Forum on History of Physics

September 1999 Newsletter

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RESPONSIBILITIES OF HISTORIANS OF PHYSICS

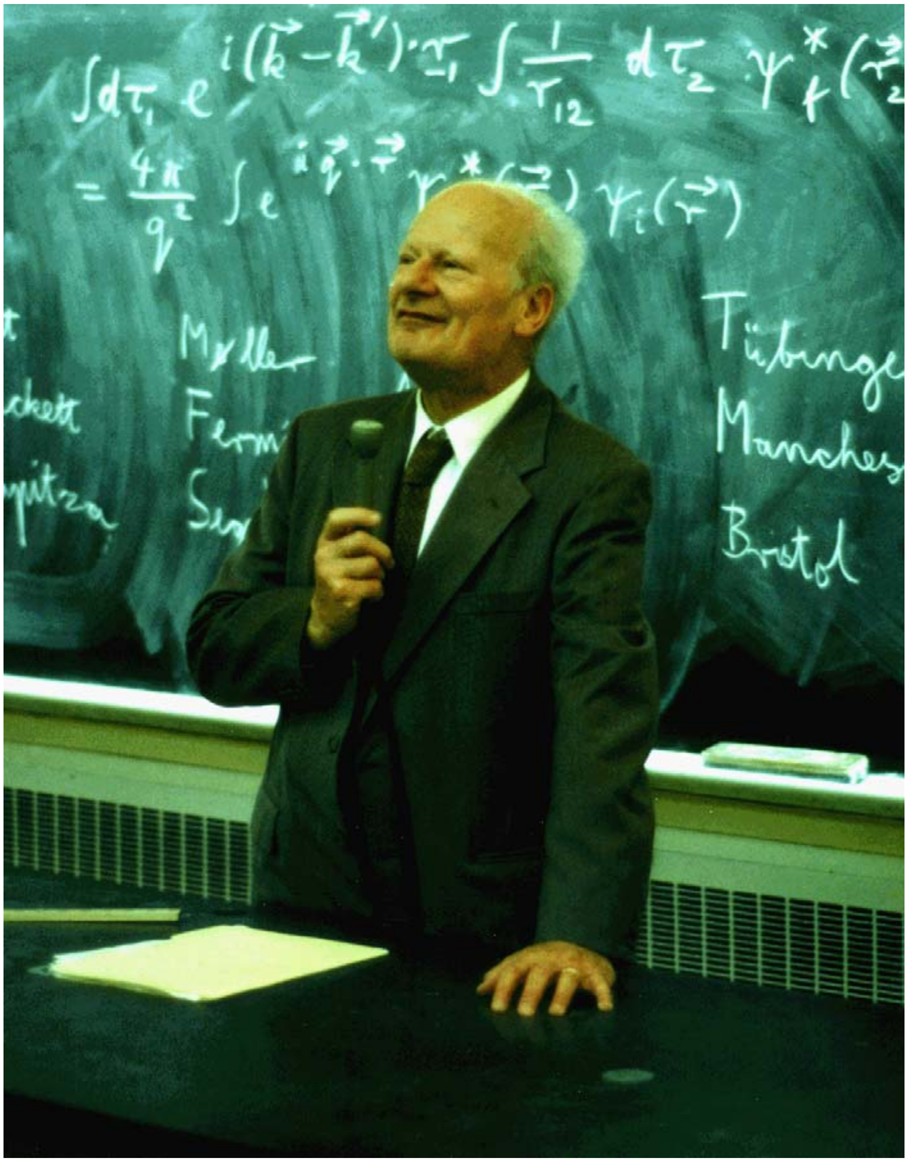
This past year, under the leadership of Roger Stuewer, has been one of enormous success for the Forum. At the Centennial Meeting of the American Physical Society in Atlanta, the Forum sponsored three sessions-two on physics in the twentieth century and one on I.I. Rabi - and cosponsored two others. These sessions were both intellectual and popular successes. I attended each one, and I was informed, enlightened, entertained, and moved. I have no words to describe my feelings as I listened to ninety-two year old Hans Bethe reminiscing about his friend and colleague I.I. Rabi. It was magic. You had to have been there. This year we have a chance to build on this success. In addition to our usual symposia at the March and April meetings, we will have contributed paper sessions on the history of physics at the April meeting in Long Beach, California. The leadership of the APS has recognized that historical work does not fit conveniently into the 10-minute contributed paper format, and they have allowed us, as an experiment, to have 20-minute contributed papers. I encourage you to submit abstracts for our contributed paper sessions at the April meeting (January 7, 2000 deadline). This is a chance to show our colleagues the good work done by members of the Forum.

I'd also like to take this opportunity to preach a little. Now that the furor over the "Science Wars" and the "Sokal Affair" has died down, it is time to address what I believe are some of the fundamental issues underlying these controversies. The first is the issue of scientific knowledge. Does science, in general, and physics, in particular, produce knowledge? I believe that it does and that that knowledge is based on valid experimental evidence and on reasoned and critical discussion. In short, I believe that science is a reasonable enterprise. Our critics disagree. To combat this view we need more good history of physics, which includes its technical details. The history of science involves science.

This does not mean that I advocate a history of science that shows only unbroken progress and success. We can, and should, show science as it is, with errors, wrong turns, and dead ends. The structure of twentieth century physics-quantum mechanics, relativity, quantum field theory, string theory and the experiments that support and test these theories, is, I believe, humanity's greatest collective intellectual achievement. But twentieth century physics also includes episodes like the 17-keV neutrino and the "Fifth Force" in gravity. These are episodes in which interesting and legitimate speculations have been shown to be wrong by experimental evidence. They are also an important part of physics. Discussing how the decision was reached that these speculations were wrong also supports the view that science is a reasonable enterprise. We must also be careful to distinguish between "wrong" but "good" science, and "bad" science. Our critics do not seem to make this distinction. Cold fusion is not, as some have claimed, science as usual. It is unusual, and bad, science. We also need to address the issue of the scientific education of our students and of the general public. The fact that, as Gross and Levitt and Sokal and Bricmont have pointed out, Latour and Derrida do not understand relativity, or that Irigaray does not understand fluid dynamics, would not be troubling if their views were confined to rarely-read academic journals. Unfortunately these views also appear not only in the popular press, but also in what some, but certainly not all, of our colleagues in the humanities and social sciences are teaching to our students. I believe this is inadequate education and we should take steps to improve it.

This is not, however, a battle between the "good" scientists and the "bad" humanists and social scientists. There are many scholars in the humanities and social science who share our intellectual values and standards, and who respect the achievements of science. They are our allies, not our enemies. As George Levine, one of the contributors to the famous, or infamous, "Science Wars" issue of Social Text, remarked in his aptly titled book, One Culture, "It [his book] takes seriously the view that science is one of the great achievements of the human mind, that it matters powerfully to us, for better or worse, in the way we live, the way we think, and the way we imagine. There is no literature more important." We need to provide scholars like George, our students, both science and nonscience majors, and the general public, with understandable and accurate accounts of the history of physics. It may seem that I am asking for an impossibility-studies of the history of physics that include technical details and also studies that are intended for a nonscientific audience. It may be difficult to do both at once, but we can certainly do both separately.

-Allan D. Franklin, Forum Chair



Caption: Physicist Hans Bethe who shared his reminiscences about I. I. Rabi in a Forum-sponsored session at the Atlanta APS Centennial meeting.

Photograph by Roy Bishop, Acadia University, courtesy of AIP Emilio SegrS Visual Archives

From the Editor: Anniversaries for 2000

I find anniversaries a nice opportunity to look back at important events in physics and to be reminded of some that I have not kept up on. This is also a chance for public education and getting the attention of our students to interesting physics. I look forward to seeing historical notes on the work of some of the following important physicists with anniversaries in the coming year. These include

- 150th anniversary of the birth of Oliver Heaviside and Augusto Righi
- 100th anniversary of the birth of Fr,d,ric Joliot, Fritz London, and Wolfgang Pauli And perhaps more significant are the anniversaries of important discoveries, such as
- 400th anniversary of William Gilbert's De Magnete, the first work of physical science

based completely on experimentation.

- 200th anniversary of William Herschel's discovery of infrared radiation, Alessandro Volta's invention of the voltaic cell.
- 150th anniversary of Rudolf Clausius's formulation of the second law of thermodynamics and of Foucault's accurate determination of the speed of light.
- 100th anniversary of Planck's radiation law, Planck's constant, and the introduction of energy quanta. Also of the Rayleigh-Jeans formula and the Wien formula. Lorentz-FitzGerald contraction observed; Becquerel shows that uranium beta rays are electrons; Villard detects gamma rays in uranium radiation; Richardson discovers thermoelectric emission.
- 50th anniversary of Alfred Kastler's development of optical pumping and Alan Turing's proposal of the 'Turing test.'
- 25th anniversary of Benoit Mandelbrot's coining of the term 'fractal.' And no doubt many more.

-Bill Evenson, Editor

Notes & Announcements

Job Notices

From time to time we receive notices of position openings in history of physics. Since these often come out of sequence with the Newsletter publishing schedule, the notices are put on the FHP web site. If you are looking for a position, please check the web site regularly: www.aps.org/FHP/index.html, then follow the announcements link.

Internship Opportunities

The NASA History Office currently has an internship program for undergraduates. They are looking for interns for both the academic year and the summer. The unpaid internship is approximately 20 hours per week, and college sophomores and juniors are preferred. Interns have the opportunity to take on significant responsibilities in editing, doing research, answering information requests, and preparing documents in HTML for the World Wide Web. See http://www.hq.nasa.gov/office/pao/History/interncall.htm on the web for more information.

