enlightenment balancing acts, or the technologies of rationalism" by M. N. Wise, 207-56; "Afterwords" by T. Kuhn, 311-41.

[See also Holton under HISTORY OF SCIENCE]

■ SCIENCE AND SOCIETY

Macrakis, Kristie, *Surviving the swastika. Scientific research in Nazi Germany*. xii + 280 pp., illus, index. New York: Oxford University Press, 1993. ISBN 0-19-507010-0. \$39.95.

Includes brief sections on **Werner Heisenberg**, **Otto Hahn**, **Max Planck**, **Johannes Stark**, "Deutsche Physik," uranium research.

National Science Board. *Science & Engineering Indicators — 1993*. xxxi + 514 pp. Washington, DC: U.S. Government Printing Office, 1993.

A biennial report, providing quantitative measures of scientific and technological activity in the U.S. and comparisons with other countries. Includes data (going back to 1980 or earlier) on science education, the science and engineering workforce, funding of research and development, and public attitudes toward science and technology.

Renneberg, Monika and **Walker, Mark** (eds.) *Science, technology, and National Socialism*. xix + 422 pp., illus., notes, index. New York: Cambridge University Press, 1994. ISBN 0521-40374-X. \$59.95.

Includes "Pascual Jordan, quantum mechanics, psychology, National Socialism" by M. N. Wise, 224-54; "The ideology of early particle accelerators: An association between knowledge and power" by M. Osietzki, 255-70; "The Minerva Project: The accelerator laboratory at the Kaiser Wilhelm Institute/Max Planck Institute of Chemistry: Continuity in fundamental research" by B. Weiss, 271-90.

[See also Fischer under HISTORY OF ASTRONOMY]

■ SCIENCE AND THE MILITARY; ATOMIC WEAPONS

Hoddeson, Lillian; Henriksen, Paul W.; Meade, Roger A.; Westfall, Catherine et al. *Critical assembly: A technical history of Los Alamos during the Oppenheimer years, 1943-1945*. xvi + 509 pp., illus. New York: Cambridge University Press, 1993. ISBN 0-521-44132-3. \$39.95.

Hoffmann, Dieter (ed.) *Operation Epsilon: Die Farm-Hall Protokolle*. 380 pp. Berlin: Rowohlt, 1993. ISBN 3-87134-082-0.

See next item.

Operation Epsilon: The Farm Hall transcripts. Introduced by Sir **Charles Frank**. ix + 313 pp., illus., index. Berkeley: University of California Press (distrib. for Institute of Physics Publishing), 1993. ISBN 0-520-08499-3. \$30.

Transcript of recordings made of the conversations of **Werner Heisenberg** and other German scientists, discussing their atomic energy project, while they were interned at Farm Hall (England), just before and just after Hiroshima.

Powers, Thomas. *Heisenberg's war: The secret history of the German bomb*. xi + 607 pp., illus. New York: Knopf, 1993. ISBN 0-394-51411-4. \$27.00

Wittner, Lawrence, S. *The struggle against the bomb. Volume 1. One world or none: A history of the world nuclear disarmament movement through 1953*. xvi + 456 pp. Stanford, CA: Stanford University Press, 1993. ISBN 0-8047-2141-6. \$29.95.

■ SCIENCE AND OTHER DISCIPLINES

Nahin, Paul J. *Time machines: Time travel in physics, metaphysics, and science fiction*. xvii + 408 pp., illus., bibl., index. New York: American Institute of Physics, 1993. ISBN 0-88318-935-6. \$45.

■ THE SCIENTIFIC COMMUNITY

Crawford, Elisabeth; Shinn, Terry; and Sörlin, Sverker, eds. *Denationalizing science: The contexts of international scientific practice*. vii + 301 pp., illus., index. Dordrecht & Boston: Kluwer Academic Publishers, 1993. ISBN 0-7923-1855-2. \$149.

(continued on page 3)

(Crawford, Elisabeth, continued from page 2)

Includes "Migration and the denationalization of science [including theoretical physics in the 1930s]" by **Paul Hoch** and **Jennifer Platt**, 133-52; "Some socio-historical aspects of multinational collaborations in high-energy physics at CERN between 1975 and 1985" by **John Krige**, 233-62.