Physics in Perspective: A New Journal

Most journals are targeted to a small group of scholars. That is not the case for the new journal Physics in Perspective, which is published for a wide audience: historians, philosophers, physicists, and the interested public. The editors believe that scholarly papers written by historians of physics, philosophers of physics, and physicists themselves can be an effective means for bringing the ideas, the substance, and the methods of physics to non- specialists, provided jargon is avoided and care is taken in the writing. Physics in Perspective is published quarterly. Besides articles and book reviews, the journal has two regular features: first, "The Physical Tourist," identifies sites for the traveler whose interests include artifacts from the history of physics, laboratories with historical significance, birthplaces of well-known physicists, and the like; second, "In Appreciation" is written about a physicist by a student, first-hand acquaintance, or colleague. Physics in Perspective is available to members of the American Physical Society at the special subscription rate of $35 per year plus $10 shipping and handling.

Additional information can be found at the Birkh,user Verlag web site, www.birkhauser.ch/journals/1600/1600_tit.htm.

First-hand accounts of participants in interesting and important research projects - experimental, theoretical, or computational - often become documents of historical import. The editors of Physics in Perspective welcome such first- hand accounts and hereby extend an invitation to physicists, and particularly to members of the Forum on History of Physics, to submit manuscripts for publication. (John S. Rigden, American Institute of Physics, One Physics Ellipse, College Park, MD 20740, jsr@aip.org and Roger H. Stuewer, Tate Laboratory of Physics, University of Minnesota, 116 Church Street SE, Minneapolis, MN 55455, rstuewer@physics.spa.umn.edu)

New History of Science Prize Offered

The British Society for the History of Science announces the inauguration of a new prize generously donated by one of its members, Dr. Ivan Slade. The competition will take place biennially, and the prize of 300 pounds is offered for an essay (published or unpublished) that makes a critical contribution to the history of science. Examples would be scholarly work that critically engages a prevalent interpretation of a historical episode, scientific innovation, or scientific controversy.

The prize will be awarded for the first time in 1999, and submissions are now invited. There is no age limit, and entry is not limited to members of BSHS or UK citizens. Entries should be in English, and should have been published or written in the two years prior to the closing date. They should not exceed 10,000 words in length and should be accompanied by an abstract of 500 words. Three copies of the essay and abstract should be sent to the BSHS Secretary, Dr. Jeff Hughes, CHSTM, Maths Tower, University of Manchester, Manchester M13 9PL, United Kingdom. The deadline is 31 October 1999.

National Endowment for the Humanities Programs

NEH OUTLOOK, an email newsletter of the National Endowment for the Humanities (www.neh.gov) can be obtained by sending an email to newsletter@neh.gov; type the word "subscribe" in the body of the message.

NEH offers summer programs for professors and school teachers and supports Chautauquas around the country in addition to summer stipends for research and other programs. One summer program this year dealt with a re-examination of the cold-war era in light of documentary sources newly available with the political transformation of the former Soviet Union and its Eastern European satellites. This summer, NEH offered 23 seminars and institutes for college and university teachers, and 29 for school teachers. Information about these programs is available on their web site. The application deadline for stipends for the summer of 2000 is October 1, 1999. Colleges and universities may nominate up to two faculty members for awards; independent scholars may apply directly to NEH. Prospective applicants should contact the chief academic officer at their institutions, or view the application guidelines at the NEH web site. Requests for hard copies of the guidelines and application instructions may be emailed to stipends@neh.gov and must include a complete postal address.

NASA

NASA History: News and Notes is published quarterly by the NASA History Division, Office of Policy and Plans, Code ZH, NASA Headquarters, Washington, DC 20546. You can receive

NASA History: News and Notes via email. To subscribe, send a message to domo@ hq.nasa.gov. Leave the subject line blank. In the text portion simply type "subscribe history" without the quotation marks. You will receive confirmation that your account has been added to the list for the newsletter and to receive other announcements that may interest you. The latest issue of this newsletter is also available on the web at http://www.hq.nasa.gov/office /pao/History/nltrc.html.

NASA's Education Program debuted a "New" NASA Education homepage at last spring's NSTA Conference in Boston. You can see the new and improved homepage at http://education.nasa.gov

"Space Exploration at the Millennium: In Remembrance of Carl Sagan," was a symposium co-sponsored by NASA that took place on 24 March 1999 at American University in Washington, DC. The symposium featured presentations by Buzz Aldrin, Andrew Chaikin, Hugh Downs, John Glenn, Dan Goldin, Ted Koppel, Bill Nye, and Fred Ordway among others. A videotape of the symposium is available from NASA's Center for Aerospace Information (CASI). A VHS tape of the symposium is available for $36.50, including shipping and handling (stock number 1999-00- 36756, stock title: "Space 2000 Symposium"). Betacam, or broadcast quality, copies are also available. CASI can be reached by telephone at 301-621-0390, via email at help@sti.nasa.gov, or at http://www.sti.nasa.gov.

Apollo 11 Thirtieth Anniversary Web Site

A thirtieth anniversary web site for Apollo 11 has been set up at http://www.hq.nasa.gov/office /pao/History/ ap11ann/introduction.htm. The site includes a variety of newly available information such as interviews with the three crew members and interesting historical documents. It also includes links to many other useful pages on Apollo, both within and outside NASA.

The Marc-Auguste Pictet Prize

The Societ, de Physique et d'Histoire Naturelle de GenSve has announced the Marc-Auguste Pictet Prize for the year 2000, intended for a young researcher for outstanding work, unpublished or recently published, in the field of history of science. In 1998 the prize was 14,000 Swiss francs. The theme for the prize in 2000 is 'History of Electricity and Electromagnetism in the XVIIIth and XIXth Centuries.' Full details from Pr,sident de la SPHN, Mus,e d'Histoire Naturelle, Case postale 6434, Ch-1211 Geneva 6, Switzerland.

Rockefeller Archive Center Grants

The Rockefeller Archive Center awards grants for researchers engaged in work that requires use of the collections at the Center. The closing date for applications is 30 November 1999. Details from Darwin H. Stapleton, Director, Rockefeller Archive Center, 15 Dayton Avenue, North Tarrytown, New York 10591- 1598, archive@ rockvax.rockefeller.edu or http://www.rockefeller.edu/archive.ctr.

Meetings

From 7-10 October 1999, the annual meeting of the Society for the History of Technology (SHOT) will be held in Detroit, Michigan. Contact: Lindy Biggs, SHOT Secretary, History Department, 310 Thach Hall, Auburn University, AL 36849-5259, (334) 844-6645, fax at (334) 844-6673, or email: biggslb@mail.auburn.edu. The Institute of Physics History Group is sponsoring a conference on Volta and the Invention of the Electrochemical Battery at Oxford on 23 October 1999. Details from Neil Brown, n.brown@physics.org.

From 3-7 November 1999, the seventy-fifth anniversary meeting of the History of Science Society will be held in Pittsburg, Pennsylvania. Contact: Fred Gregory, email: fgregory@ufl.edu or Edith Sylla, email: Edith_Sylla@ncsu.edu. On 4-7 November 1999 the American Assoc. for the Rhetoric of Science and Technology, an affiliate of the National Communications Association, will host panels at the NCA annual conference in Chicago, Illinois; topics will include rhetorical analysis of science and technology policy debates, scientific and technical texts, and the impact of popular representations of science. Contact: Alan Gross, email: grossalang@aol.com.

From 7-10 January 2000, the American Historical Association will hold its annual meeting in Chicago, IL. Contact AHA, 400 A Street, SE, Washington, DC 20003, phone (202) 544-2422. The German Geophysical Society will hold a session on the History of Geophysics and Space Physics in Munich in March 2000. Contact Dr. Wilfried Schr"der, Hechelstrasse 8, D-28777 Bremen-Roennebeck, Germany.

From 30 March-2 April 2000 the Organization of American Historians and the National Council on Public History will hold a joint annual meeting in St. Louis, MO. Contact OAH, 112 North Bryan Street, Bloomington, IN 47408, phone (812) 855-7311.

Science in the 19th-century Periodical: An Interdisciplinary Conference will be held 10-12 April 2000 at University of Leeds, UK. Details from Dr. J. R. Topham, School of Philosophy, University of Leeds, LS2 9JT, UK, j.r.topham@leeds.ac.uk. A conference on the History of Science and the Public Understanding of Science will be held in April 2000. The conference will explore the history of 'science communication' to diverse audiences and ask what roles history of science can play in public understanding of science today. Further details from Dr. J. Hughes, CHSTM, Maths Tower, The University, Manchester, M13 9PL, UK, hughes@fs4.ma.man.ac.uk.

Tentative joint British Society for the History of Science/British Society for the History of Mathematics meeting on the History of Computing, fifty years after the completion of the Pilot Automatic Computing Engine (ACE) designed by Alan Turing: ACE2000 in London, 6-7 May 2000. Details from David Anderson (andersond@sis.port.ac.uk), Janet Burt (burtj@sis.port.ac.uk), Jack Copeland (JackCopeland@compuserve.com).

Conference on Portraiture and Scientific Identity at the National Portrait Gallery, London, 23-24 June 2000. Proposals for papers due 1 November 1999. Contact Prof. Ludmilla Jordanova, School of World Art Studies and Museology, University of East Anglia, Norwich, Norfolk, NR4 7TJ, UK, l.jordanova@uea.ac.uk.

The History of Philosophy of Science Group (HOPOS) will hold its Third International History of Philosophy of Science Conference in Vienna on 6-9 July, 2000. Details from Institute Vienna Circle, Museumstrasse 5/2/17, A-1070, Wien, Austria, i_v_c@ping.at (write 'HOPOS 2000' on the subject line) or http://scistud.umkc.edu/hopos/index.html.

What is to be done? History of Science in the New Millennium, a conference in St. Louis on 3-6 August 2000, will be the fourth British-North American joint meeting of the British Society for the History of Science, the Canadian Society for the History and Philosophy of Science, and the History of Science Society. Paper proposals are due by 15 December 1999. See http://depts.washington.edu/hssexec/ or email hssexec@u.washington.edu.

The International Committee of Historical Sciences will hold its 19th international congress in

Oslo, Norway, on 6-13 August 2000. It invites proposals for presentations on all subjects. Contact the 19th International Congress of Historical Sciences, Department of History, P.O. Box 1008, Blindern, N-0315, Oslo, Norway or Renate Bridental, Ph.D. Program in History, Graduate School and University Center, City University of New York, 33 West 42nd Street, New York, NY 10036-8099.

From 17-20 August 2000 the Society for the History of Technology (SHOT) will hold its annual meeting at the Munich Center for the History of Science and Technology, Munich, Germany. Contact Lindy Biggs, SHOT Executive Director, 310 Thach Hall, Auburn University, AL 36849-5259, (334) 844-6645, fax at (334) 844- 6673, or email: biggslb@mail.auburn.edu.

On 12-15 October 2000 St. Louis University is sponsoring, Writing the Past, Claiming the Future: Women and Gender in Science, Medicine, and Technology. Papers on all aspects of gender in science and technology are invited. Deadline for proposals is 1 January 2000. Contact Charlotte G. Borst, Department of History, St. Louis University, 3800 Lindell Blvd., P.O. Box 56907, St. Louis, MO 63156.

An International Conference on Galileo, sponsored by the Canary Orotava Foundation for the History of Science, will be held in February 2001 at Tenerife, Canary Islands. Details from s_orotava@redestb.es. On 26-29 April 2001 the Organization of American Historians will hold its annual meeting at the Westin Bonaventure Hotel in Los Angeles, CA, with the theme, "Connections: Rethinking our Audiences." Proposals are invited, and must be postmarked no later than 12 January 2000. Contact the 2001 Program Committee, Organization of American Historians, 112 North Bryan Avenue, Bloomington, IN 47408-4199. For further information on the conference visit the OAH web page: http://www.indiana.edu/~oah/meetings/2001 program/call.html.

XXIst International Congress of History of Science. During the LiSge Congress in 1997, the proposal of Mexico to host the XXIst International Congress of History of Science in 2001 (July 8-14) was accepted. The Announcement of the Congress has been distributed and a copy can be obtained if you ask for it from: Prof. Juan Jos, Salda a, Chairman of the Organizing Committee of the XXIst ICHS. Apartado postal 21-873, 04000 Mexico D.F.,MEXICO; email: xxiichs@ servidor.unam.mx; or visit the web site of the IHUPS/DHS: www.cilea.it/history/DHS

Dibner Institute for the History of Science and Technology: Fellows Programs 2000-2001

The Dibner Institute for the History of Science and Technology invites applications to its two fellowship programs for the academic year 2000-2001: the Senior Fellows program and the Postdoctoral Fellows Program. There will be some twenty Fellows at the Institute each term. The Dibner Institute is an international center for advanced research in the history of science and technology, established in 1992. It draws on the resources of the Burndy Library, a major collection of both primary and secondary material in the history of science and technology, and enjoys the participation in its programs of faculty members and students from the universities that make up the Dibner Institute's consortium: The Massachusetts Institute of Technology, the host institution; Boston University; Brandeis University; and Harvard University. The Institute's primary mission is to support advanced research in the history of science and technology, across a wide variety of areas and a broad spectrum of topics and methodologies. The Institute favors projects that address events dating back thirty years or more.

Senior Fellows Program: Candidates for Senior Fellowships should have advanced degrees in disciplines relevant to their research and show evidence of substantial scholarly accomplishment and professional experience. Senior fellows may apply for a second fellowship appointment five years after their first successful application. Scholars may apply to the Senior Fellows Program for the Fall (Term 1), the Spring (Term 2), or both. Term 1 extends from August 1 through December 31, with full activities beginning on September 1; Term 2 extends from January 1 through May 31, with full activities beginning on February 1. At the time of application, Term 1 candidates may request an arrival date in August; Term 2 candidates may request an extension into June. The Institute prefers, if possible, that senior fellows apply for a two-term residency.

Postdoctoral Fellows Program: Fellowships are awarded to outstanding scholars of diverse countries of origin who have been awarded the Ph.D. or equivalent within the previous five years. Postdoctoral Fellowships run for one year, from September 1 through August 31, and may be extended for a second and final year at the discretion of the Dibner Institute. Terms and Conditions: All Dibner Fellows are expected to reside in the Cambridge/Boston area during the terms of their grants, to participate in the activities of the Dibner Institute community, and to present their current work once during their fellowship appointments. Fellowships provide office space, support facilities, and full privileges at the Burndy Library and at the libraries of consortium universities. Fellows will have access to the entire spectrum of activities that take place at the Dibner Institute, where they will be able to collaborate in an atmosphere of collegiality and find the resources and appropriate settings to carry on their work. Funds are available for housing, living expenses, and one round-trip fare for international fellows. Estimates of costs, as well as the average stipend awarded in 1999-2000, are provided with the application forms. The deadline for receipt of applications for 2000-2001 is December 31, 1999. Fellowship recipients will be announced in March 2000. Please send requests for further information and for application forms directly to: Trudy Kontoff, Program Coordinator, Dibner Institute for the History of Science and Technology, Dibner Building, MIT E56-100, 38 Memorial Drive, Cambridge, Massachusetts 02139. Phone: 617. 253.6989, Fax: 617. 253.9858, email: dibner@mit.edu

Dibner Institute Names Resident, Visiting and Postdoctoral Fellows for 1999-2000

The Dibner Institute for the History of Science and Technology is pleased to announce the appointments of the Dibner Institute Fellows for 1999-2000. The Institute has appointed nineteen Senior and eleven Postdoctoral Fellows. They come from several nations and pursue many different aspects of the history of science and technology.

The following nineteen persons have been appointed as Dibner Institute Senior Fellows:

Davis Baird, Associate Professor in the Department of Philosophy, University of South Carolina, is the author of Inductive Logic: Probability and Statistics (1992) and the 1998 article, "Encapsulating Knowledge: The Direct Reading Spectrometer." At the Dibner Institute he plans to complete a manuscript, "Instrument Knowledge: A Philosophy of Scientific Instruments" and begin research on Baird Associates, a company that developed and manufactured scientific instruments, founded by his father in 1936.

Bernadette Bensaude-Vincent, Professor at Universit, Paris X, is the author of Elogie du Mixte. Materiaux Nouveaux et Philosophie Ancienne (1998) and Lavoisier, Memoires d'une Revolution (1993). In 1997 she received the Dexter Award for outstanding achievement in the history of chemistry. The project she will be working on at the Dibner Institute is titled "Nature and Artifact in Chemical Industries, 1900-2000."

Christine Blondel is Charg,e de Recherche at the Centre National de la Recherche Scientifique (CNRS), France. She is the author of Histoire de l',lectricit, (1994) and, with A. C. Vauge, Repertoire de l'histoire des sciences et des techniques en France (1994). At the Dibner Institute she will be working on a project about the history of electricity in France from the 1770s - 1914 titled "French Amateurs in Electricity at the End of the Eighteenth Century."

David Bloor, Professor at the University of Edinburgh, Scotland, and Director of its Science Studies Unit, is the author of Wittgenstein, Rules and Institutions (1997) and Knowledge and Social Imagery (1991). During his visit at the Dibner Institute he plans to test Sir Frederic Bartlett's 1932 case study, Remembering, in which Bartlett claims that different national groups produce culturally and nationally specific forms of technological devices. He will concentrate on sound-locator equipment as developed by the Germans, the British, the French, and the Americans.

William Brock, Emeritus Professor of History of Science, the University of Leicester, UK, is the author of Justus von Liebig. The Chemical Gatekeeper (1997) and The Fontana History of Chemistry (London 1992), issued as The Norton History of Chemistry (New York 1993). At the Dibner Institute he will continue his research for a book with the working title, "Sir William Crookes (1832-1919) and the Business of Science."

Kenneth Caneva, Professor of History at the University of North Carolina at Greensboro, is the author of the volume, Robert Mayer and the Conservation of Energy (1993) and the 1998 article, "Colding, Orsted, and the Meanings of Force." Professor Caneva's project while at the Dibner Institute is tentatively titled "The Reconstruction of Scientific Knowledge: From Personal Conviction to Collective Acceptance."

Claudine Cohen is Associate Professor at Ecole des Hautes Etudes en Sciences Sociales, Paris. Her dissertation, "La GenSse de Telliamed: Th,orie de la Terre et Historie naturelle . l'aube des LumiSres," is being published in 1999. She is also the author of Le Destin du Mammouth (1994). Her research project at the Dibner Institute will explore the interactions betwen French and American paleontological sciences from 1830 - 1950.

Jack Copeland, Professor at the University of Canterbury, Christchurch, New Zealand, is the author of Artificial Intelligence (1993) and the forthcoming volume, "Turing's Machines." For his work at the Dibner Institute he plans to continue a work-in-progress, titled "Synopsis of 'Turing's Machines,' A Work in the History and Philosophy of Computation."

Mordechai Feingold, Professor of Science Studies at Virginia Polytechnic Institute, is the author of "The Oxford Curriculum in Seventeenth-Century Oxford," pp. 211-503 of volume four of The History of the University of Oxford (1997) and The Mathematicians' Apprenticeship: Science, Universities and Society in England, 1560-1640 (1984). At the Dibner Institute he will continue work on his book, "Cast a Giant Shadow: A History of the Royal Society, 1660-1850, Vol. I: A House Divided, A House Besieged 1660-1727."