Geiger, Roger. Research and relevant knowledge: American research universities since World War II. xvi + 411 pp. New York: Oxford University Press, 1993. ISBN 0-19-505346-X. \$65.

■ SCIENCE EDUCATION

Clark, Burton R. (ed.) Research foundations of graduate education: Germany, Britain, France, United States, Japan. xxi + 390 pp. Berkeley: University of California Press, 1993. ISBN 0-520-079973. \$45.
Includes physics education in all 5 countries.

■ INSTITUTIONAL DEVELOPMENT OF SCIENCE

Good, Gregory A. (ed.) The earth, the heavens and the Carnegie Institution of Washington. (History of Geophysics, Volume 5.) xiii + 252 pp. [double-column], illus. Washington, DC: American Geophysical Union, 1994. ISBN 0-87590-279-0; ISSN 8755-1217. \$42.

Based on a conference held in June 1992. Includes "Weighing the earth from a submarine: The gravity measuring cruise of the U.S.S. S-21" by **Naomi Oreskes**, 53-68; "Sharing a mountaintop: The Smithsonian Astrophysical Observatory on Mount Wilson" by **R. S. Brashear**, 89-101; "Converting an hypothesis into a research program: T. C. Chamberlin, his planetesimal hypothesis [for the origin of the solar system], and its effect on research at the Mt. Wilson Observatory" by **N. S. Hetherington**, 113-23; "To Watheroo and back: The DTM [Department of Terrestrial Magnetism of CIW] in Australia, 1911-1947" by **R. W. Home**, 149-60; "Merle A. Tuve's post-war geophysics: Early explosion seismology" by **Thomas D. Cornell**, 185-214; other articles on the history of CIW; on CIW-sponsored research on magnetism, astronomy, ionospheric research, and on radiometric dating; and on source materials for the history of physical science.

Seaborg, Glenn T. The Atomic Energy Commission under Nixon: Adjusting to troubled times. With **Benjamin S. Loeb**. xx + 268 pp., illus., notes, bibl., index. New York: St. Martin's Press, 1993. ISBN 0-312-07899-4. \$39.95.

A sequel to his earlier books about his service under Kennedy and Johnson; Seaborg resigned as chairman of the AEC in August 1971. This is "the story of what it is like to preside over a once proud and privileged government agency that is declining in reputation and influence..." For a chapter titled "The advice of scientists" the motto is "You can lead a horse to water but you cannot make him drink."

■ HISTORY OF SCIENCE

Cohen, I. Bernard (ed.) The natural sciences and the social sciences: Some critical and historical perspectives. (Boston Studies in the Philosophy of Science, 150) xxxvi + 403 pp. Norwell, MA: Kluwer, 1994. ISBN 0-7923-2223-1.

Includes "From Quetelet to Maxwell: Social statistics and the origins of statistical physics" by **Ted Porter**, 345-62.

Holton, Gerald. Science and anti-science. x + 203 pp., index. Cambridge, MA: Harvard University Press, 1993. ISBN 0-674-79298-X (paper). \$24.95.

Includes "Ernst Mach and the fortunes of positivism," 1-55; "More on Mach and Einstein," 56-73; "Quanta, relativity, and rhetoric," 74-108.

Margolis, Howard. Paradigms & barriers: How habits of mind govern scientific beliefs. xii + 267 pp., bibl., index. Chicago: University of Chicago Press, 1993. ISBN 0-226-50522-7, \$40.00 (hardcover); ISBN 0-226-50523-5, \$15.95 (paper).

Historical examples include the emergence of probability, the change from Ptolemaic to Copernican astronomy, and the **Hobbes-Boyle** dispute on air pressure (including a critique of **S. Shapin & S. Schaffer**, *Leviathan and the Air Pump*, 1985).

Pyenson, Lewis. Civilizing mission: Exact sciences and French overseas expansion, 1830-1940. xxi + 377 pp., illus., index. Baltimore: Johns Hopkins University Press, 1993. ISBN 0-8018-4421-5. \$45.

Astronomy, geophysics, meteorology, physics, seismology, and terrestrial magnetism in the French overseas empire and the French sphere of influence.

■ HISTORY OF PHYSICS

Brown, Laurie M. (ed.) Renormalization: From Lorentz to Landau (and beyond). vii + 192 pp., illus., index. New York: Springer-Verlag, 1993. ISBN 0-387-97933-6. \$69.

Includes: "Introduction: Renormalization, 1930-1950" by **L. M. Brown**, 1-27; "Renormalization in historical perspective — the first stage" by **M. Dresden**, 29-55; "New philosophy of renormalization: from the renormalization group equations to effective field (continued on page 4)

(Brown, Laurie M., continued from page 3)

theories" by T. Y. Cao, 87-133; "Changing conceptualization of renormalization" by S. S. Schweber, 135-66; "Historical remarks on the renormalization group" by D. V. Shirkov, 167-86.

Bruzzaniti, Giuseppe. Dal segno al nucleo. Saggio sulle origini della fisica nucleare. 314 pp., notes, index. Turin: Bollati Boringhieri, 1993. ISBN 88-339-0779-1.

Franklin, Allan. The rise and fall of the fifth force: Discovery, pursuit, and justification in modern physics. viii + 141 pp., illus. New York: American Institute of Physics, 1993. ISBN 1-56396-119-9. \$29.95.

On the 1986 proposal by Ephraim Fischbach, widely debated and investigated by physicists for a few years, then generally rejected around 1990.

Lindqvist, Svante (ed.) Center on the periphery: Historical aspects of 20th-century Swedish physics. Iv + 516 pp. Canton, MA: Science History Publications, 1993. ISBN 0-88135-157-1. \$50.

Contents: "Introductory essay: Harry Martinson and the periphery of the atom" by S. Lindqvist; "Physics as culture: Science and *Weltanschauung* in inter-war Sweden" by Kjell Jonsson, 3-23; "Physics as ideology: Svante Arrhenius as a writer of popular science" by Olov Amelin, 42-57; "Physics in a stronghold of engineering: Professorial appointments at the Royal Institute of Technology, 1922-1985" by Ulf Larsson, 58-75; "Where science turns into sports and politics: The decline of Swedish polar research in the early 20th century" by Urban Wråkberg, 79-106; "Big science in a small country: Sweden and CERN II" by Sven Widmalm, 107-40; "Physics in uniform: The Swedish Institute of Military Physics, 1939-1945" by Hans Weinberger, 141-63; "The socialization of science: Technical research and the natural sciences in Swedish research policy in the 1930s and 1940s" by Thorsten Nybom, 164-78; "Implementing the welfare state: The emergence of Swedish atomic energy research policy" by Stefan Lindström, 179-95; "Breakthrough on the periphery: Bengt Edlén and the identification of the coronal lines, 1939-1945" by Karl Hufbauer, 199-237; "International acclaim and Swedish obscurity: The fall and rise of David Enskog" by Mats Fridlund, 238-68; "Reaching out: Janne Rydberg's struggle for recognition" by Paul C. Hamilton, 269-92; "Relative acceptance: The introduction and reception of Einstein's theories in Sweden, 1905-1965" by Carl-Olov Stawström, 293-305; "When theory addresses experiment: The Siegbahn-Sommerfeld correspondence, 1917-1940" by Thomas Kaiserfeld, 306-24; "The ideological use of instrumentation: The Svedberg, atoms, and the structure of matter" by Anders Lundgren, 327-46; "The failure of a successful artifact: The Svedberg ultracentrifuge" by Boelie Elzen, 347-77; "Technological drift in science: Swedish radio astronomy in the making, 1942-1976" by Mikael Hård, 378-97; "The intellectual politics of laboratory technology: The protein network and the Tiselius apparatus" by Lily E. Kay, 398-423; "The proud tower: Knut Ångström and the international style of *fin de siècle* physics buildings" by Anders Marelius and Erik Noreland, 424-39; "Bibliography of the history of 20th-century Swedish physics" by Margareta Bond-Fahlberg, 441-500.

Mann, Alfred K. and Cline, David B. (eds.) Discovery of weak neutral currents: The weak interaction before and after. Santa Monica, CA, February 1993. (AIP Conference Proceedings, 300) xi + 676 pp. New York: AIP Press, 1994. ISBN 1-56396-306-X. \$145.