Yves Gingras, Professeur Titulaire in the Department of History, University of Qu,bec at Montr,al, is the author with Peter Keating and Camille Limoges, of Du scribe au savant. Les porteurs du savoir de l'Antiquit, . la R,volution industrielle (1998) and Pour l'avancement des sciences. Histoire de l'ACFAS 1923-1993 (1994). At the Dibner Institute he will continue research for his project on the relationship between the mathematization of physics and the transformation of the notion of substance.

Ruth Glasner is a Senior Lecturer at Hebrew University, Jerusalem. She is the author of the book, A Fourteenth-Century Scientific-Philosophical Controversy: Jedaiah ha-Penini's 'Treatise on Opposite Motions' and 'Book of Confutation' (1998), as well as the article, "Gersonides' Lost Commentary on the Metaphysics." Her project at the Dibner Institute is titled "The Hebrew

Supercommentaries on Aristotle's Physics."

Helen Lang is Professor and Chair of the Philosophy Department, Trinity College, Hartford, CT. She is the author of The Order of Nature in Aristotle's Physics: Place and the Elements (1998) and Aristotle's Physics and its Medieval Varieties (1992). She will be doing research at the Dibner Institute for a project titled "Place and Extension: The Problems and Language of Ancient Physics."

Wenlin Li is Research Professor at the Institute of Mathematics, Academia Sinica, Beijing, China. He is the author of Highlights of Classics of Mathematics (a source book in Mathematics) (1998) and, with Li Xixian, et al. On Science as System (1995), and the article, "G"ttingen's Influence on the Development of Mathematics in East Asia." At the Dibner Institute he will continue his investigations into mathematical exchanges between China and western countries by exploring the transmission of mathematical knowledge between the United States and China.

Nancy Nersessian, Professor, Program in Cognitive Science at Georgia Institute of Technology, is author of the book in press, "Creating Science: A Cognitive- historical Approach to Conceptual Change" and Faraday to Einstein: Constructing Meaning in Scientific Theories (1984, reprint 1990). At the Dibner Institute she will continue to work on her NSF-sponsored research project, "Culture in Cognition: Toward an Integrative Analysis of Representation in Science."

William Newman, Professor at Indiana University, is the author of Gehennical Fire: The Lives of George Starkey, An American Alchemist in the Scientific Revolution (1994) and The Summa Perfectionis of Pseudo-Geber. A Critical Edition, Translation and Study (1991). During the fall term he will continue his collaboration with Lawrence Principe, working on the laboratory notebooks of George Starkey and Robert Boyle. Professor Newman will also undertake a reconsideration of early modern matter-theory, exploring the relationship between the re-emergence of atomism in early modern science and medieval Aristotelian theories of matter.

Lawrence Principe, Associate Professor, Johns Hopkins University, is the author of The Aspiring Adept: Robert Boyle and His Alchemical Quest (1998) and the forthcoming article, "The Alchemies of Robert Boyle and Isaac Newton: Alternate Approaches and Divergent Deployments" in the volume, In Canonical Imperatives: Rethinking the Scientific Revolution, edited by Margaret Osler. At the Dibner Institute he will continue his collaboration with William Newman exploring the importance of experiment in seventeenth-century alchemy and the influence of George Starkey on Robert Boyle.

Gregor Schiemann is Assistant Professor at Humboldt Unversit,t, Institut f�r Philosophie, Berlin. He is the author of Wahrheitsgewissheitsverlust. Hermann von Helmholtz' Mechanismus im Anbruch der Moderne. Eine Studie zum sbergang von Klassicher zu moderner Naturphilosophie (1997) and the editor, with Michael Hauskeller and Christoph Rehmann-Sutter, of Naturerkenntnis und Natursein (1997). The title of his research project while at the Dibner Institute is "Aristotle and Descartes' Concept of Nature and the Transformation of Psychology in the 16th and 17th Centuries."

Ana Simoes is Assistant Professor in the Department of Physics, University of Lisbon, Portugal. She is the author, with Ana Carneiro and Maria Paula Diogo, of "Constructing Knowledge, Eighteenth-Century Portugal and the New Sciences" and, with Kostas Gavroglu, of "Different Legacies and Common Aims: Robert Mulliken, Linus Pauling and the Origins of Quantum Chemistry." At the Dibner Institute she will be working on two projects. The first is the completion of a history of quantum chemistry, written with Kostas Gavroglu, tracing the development of the field of quantum chemistry from the 1920s - early 1950s and the communities of quantum chemists in the United States, Germany, and the United Kingdom. The second project is a biography of Jos, Correia da Serra (1750-1823), a Portuguese man of letters, diplomat, Freemason, and botanist.

John Stillwell, Associate Professor of Mathematics, Monash University, Victoria, Australia, is the author of Numbers and Geometry (1998) and Elements of Algebra: Geometry, Numbers, Equations (1994). At the Dibner Institute he plans to write a book on "Exceptional Objects" and their role in the history of mathematics.

The Dibner Institute has made the following eight Postdoctoral Fellowship appointments:

Luca Ciancio received his Ph.D. at the University of Florence. He is the editor of A Calendar of the Correspondence of John Strange F.R.S. (1732-1799) (1998) and the author of Autopsie della Terra. Illuminismo e geologia in Alberto Fortis (1741-1803) (1997). His project at the Dibner Institute is titled "Interpreting the Temple of Serapis. A Case-study in the Relationship between Geology and Antiquarianism (1750-1830)."

Slava Gerovitch, received his Ph.D. from MIT's Program in Science, Technology and Society Program. He has translated Loren Graham's book, Science in Russia and the Soviet Union, into Russian. He contributed "Striving for 'Optimal Control': Soviet Cybernetics as a 'Science of Government' " to Cultures of Control in the Machine Age, in press. At the Dibner Institute he will complete a book on the history of Soviet cybernetics, based on his dissertation.

Michael Gorman completed the work for his Ph.D. at the European University Institute, Florence, Italy. He has written several articles, now in press, including "Mathematics and Modesty in the Society of Jesus: The Problems of Christoph Grienberger", to appear in Archimedes and and "From the 'Eyes of All' to Usefull Quarries in Philosophy and Good Literature': Consuming Jesuit Science 1600-1665," to appear in the book, The Jesuits: Culture, Learning and Arts. For his research proposal at the Dibner Institute he plans to conduct a reappraisal of the origins of Jesuit science practice against the background of the 'science policy' of the Jesuit order.

Christophe Lecuyer, a recipient of the Ph.D. from Stanford University, is the author of the articles "University-Industry Relations during the Progressive Era: The Case of MIT" and "Instrument Makers and Discipline Builders: The Case of NMR." The title of his research project at the Dibner Institute is "From the Lab to the Fab: Physics Research, Manufacturing Practice, and Ion Implantation at High Voltage Engineering Corporation and Fairchild Semiconductor, 1962-1978."

Massimo Mazzotti, is a Ph.D. candidate at the University of Edinburgh, Scotland. He is the author of the following forthcoming articles: "The Geometers of God. Mathematics and Reaction in the Kingdom of Naples" and "L'immagine della scienza nel 'Bullettino' di Baldassarre Boncompagni (1868-1887)." His research project at the Dibner Institute is titled "Conservative Thought and Scientific Knowledge: A Socio-Historical Perspective."

Jutta Schickore, a Postdoctoral Fellow at the Max-Planck Institut, Berlin, is the author of the articles, "Sehen, Sichtbarkeit und empirische Forschung" and "Theoriebeladenheit der Beobachtung: Neubesichtigung eines alten Problems." She will work at the Dibner Institute on a project titled "Constructive Constraints: Exploring Errors and Pitfalls in Microscopy."

Brett Steele, Lecturer in the Department of History at UCLA, is the author of the articles, "Symmetry and Symbiosis: The Science of Mechanics and the Art of War" and "Rational Mechanics as Military Technology: Leonard Euler and Interior Ballistics." His work at the Dibner Institute will use recent archival research to develop further his dissertation, "The Ballistics Revolution: Military and Scientific Change from Robins to Napoleon."

R. Andre Wakefield, currently an exchange scholar at Harvard University, is the author of the forthcoming article, "Das Verm,chtnis einer Verbindung: Freiberg und die Bergbauwissenschaften in den Best,nden der G"ttingen Universit,tsbibliothek" and "Police Chemistry," based on a paper presented at the 1998 Annual History of Science Society Meeting. He plans to work on a project titled "An Early Modern Chemistry of the Mines, 1710 - 1800" while at the Dibner Institute.

The Dibner Institute has reappointed the following persons to a second year as Postdoctoral Fellows:

Arne Hessenbruch is the editor of the forthcoming "Reader's Guide to the History of Science," and author of "The Spread of Precision Measurement in Scandinavia 1660-1800." At the Dibner Institute, his project is a book titled "Scientific Quantification and Money."

Klaus Staubermann completed his dissertation, "Controlling Vision - The Photometry of K.F. Zoellner" at Cambridge University, UK. For his work at the Dibner Institute, he will analyze the scientific practice of three leading astrophotometrists, G. M�ller at Potsdam, E. Pickering at Harvard, and C. Pritchard at Oxford.

Benno van Dalen was an Alexander von Humboldt Foundation Fellow at the Institut f�r Geschichte der Naturwissenschaften, Frankfurt. He is the author of "A Statistical Method for Recovering Unknown Parameters from Medieval Astronomical Tables" and "On Ptolemy's Table for the Equation of Time." At the Dibner Institute, he has started work on a manuscript tentatively titled "The Activities of Muslim Astronomers in China During the Mongolian Yuan Dynasty (1260-1368)."

Dibner Institute names seven Graduate Student Fellows for 1999-2000

The Dibner Institute for the History of Science and Technology is pleased to announce that fellowship awards have been made to seven Ph.D. candidates enrolled in programs at three Dibner Institute consortium-member institutions: the Dibner Institute's host institution, the Massachusetts Institute of Technology; Boston University; and Harvard University. The Dibner Graduate Fellowship program is open to students writing their doctoral dissertations. Selection is based on excellence and scholarly promise, without regard for need.

Babak Ashrafi, MIT, received an S.B. in Physics and Mathematics from MIT and a Ph.D. in Physics from the State University of New York at Stony Brook. He is studying the efforts in the 1930s and 1940s to write a relativistic version of quantum mechanics for his thesis, "From Relativistic Electrons to Quantum Fields."

David Kaiser, Harvard University, has been working in a "double" Ph.D. program. In 1997 he defended his dissertation, "Post-Inflation Reheating in an Expanding Universe," for the Department of Physics, and he is preparing a second dissertation for the Department of the History of Science. This work is titled "Making Theory: Training American Theoretical Physicists in an Age of Big Science, 1948-1969." He graduated summa cum laude from

Dartmouth College with a major in physics.

Matthew Jones, Harvard University, received an M. Phil. from Cambridge University and an A.B. magna cum laude from Harvard College with majors in History and Science. His dissertation is titled "The Aesthetics of Inference: The Mathematics of Descartes and Leibniz and the Dream of Systematic Public Knowledge in the Seventeenth Century."

Robert Martello, MIT, received a B.S. from MIT with a major in Earth, Atmospheric, and Planetary Science and an M.S. in Civil and Environmental Engineering. His dissertation, "Paul Revere's Last Ride: The Road to Rolling Copper," is a study of Paul Revere's lifelong technological education and his development, at the age of 65, of America's first copper rolling mill.

Benjamin Pinney, MIT, has received an M.A. in Architecture from Princeton University and the B.A. magna cum laude in Political Economy from Williams College. His dissertation is titled "Organizing Engineering Labor: A History of Project Management to 1970."

Gerald A. Ward, Boston University, received a B.A. and an ALM, summa cum laude in History of Science, Harvard Extension School. His dissertation is titled "From Merchant Adventurers to Merchants of Light: The Development of English Oceanic Commerce and New World Colonies and the Making of Bacon's Great Instauration."

Timothy Wolters, MIT, received an M.A. at the University of Maryland, and the B.A. magna cum laude in History/Computer Applications at the University of Notre Dame. The working title of his dissertation is "Carrier Aviation Policy and Procurement in the US Navy, 1936-1955."

APS and AIP News

2000-2001 APS/AIP Congressional Science Fellowship Programs

The American Institute of Physics and the American Physical Society are accepting applications for their 2000-2001 Congressional Science Fellowship Programs. Fellows serve one year on the staff of a Member of Congress or congressional committee, learning the legislative process while they lend scientific expertise to public policy issues. Qualifications include a PhD or equivalent research experience in physics or a closely related field. Fellows are required to be U.S. citizens and, for the AIP Fellowship, members of 1 or more of the AIP Member Societies. A stipend of up to $49,000 is offered, in addition to allowances for relocation, in-service travel, and health insurance premiums. Applications should consist of a letter of intent, a 2-page resume, and 3 letters of recommendation. Please see our websites (http://www.aip.org/pubinfo or http://www.aps.org/public_affairs/fellow.html) for detailed information on applying. If qualified, applicants will be considered for both programs. All application materials must be postmarked by January 15, 2000, and sent to: APS/AIP Congressional Science Fellowship Programs, One Physics Ellipse, College Park, MD 20740-3843.

AIP Center for the History of Physics

New History of Physics Exhibits on the Internet

"Werner Heisenberg / Quantum Uncertainty", and "Andrei Sakharov: Soviet Physics, Nuclear Weapons and Human Rights," two new historical exhibits on the World Wide Web, have been announced by the Center for History of Physics of the American Institute of Physics. The exhibits are designed to be useful for educational purposes to a wide spectrum of audiences including high-school and college students, teachers, scientists and historians. Besides many outstanding photographs and other illustrations, both exhibits include supplementary documentation and clips of the physicists' voices. They add to the Center's existing award-winning exhibits "Albert Einstein, Image and Impact" and "The Discovery of the Electron," and can all be accessed from the Center's homepage: http://www.aip.org/history/

Heisenberg (1901-1976), one of the greatest physicists of the twentieth century, is best known as a founder of quantum mechanics and especially for the uncertainty principle in quantum theory. He also played a controversial role as a leader of Germany's nuclear fission research under the Nazi regime. After World War II he was active in elementary particle physics and West German science policy. All these topics are covered in the exhibit written by Professor David Cassidy of Hofstra University, the author of the major biography Uncertainty: The Life and Science of Werner Heisenberg (1992). Sakharov (1921-1989), the Soviet physicist who became, in the words of the Nobel Peace Committee, a "spokesman for the conscience of mankind," was fascinated by fundamental physics and cosmology, but first he spent two decades designing nuclear weapons. He came to be regarded as the father of the Soviet hydrogen bomb, contributing perhaps more than anyone else to the military might of the USSR. But gradually Sakharov became one of the regime's most courageous critics, a defender of human rights and democracy. He could not be silenced, and helped bring down one of history's most powerful dictatorships. The exhibit, which includes numerous photos provided by Sakharov's family, is authored by Dr. Gennady Gorelik, who is currently working on a scholarly biography of Sakharov. Several further historical exhibits are in planning, including ones on Marie Curie, Max Planck and the quantum, and twentieth century cosmology. The Center invites comments on the existing exhibits and encourages historians to consider cooperating and using our services for additional projects in their areas of expertise. (See the Website for contact information.)

Grants-in-Aid for History of Modern Physics and Allied Fields (Astronomy, Geophysics, etc.)

The AIP Center for History of Physics has a program of grants-in-aid for research in the history of modern physics and allied sciences (such as astronomy, geophysics, and optics) and their social interactions. Grants can be up to $2500 each. They can be used only to reimburse direct expenses connected with the work. Preference will be given to those who need funds for travel and subsistence to use the resources of the Center's Niels Bohr Library (near Washington, DC), or to microfilm papers or to tape-record oral history interviews with a copy deposited in the Library. Applicants should name the persons they would interview or papers they would microfilm, or the collections at the Library they need to see; you can consult the online catalog at our web site, http://www.aip.org/history, and please feel free to make inquiries about the Library's holdings.

Applicants should either be working toward a graduate degree in the history of science (in which case they should include a letter of reference from their thesis adviser), or show a record of publication in the field. To apply, send vitae, a letter of no more than two pages describing your research project, and a brief budget showing the expenses for which support is requested to: Spencer Weart, Center for History of Physics, American Institute of Physics, One Physics Ellipse, College Park, MD 20740; phone: 301-209-3174, Fax: 301-209-0882 e-mail: sweart@aip.org. Deadlines for receipt of applications are June 30 and December 31 of each year.

History of Physics Syllabi on the Internet. Call for Syllabi.

As an aid to teaching and studying the history of physics, and as an introduction to the vast literature in the field, the AIP Center for History of Physics has put together a collection of syllabi. With the kind permission of their authors, sample syllabi are exhibited on the internet at http://www.aip.org/history/syllabi/ They feature courses taught at a variety of universities, including "Scientific Revolution," "History of Modern Physics," "Nuclear Age", "Science after WWII," and "Historical Experimentation." If you are teaching a course on the history of physics or a related science, please visit our homepage and send us your comments. And please send a copy of your syllabus or reading list, in any paper or electronic format. (Alexei Kojevnikov and Spencer Weart, chp@aip.org)

New Grants to Archives

The AIP Center for History of Physics has announced a new program of grants to archives to make accessible records and papers which document the history of modern physics and allied fields (such as astronomy, geophysics, and optics). Grants can be up to $10,000 each and can be used only to cover direct expenses connected with preserving, inventorying, arranging, describing, or cataloging appropriate collections. Expenses may include acid-free storage materials and staff salary/benefits but not overhead. The AIP History Center's mission is to help preserve and make known the history of modern physics and allied fields, and this new grant program is intended to help support significant work to make original sources accessible to researchers. Preference will accordingly be given to medium size or larger projects for which the grant will be matched from other sources or by the parent organization. Application deadline for this year was July 1, but the program will be offered annually if funds permit. For grant guidelines or for more information on the Center and its programs, check their web site at http://www.aip.org/history/grntgde.htm, or call (301) 209-3165.

Annual Bibliography

The annual bibliography of recent books in the history of physics, produced by the AIP Center for History of Physics in cooperation with the Forum, is now entering its fifth year. Among other uses, the list can help readers to suggest books for purchase by their institutional libraries. Stephen Brush, who inaugurated and diligently compiled the bibliography, is turning over the reins to Per and Eleanor Dahl, who have generously agreed to carry on this valuable task. The bibliography is published each Fall in the Center's free AIP History of Physics Newsletter, and is available on its web site at http://www.aip.org/history/web-news.htm#bibl.

Books of Possible Interest

The Particle Century

Gordon Fraser, ed., (Institute of Physics Publishing, Bristol, 1998). 236 pages, $59.50

Reviewed by Martin L. Perl
Stanford Linear Accelerator Center, Stanford University

Gordon Fraser has performed a very welcome service by commissioning and editing nineteen essays on the history of elementary particle physics in the twentieth century, with just about every essay being written by the physicists who made that history.