Includes "Early study of muons and muon decay" by M. Conversi, 3-16; "The discovery of the V-particles" by G. D. Rochester, 17-38; "Search for the free neutrino" by F. Reines, 39-51; "Contributions of β -decays to the developments of electroweak interaction" by C.-S. Wu, 52-92; "The early period of the universal Fermi interaction" by Jayme Tiomno, 99-109; "Origin of the universal V-A theory" by E. C. G. Sudarshan and R. E. Marshak, 110-124; "The τ -puzzle" by R. H. Dalitz, 141-58; "The early search for weak neutral currents and the rise of the standard model" by D. B. Cline, 175-86; "Discovery of weak neutral currents in Gargamelle" by D. Haidt, 187-206; "Observation of weak neutral currents and bare charm in Fermilab Experiment 1A" by A. K. Mann, 207-43; "The discovery of neutral currents" by P. Galison, 244-286; "Five phases of weak neutral current experiments from the perspective of a theorist" by P. Langacker, 289-325; "The development of colliders" by A. M. Sessler, 509-25; "Experimental observation of the intermediate vector bosons W^+ , W^- , and Z^0 " by C. Rubbia, 526-91; "Discovery of the gluon" by S. L. Wu, 598-623; "The discovery of charm" by G. Goldhaber, 624-40; "30 years of weak neutral currents" by D. B. Cline, 643-73.

Miller, Arthur I. Early quantum electrodynamics: A sourcebook. xix + 265 pp., index. New York: Cambridge University Press, 1994. ISBN 0-521-43169-7. \$59.95.

Contents: "Frame-setting essay" by Miller, 3-118; papers by Dirac, Fierz, Heisenberg, Kramers, Pauli, Weisskopf.

Redhead, Paul A. (ed.) Vacuum science and technology: Pioneers of the 20th century. (History of Vacuum Science and Technology, vol. 2) xi + 229 pp., illus. New York: American Institute of Physics, 1994. ISBN 1563962482 (pb), \$35.

Includes: "The American Vacuum Society at 40" by Jack H. Singleton, 1-22; "Saul Dushman (1883-1954)" by J. M. Lafferty, 32-42; "Wolfgang Gaede (1878-1945)" by Günter Reich, 43-58; "History of vacuum science: A visual aids project" by J. M. Lafferty, 91-106; "Early development of the molecular-drag pump" by Günter Reich, 114-125; "The quest for ultrahigh vacuum (1910-1950)" by P. A. Redhead, 133-143; reproductions of classic papers by Dushman and others.

Schweber, Silvan S. QED and the men who made it: Dyson, Feynman, Schwinger, and Tomonaga. xxviii + 732 pp., bibl., index. Princeton, NJ: Princeton University Press, 1994. ISBN 0-691-03685-3 (hc) \$72.50. ISBN 0-691-03327-7 (paper) \$39.50.

The birth of quantum field theory in the 1920s (Pascual Jordan, P. A. M. Dirac); quantum electrodynamics ("QED") during the 1930s; divergences; conferences at Shelter Island, Pocono, and Oldstone; the Lamb shift and the magnetic moment of the electron; Sin-itiro Tomonaga and the rebuilding of Japanese physics; Julian Schwinger and the formalization of quantum field (continued on page 5)

(Schweber, Silvan S., continued from page 4)

theory; **Richard Feynman** and the visualization of space-time processes; **Freeman Dyson** and the structure of quantum field theory; QED in Switzerland; reflections on renormalization theory.

Verschuur, Gerrit L. Hidden attraction: The history and mystery of magnetism. vii + 256 pp., illus. New York: Oxford University Press, 1993. ISBN 0-19-506488-7. \$25.

Deals mostly with 19th and 20th centuries.

[See also **Von Plato** under HISTORY OF MATHEMATICS; **Woodward** under SCIENTIFIC COMMUNITY]

■ HISTORY OF ASTRONOMY, ASTROPHYSICS, COSMOLOGY AND SPACE SCIENCES

Fischer, Peter. The origins of the Federal Republic of Germany's space policy 1959-1965 — European and national dimensions. 65 pp. Noordwijk, Netherlands: European Space Agency, report ESA HSR-12, 1994.