The essays come in a pleasant variety of forms and types of content. Some essays summarize a broad area of experimental discoveries. Thus W.O. Lock tells about the extraordinary discoveries in cosmic rays of new particles, ranging from the finding of the positron in the early 1930's to the finding of strange particles in the 1950's. And Nicholas Samios tells the corresponding story of the discoveries of new particles using the first accelerators, the most amazing being the finding of the omega-minus hyperon in 1964.

Other essays concentrate on particular experiments that brought us spectacular new knowledge. Examples are: the description by Jerome Friedman and Henry Kendall of the electron scattering experiments that demonstrated the quark structure of the nucleons, the essay by Sau Lan Wu on the experimental demonstration of the existence of gluons, the description by Roy Schwitters of the 'November Revolution' in particle physics, and Melvyn Shochet's history of the finding of the top quark. The essays on the experimental history are well illustrated by all sorts of diagrams, graphs and photographs; many of the photographs are wonderfully nostalgic such as the 1938 cloud chamber picture of a positive muon obtained by Nedermeyer and Anderson and the photograph of the UA1 detector in the essay by Carlo Rubbia on the discovery of the W and Z bosons.

Being an experimenter, my first interest naturally went to the essays on the experimental history of particle physics. But the essays on the great theoretical advances in particle physics are equally enjoyable. There is M. Veltman's insightful discussion of gauge theories, Christine Sutton's summary of weak interaction theory, and an introduction to today's hot topic of CP violation by Ahmed Ali and Boris Keyser.

This beautifully published volume also contains a number of essays on broader topics in elementary particle physics and related fields. The so-called standard model of particle physics, a term I detest, is summarized in essays by Yuval Ne'eman, Guido Altarelli and by Graham Ross; it is the phrase standard model that I detest, not the essays. Connections between particle physics, cosmology and astronomy are sketched in stimulating essays by John Ellis, Qaisar Shafi and A. C. Fabian.

The collection is made complete by three essays summarizing more general historical aspects of particle physics: Catherine Westfall and John Krige write about international aspects of particle physics, E. J. N. Wilson summarizes particle accelerator history and David Saxon summarizes particle detector history. These essays also contain some wonderful photographs. I was very touched by the photograph of the Cosmotron at Brookhaven National Laboratory, the accelerator where I worked on my first particle physics experiment. The Cosmotron looked so large at the time, 1958; it looks so small in the photograph. There are also two useful additions to the book, a particle physics glossary and a list of Nobel Laureates in physics.

So this is a fascinating and entertaining history of particle physics; most older particle physicists, dare I use the word older, will treasure it. Others with an interest in particle physics will want to keep The Particle Century on their bookshelf, dipping into it for information and sheer reading pleasure. I must add that the excellent introductory notes to each essay by Gordon Fraser will be of particular value to this second group of readers. Finally this is the book I will give to all my beginning graduate students in particle physics, if this doesn't stimulate them to wonderful dreams and hopes, nothing will. This review is for the History of Physics Newsletter and so I should comment on the value of the book to science historians. The facts and dates of advances and discoveries in particle physics will certainly be very useful, as will the formal descriptions of how these advances and discoveries were made. But I wish that the essayists had written from a more personal viewpoint, telling something about their hopes and fears and mistakes and lucky breaks. This would provide more insight for the historians. I realize it is not the style in physics; we are all so macho, so technically proper. There is one essay that properly describes the hopes and fears and mistakes and lucky breaks; this essay by Roy Schwitters entitled "Unexpected Windfall" tells about the discovery of the Psi/J particle. Schwitters writes the magical words "A greater magicalsurprise was lurking in the data at 3.1 GeV."; he writes about a busy weekend when ". a fresh Pacific storm boiled over the hills west of SLAC..". W. O. Lock also gets some human feeling into his essay entitled "Cosmic Rain," but he has much to tell in a few pages, and cannot give any details.

The Defining Years in Nuclear Physics 1932-1960s

M. MladjenoviY, (Institute of Physics Publishing, Bristol and Philadelphia, 1998). xx + 441 pages. $150.00.

Reviewed by Roger H. Stuewer
University of Minnesota

Facing the title page of this book is a page also giving its title but adding the words, "with reference to the following Nobel Prize winners." In this list we find the names "Hahn and Strassman" and "Lee and Young," which is not an auspicious beginning.

The author, Milorad MladjenoviY, is formerly professor at the University of Belgrade, where he taught nuclear physics and the history of physics. He currently is scientific advisor at the Vin.a Institute of Nuclear Sciences. He has written five monographs on nuclear physics in English and five textbooks on the history of classical physics in Serbian. The immediate predecessor to the present book is his book, The History of Early Nuclear Physics (1896-1931) (World Scientific, Singapore, 1992).

The author divides his present history into four main parts, covering (1) the period from the discovery of the neutron to nuclear fission, (2) nuclear instruments, (3) nuclear models, and (4) nuclear reactions. Each part is further divided into various sections that focus on particular topics, for example, the discovery of the neutron in part 1, gas counters in part 2, the shell model in part 3, and nucleon-nucleon scattering in part 4. The author bases his discussions almost entirely on the original articles and books published by the nuclear physicists who were active during the period in question, and his discussions of the scientific content of these articles and books are often valuable and insightful. This is a clear strength of this book.

The author's organization has forced him to abandon a chronological presentation from beginning to end, which does not allow the reader to gain a clear sense of the evolving history of nuclear physics from the 1930s to the 1960s as characterized by an interplay among new instrumentation, experimental results, and theoretical insights. By jumping back and forth in time, much of this interplay in its historical context is lost. Here is an example. In part 1 the author discusses Chadwick's discovery of the neutron in early 1932 near the beginning, the Joliot-Curies' discovery of positron-producing reactions in 1933 in the middle, and Heisenberg's and Majorana's theories of nuclear forces of 1932-33 at the end (even after the discovery of fission in 1938). Part 2 then opens with the invention of the Cockcroft-Walton accelerator and cyclotron in 1932, but the actual lithium-disintegration experiments of Cockcroft and Walton and the ill-fated deuteron experiments of Lawrence, along with their reports on these experiments at the seventh Solvay conference in October 1933, are not discussed until the beginning of part 4 on nuclear reactions. This dispersal has largely destroyed the interplay and historical context of these developments during 1932-33. The reader nowhere learns, for example, that as a direct consequence of these discoveries and new instrumentation, Chadwick argued for a low neutron mass (1.0067 amu), Lawrence argued for a very low neutron mass

(1.0006 amu), and the Joliot-Curies argued for a high neutron mass (1.011 amu) at the 1933 Solvay conference, and that these experimental discrepancies were a major source of contention there, because they carried with them great theoretical implications for the structure of the nucleus. Moreover, this dispute was not settled until Chadwick and Maurice Goldhaber, a refugee from Nazi Germany who found a home in Cambridge, carried out their experiments on the photodisintegration of the deuteron in the middle of 1934, which established the neutron mass at 1.0080 amu, and which, much to Chadwick's surprise, meant that the neutron no longer could be regarded as an electron-proton compound but had to be a new elementary particle which itself could decay by beta emission. Thus, Chadwick and Goldhaber's experiment (which, by the way, completely escaped MladjenoviY's attention) finally - and only in 1934 - undercut entirely any experimental basis for believing that electrons were present in nuclei, just as Fermi's theory of beta decay - also only in 1934 - undercut entirely any theoretical basis for this same long-standing view.

Regrettably, this is by no means the only instance where the author's organization has militated against treating the history of nuclear physics as an interplay of new instrumentation, experiment, and theory. Thus, his part 2 on nuclear instruments is filled with diagrams of instruments with little explanation of how they actually functioned, and few indications of the new experimental results obtained with them and their theoretical implications. We also learn very little about the political or institutional contexts in which any of this work took place (there is nothing on the intellectual migration of the 1930s, for example), or even, for the most part, the name of the city or university in which people lived and worked. An exception that proves the rule occurs in the author's discussion of a conference in Paris in 1954, which for the first time after the war was attended by three Soviet physicists, one of whom was L.A. Sliv. The author says that Sliv questioned, in Russian, an assertion by M.E. Rose that the nucleus could be considered as a point without internal structure, but even though some physicists tried to help with translation, no proper discussion of Sliv's objection occurred. MladjenoviY then comments: "From the human point of view, it was one of those situations that are not a subject for the history of science, which is limited to the growth of ideas" (p. 222). Not many people today take such a narrow view of the history of science.

Indeed, many of the shortcomings of this book can be traced to its author's unfamiliarity, as judged from his references, with the existing historical literature. Perhaps not so surprising is that he overlooked some of this literature that has been published in historical journals, but it is not so understandable that he apparently did not examine, for example, the books by Daniel J. Kevles, The Physicists (1978), Roger H. Stuewer, ed., Nuclear Physics in Retrospect (1979), Emilio Segr,, From X-Rays to Quarks (1980), Abraham Pais, Inward Bound (1986), Ruth Lewin Sime, Lise Meitner (1996), Laurie M. Brown, et al., ed., Twentieth Century Physics, 3 Vols. (1995), and Laurie M. Brown and Helmut Rechenberg, The Origin of the Concept of Nuclear Forces (1996), the last two of which were even put out by his own publisher, The Institute of Physics. These books, at the same time, are only a fraction of the published historical literature, which the author could have learned about, if nowhere else, from the American Institute of Physics Center for History of Physics. In any case, it would be tedious to dwell on the historical disagreements between these and other works and the one under review here.

Another unusual aspect of this book deserves comment, however. The author seems to be fond of second guessing the Nobel Prize committees in Stockholm. Thus, he remarks: "We know now that Fermi should have won his first Nobel prize for his theory of -disintegration" (p. 241). But that is not all: "The first nuclear reactor was conceived and built by Fermi at the University of Chicago. It was completed on 2 December 1942 (and that is the third Nobel prize that Fermi fully deserved)" (p. 254). The author also does not avoid hyperbole: "Bohr and Mottelson, the most efficient tandem in the history of physics, won the Nobel Prize in 1975" (p. 332). The hypothesis of spin dependence of nuclear forces was attributed by Feenberg and Knipp in 1935 to Wigner, "who could afford not to worry about priority and publishing. This is a mark of an exceptional scientist, who well deserved his Nobel Prize" (p. 376). (One wonders if even Wigner might not have been happy to learn in 1935 that he was going to win a Nobel Prize in 1963.) In one of his few negative appraisals, the author takes Bohr to task for arguing strongly against a single-particle or shell model in 1936, commenting: "This is a fundamental issue, and as we have seen, considering the nuclear models, Bohr was wrong. The lesson is that a scientist should not present new ideas in such an exclusive way, condemning without proof the opposite models" (p. 392). Finally, we all might agree that Bethe's bible of 1936-37 "represents the most remarkable monograph in the history of nuclear physics," while at the same time we might hesitate a bit to make the comparison that, "The way Bethe handles mathematical physics is similar to that of Newton and Euler" (p. 397). One wonders about the historical value of judgments such as these.

This book is handsomely produced, but not free of avoidable errors. I already have noted "Strassman" (without the second "n" and no Nobel Prize winner) and the more embarrassing "Young" instead of Yang. But I caught a number of additional errors in the text or index, and there may well be more. Here is my list, with the incorrect version in quotation marks followed by the correct one in parentheses: "Ajsenberg" and "Ajsenberg"-Selove (Ajzenberg), "Barshall" (Barschall), von "Bayer" (Baeyer), "F.F." (B.F.) Bayman, "Benszer" (Benczer), "S. Livingstone" (M.S. Livingston), "Lorenz" (Lorentz), "Idda" (Ida) Noddack, "Swan" (Swann), "Sharff" (Scharff)-Goldhaber, "Telegdy" (Telegdi), "Weil" (Weyl), "Wideroe" (Wider"e), "Yamanoushi" (Yamanouchi) - and even "Mladjenovi*" instead of MladjenoviY (p. 175). Since the name index evidently was computer- generated, most of these errors are reproduced there. Moreover, a spot check revealed that the pages given in the name index often do not correspond to the pages of the text itself.

In sum, a satisfactory, not yet definitive, history of nuclear physics from 1932 to the 1960s remains to be written.

Pythagoras' Trousers:God, Physics, and the Gender Wars

Margaret Wertheim, (W. W. Norton & Company, 1997). 288 pages, paperback, $13.95

Reviewed by Donavan Hall
National High Magnetic Field Laboratory

Margaret Wertheim quotes a feminist philosopher of science, Sandra Harding, in her introduction: "Women have been more systematically excluded from doing serious science than from performing any other social activity except, perhaps, front-line warfare." [p. 11] Throughout the rest of the book Wertheim fails to mention Harding, whose critique of science is the same as Wertheim's own. Harding says science is nothing but an outgrowth of Christianity and its Western, imperialist, oppressive hierarchy; the very nature of science is masculinist, she contends, and women must change the culture of science; women must feminize science. Such is the basic thesis of Pythagoras' Trousers. Christina Hoff Sommers, in her book Who Stole Feminism: How Women Have Betrayed Women, poses a question to Harding: "If science is Western and oppressive, then why are the Chinese and Japanese so good at it? Why did the Chinese student demonstrators in Tiananmen Square choose democracy and science as their way to freedom?" This question is never addressed in Wertheim's book.

Wertheim believes science, as it is practiced, is masculinist and, if not blatantly Christian, then it is at least quasi-religious. She holds that science must be feminized for two reasons: (1) the world picture presented by masculinist physics is untenable, and (2) the goals that follow from this world picture have "disturbing consequences for society at large." [p. 237] Wertheim's example that she says typifies these two reasons is the search for a unified field theory of natural forces: the so-called theory of everything (TOE). Wertheim says that it would be irresponsible to spend billions of dollars building massive accelerators that might prove a theory that is "unlikely to have any application to daily human life." [p. 238] So, for Wertheim, the justification of fundamental science is its ability to produce useful technology. She quotes Robert Wilson's justification for the SSC: It [the SSC] has only to do with the respect with which we regard one another, the dignity of man, our love of culture. It has to do with, are we good painters, good sculptors, good poets? I mean all the things we really venerate and honor in our country and are patriotic about. It has nothing to do with the defense of our nation, only to do with making it worth defending. [p. 239] Such justifications are too abstract, too masculinist, and quasi-religious for Wertheim who retorts: "No knowledge, for its own sake, is worth this price." [p. 239] Wertheim asserts that equitable representation of females in physics would tend to redirect the course of research away from a unified theory of everything. Women do not seek the sort of "transcendence" represented by unified field theory; women are more "grounded". [p. 240]

Wertheim refers several times to the "marginalization of women in physics." While it is true that few women have chosen careers in physics, I was left wondering who was doing the marginalizing? Wertheim blames no one in particular for the marginalization of women in physics, but rather she blames the entire culture of physics. She describes the reigning culture of physics as expressly masculine. She implies that the women who break into this culture and succeed must surrender (at least, in part) their femininity.

As a field experiment to test Wertheim's hypothesis, I asked my wife why she didn't choose to study physics (she opted for biology instead). Her reply was that she was more interested in living things and people. For her physics is the study of dead stuff. Wertheim would say that my wife stayed away from physics because its "antihuman focus" is "deeply alienating." She adds that many men also find this to be true, but one is left wondering if the men and women who become professional physicists have adapted to their environment by becoming anti-human themselves. I feel certain that Wertheim does not think this is necessarily true, but the question begs asking.

Wertheim urges physicists to direct their efforts to different goals and dreams. But what different goals and dreams? This question is left unanswered. She means that focusing on particles and forces contributes to the anti-human atmosphere in physics; perhaps her prescription would be that physicists should focus on humans and their interactions. But this can't be the case since there are perfectly well established sciences for such study: psychology, sociology, communications, etc. From what I have seen of these so-called sciences, they can be practiced in as much of an anti-human atmosphere as physics.

Wertheim claims that women will stimulate new science. Her example is Nobelist Barbara McClintock's idea of the dynamic genome-"jumping" genes. McClintock is described as "eschewing the officially sanctioned methodology of science" [p. 244] in order to make her breakthrough. Wertheim makes a big deal about McClintock's description of her insight as akin to "listening" to her corn plants. Wertheim's source for the interpretation of McClintock's discovery is feminist philosopher Evelyn Fox Keller. McClintock herself has denied that Evelyn Fox Keller's account of her discovery is anything close to the truth. According to McClintock, scientific insight transcends gender and race. McClintock evidently is an unwilling poster child for the gender feminist cause.

Finally, Wertheim calls for "affirmative action" [p. 245] to encourage more women to enter physics. She comes very close to suggesting transformation of the science curriculum to make it more gender neutral, or more feminist friendly. Women cannot be assimilated into the present culture of physics; so the method for effecting change will be through education reform. While Wertheim did not come right out and spell out what a transformed science curriculum would look like, we should be cautious about such efforts since they have generally led to a lowering of the standards of education for women, ultimately hurting them more than helping them. (Anyone interested in a defense of this thesis should read Christina Hoff Sommers' book mentioned above.)

Wertheim succeeds in popularizing the gender feminist critique of science. In doing this she tempers the typical gender feminist rhetoric and presents a sympathetic case for making physics more feminine. Unfortunately, Wertheim does not address all the questions she raises in the book. Where she succeeds in being entertaining; she fails in completeness.

Reports

Centennial Symposium: 20th Century Developments in Instrumentation and Measurements, Atlanta Centennial APS Meeting 21 March 1999

(Report by Bill Evenson, BYU, session chair)

This symposium was organized by Lawrence G. Rubin (MIT) on behalf of the Topical Group on Instrument and Measurement Science, with joint sponsorship by FHP and chaired by Bill Evenson (BYU). More than 500 people attended. Arden L. Bement (Purdue) began by addressing "Status of Electrical and Magnetic Instruments as of the Turn of the Century." He outlined the significant developments in electrical and magnetic instrumentation during the last decades of the 19th Century, based on the book The Story of Electrical and Magnetic Measurements: From 500 BC to the 1940s by Joseph F. Keithley, founder of Keithley Instruments, Inc.

By 1890, the mathematics of electromagnetic radiation had been formulated by Maxwell; however, the foundations of electrodynamics and magnetism were still evolving. Instruments prior to that time were hand crafted by artisan- entrepreneurs and were limited in their use to a small fraternity of experimenters. The principal developments that set the stage for early 20th century instrumentation advancements were primarily fourfold: (1) an improved mathematical and physical foundation for electrical and magnetic phenomena, (2) improvements in the sensitivity of galvanometers and electrometers, (3) the establishment of a successful electrical instrument manufacturing industry, and (4) the birth and rapid growth of the electric power, telegraph, telephone and radio industries.

Bement explained the early hypotheses and misconceptions that initially limited the development of electrical and magnetic instruments, including fluid theories of electricity, separate theories of electricity and magnetism, the idea that there were different forms of electricity (electrostatic or atmospheric, voltaic or wet, animal or galvano), and aether theories. Early 19th century instruments, primarily electroscopes and electrometers, were primitive and unreliable, one of a kind, without common standards or units. Measurements were therefore tedious and difficult to compare and reproduce. Improvements in instrumentation were stimulated by major discoveries such as the thermopile, giving a voltage standard, the emergence of physical theories and invention and industrial development, including such innovations as the telegraph, transatlantic cable, electric lighting, and the mirror galvanometer.