Gingerich, Owen. The eye of heaven: **Ptolemy, Copernicus, Kepler.** viii + 442 pp. New York: American Institute of Physics, 1993. ISBN 0-88318-863-5. \$24.95.

Reprint of previously published articles on the Copernican revolution, with new preface and epilogue.

Grant, Edward. Planets, stars, and orbs The medieval cosmos, 1200-1687. xxiii + 816 pp, illus., bibl., index. New York: Cambridge University Press, 1994. ISBN 0-521-433-444. \$69.95.

Hetherington, Norriss S. (ed.) Cosmology: Historical, literary, philosophical, religious, and scientific perspectives. xi + 631 pp., bibl. notes, index. New York & London: Garland Publishing, 1993. ISBN 0-8153-1085-4 (hardcover), \$85. ISBN 0-8153-0934-1 (paper), \$18.95.

Includes articles on ancient, medieval and Native American cosmologies, **Copernicus, Kepler, Newton**, 19th century reflecting telescopes, spectroscopy, cosmology 1900-1931, Hubble, big bang, steady state, modern theories, philosophical and religious aspects.

Hetherington, Norriss S. (ed.) Encyclopedia of cosmology: Historical, philosophical, and scientific foundations of modern cosmology. xv + 686 pp., illus, index. New York: Garland Publishing, 1993. ISBN 0-8240-7213-8. \$125.00.

Krige, John Europe into space: The [**Pierre**] **Auger** years (1959-1967). 74 pp. Noordwijk, Netherlands: European Space Agency, 1993.

Lemonick, Michael D. The light at the edge of the universe: leading cosmologists on the brink of a scientific revolution. viii + 325 pp., illus., index. New York: Villard Books [distributed by Random House], 1993. ISBN 0-679-41304-9. \$24.

Neta Bahcall, George Blumenthal, Robert Dicke, Sandra Faber, Margaret Geller, Alan Guth, Jacqueline Hewitt, John Huchra, Norm Jarosik, Robert Kirshner, Jeremiah Ostriker, Bohdan Paczynski, Lyman Page, P. James E. Peebles, Joel Primack, Vera Rubin, Bernard Sadoulet, David Schramm, George Smoot, David Spergel, John Tonry, Edward Turner, Michael Turner, J. Anthony Tyson, David Weinberg, David Wilkinson, Ed Wollack.

Moss, Jean Dietz Novelties in the heavens: Rhetoric and science in the Copernican controversy. xiv + 353 pp, bibl., index. Chicago: University of Chicago Press, 1993. ISBN 0-226-54234-3 (hc), \$49.95; ISBN 0-226-54235-1 (paper), \$17.95.

Discusses the arguments of **Copernicus, Kepler, Galileo, Tommaso Campanella, Giordano Bruno, Cardinal Robert Bellarmine, Orazio Grassi, and John Wilkins.**

Osterbrock, Donald E. Pauper & Prince: Ritchey, Hale & big American telescopes. xv + 359 pp., illus., notes, index. Tucson: University of Arizona Press, 1993. ISBN 0-8165-1199-3. \$45.

On **George Willis Ritchey** and **George Ellery Hale.**

Paul, Erich Robert. The Milky Way galaxy and statistical cosmology, 1890-1924. xiv + 262 pp., illus., fac-sims., ports., index. New York: Cambridge University Press, 1993. ISBN 0-521-35363-7. \$44.95.

On the work of **J. C. Kapteyn, Hugo von Seeliger** and others.

Peterson, Ivars. Newton's clock: Chaos in the solar system. xiii + 317 pp, illus., bibl., index. New York: Freeman, 1993. ISBN 0-7167-2396-4. \$21.

A popular history of celestial mechanics, emphasizing the problem of the predictability of future motions of planets and other bodies; together with an account of recent applications of chaos theory to this problem. Discusses the work of **P. S. de Laplace, Jacques Laskar, Henri Poincaré, Gerald Sussman, Jack Wisdom, and others.**

Russo, Arturo (ed.) *Science beyond the atmosphere: The history of space research in Europe*. Proceedings of a symposium held in Palermo, 5-7 November 1992. viii + 219 pp, illus. Noordwijk, The Netherlands: European Space Agency Publications Division, n.d. [received September 1993].

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[see also **Hetherington** under HISTORY OF ASTRONOMY]

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