Alan Bagley (Hewlett-Packard, Retired) then discussed "Electronic Instruments During the Past 60 Years." He also focused on measuring instruments, reviewing the many revolutions of electronic technology since the late 1930s. Bagley began with a slide showing a page from David Packard's lab notebook, dated May 5, 1939. Packard was calibrating a Marine Band Harmonica using an audio oscillator recently invented by Bill Hewlett. The business had just been started up in a residential garage. The measurement technique was not at all automatic, rather it was "zeroing out a difference," which had been used for more than a century in the Wheatstone bridge.

Electronic instruments advanced very rapidly from that point in subsequent decades. Bagley reviewed the development of oscilloscopes, signal generators, spectrum analyzers, frequency counters and related instruments, including the increasing automation of electronic instruments from 1940 to the present. In the early 1950s the idea for plug-ins came during the development of an HP frequency counter. The development of measuring instruments has sometimes followed advances in technology, and sometimes led them.

Precision that used to be expressed in percent is now casually referred to in parts per million or billion, and standards for physical units have been improved: a particular resonance of cesium is now our standard of frequency and time, replacing the period of the earth's rotation. In the most precise measurements, relativistic effects are taken into account. In display devices, galvanometers have been replaced by digital readouts for more accurate quantitative data, then revived again when easier interpretation is desired. The champion of qualitative display is the cathode-ray tube, showing us a picture of "what's going on" in the time domain, frequency domain, and data domain. Bagley reviewed progress in the resulting oscilloscope, spectrum analyzer, and logic analyzer. Instruments have moved from the audio frequency range through microwave to optical frequencies. In signal sources, oscillators led to signal generators and synthesizers, then on to tunable lasers. Internal computation has radically improved the speed, accuracy, and versatility of many instruments. Most are made ready for remote computer control, so complex problems can be solved by automated systems. Component measurements have progressed from the simple Wheatstone bridge to microwave bridges, 8-digit multimeters, curve tracers, network analyzers, and million-dollar integrated- circuit testers.

The third talk, "The Birth of the Integrated Circuit," was presented by Gordon Moore (Intel Corporation). Moore reviewed the development of integrated circuits from wafers of transistors in about 1957, Kilby's first IC in 1958, the first planar transistor in 1959, to the first planar integrated circuit in 1961. He discussed the building of ICs through epitaxial isolation and the development of buried-layer isolation technology (1963). He reviewed other developments in technology, such as MOS and CMOS technologies and their contributions to the IC. "Moore's law" began from the observation he made in an article in the late 1960s that the number of components per integrated function for minimum cost per component was growing exponentially in time with a doubling time of about 12 months. Moore reviewed the growth of IC complexity up to the present in memory and microprocessor IC chips, both of which continue to grow exponentially. Minimum feature size on ICs has decreased exponentially since the early 1960s, so that the "lithography gap," the difference between projected or desired feature size and the size attainable by current lithography technology, is growing, as projected into the next ten years. He therefore reviewed initiatives being undertaken to close the gap along with some of the latest developments in IC technology.

Finally, he showed that nearly every measure of development in the semiconductor industry changes exponentially: worldwide semiconductor revenues, transistors shipped per year, and average transistor price.

"NIST at 98 - A Retrospective"

"NIST at 98 - A Retrospective" by Ralph P. Hudson (NBS (Retired) and NIST Guest Worker) reviewed the contributions of an important government organization for instruments and measurements and its influence on the wider development of science and industry. Over a span of 200 years the U.S. has advanced from a condition of minimal domestic industry to that of the world's dominant economic power. In the last 100 years, U.S. physics has grown from a tiny activity to that of a major player on the world scene.

As industry (and life) have become more complex, science and technology have often played the part of catalyst for growth, and more and more frequently scientists have borrowed from industrial developments to make new and/or more rapid advances. But each of these partners and reciprocal benefactors has needed one common thread to make all this possible, and that is measurement science, commencing with the most primitive of weights-and-measures services to the States and Federal entities and culminating in the latter half of the present century in a give-and-take with modern physics. Indeed, in today's world, neither industry nor science can prosper without having a significant measurement capability (ranging from substantial to state-of-the-art) and each relies upon the "entire package" of metrology, viz., an international system of units, a hierarchy of measurement standards and calibration services, quality control and measurement-assurance practices, error analysis and a thorough understanding of instrumentation and "good practice."

NBS/NIST, through a wide variety of specialized programs, addresses these needs in a way that has steadily evolved over its lifetime from a state of near- anonymity to a wide general appreciation of its indispensability to the nation at large. In a selective overview of NBS/NIST that emphasized its work in Instrument and Measurement Science and closely-related activities, the speaker discussed the historical development of the institution as its employees have striven to fulfill its mission in an ever-changing world.

"A (Brief) History of (Physics) Laboratory Automation" by James R. Matey (Sarnoff Corporation) closed the session. Automation is the application of technology to reduce the need for human intervention in a process. Automation makes it possible for us to deal with data rates which are too fast for us to keep up; it makes it possible for us to deal with data rates which are too slow to keep our attention; and automation makes it possible for us to attend to other tasks, when the data collection is routine. Laboratory automation predates the electronic stored program computer by hundreds of years, but most laboratory automation today is by computers.

The drive to automation is motivated by such factors as decreasing costs, increasing quality of life (for the physicist or graduate student, for example), increasing safety, and improving the capability of a measurement. However, in general, laboratory automation is not a large enough market to drive either the initial development or to generate sufficient deployment to drive down the unit costs to the point where scientists can afford state-of-the-art automation. Military and commercial needs have therefore dominated the development of automation tools, such as the effect of the need to determine longitude on the development of time-keeping devices (automation of counting the ticks of a pendulum or other periodic apparatus).

The "hard automation" of clocks, potentiometers, strip chart recorders and x-y plotters, for example, is targeted at a specific task, with fixed internal workings. But over the past 15 years or so, hard automation has increasingly been replaced in the laboratory by the soft automation of programmable computers. Artillery targeting problems provided an important driving force for the development of the stored program computer. And, of course, during the computer mainframe era, computers were too expensive for laboratory automation. Mini-computers were introduced in 1960, and a laboratory instrumentation computer, LINC, was constructed in 1962 at MIT, under the direction of Wesley Clark, using PDP parts.

The development of standardized buses (backplanes) was also essential in increasing the versatility of the machines and providing economy of scale. The other essential development was higher-level programming languages so scientists could relatively easily configure computers to handle laboratory tasks. Standardized operating systems, relatively inexpensive program libraries, and "shrink wrap" applications for data analysis and presentation have significantly reduced the effort of using computers in the laboratory.

Finally, developments in instrumentation I/O have made their own contributions to laboratory automation. Matey judges the development of standards for I/O to be the most important development of the past 30 years. These standards include ASCII, HPIB/IEEE-488 and RS-232, Ethernet, ISA, PCI, and recently USB and FireWire. Standardization and large markets have developed together to make the current level of laboratory automation possible.

Once automation is sufficiently integrated into our instruments (clocks, for example), then it ceases to be regarded as automation, but is seen only as a standard piece of equipment. Some of what we use today in laboratory automation will still be used at the close of the next century, but it will not be regarded as automation by most scientists at that time.

Women and Men Inside the Atom: A Historical Look, Atlanta Centennial APS Meeting 22 March 1999

(Report by Bill Evenson, BYU)

This symposium was organized by the APS Committee on the Status of Women in Physics and cosponsored by FHP. The first talk was "Nobel Women in Physics," by Sharon Bertsch McGrayne. A summary of this talk by the speaker is printed below. McGrayne's presentation was followed by Elizabeth Baranger (U. of Pittsburgh), speaking on "Maria Goeppert-Mayer - Nuclear Physicist," reviewing Mayer's career and contributions along with personal recollections. Maurice Goldhaber (Brookhaven) then gave an interesting reminiscence, "A Student at the Cavendish Laboratory in the 1930s," followed by Alfred Scharff Goldhaber (Stony Brook) on "Gertrude Scharff Goldhaber: Her Life with Physics."

Nobel Women in Physics

by Sharon Bertsch McGrayne

The physics of radioactivity and later the nucleus was marked by important contributions from women, whose biographies cast light on the working conditions of women scientists during the first three-quarters of the twentieth century. Among the women who specialized in radioactivity early in the century were Marie Curie and Irene Joliot-Curie in Paris; Lise Meitner in Berlin; Ellen Gleditsch in Oslo; Elisabeth Rona and Berta Karlik in Vienna; and Marguerite Perey in Paris and Strasbourg. By mid-century, C. S. Wu, Maria Goeppert Mayer, Gertrude Goldhaber, and Rosalyn Yalow were studying the nucleus.

Access to an academic education was a European problem. Curie left Poland because the Russian Empire banned women from universities. Meitner's education was delayed nine years because Vienna ended academic education for girls at age 14. Meitner said these "lost years" handicapped her for life. Difficulties in getting an education also marked the career of Emmy Noether, who founded abstract algebra, helped Albert Einstein with the mathematical formulation of his general theory of relativity, and helped lay the foundation for quantum theory with the Noether Theorem. Noether taught at the University of G"ttingen under David Hilbert's name until Einstein and others secured her an unpaid, temporary position as an "unofficial, extraordinary professor." Physicist Hertha Sponer, later at Duke University, also had this title at G"ttingen.

In the United States, women could get educations but not jobs. State anti- nepotism laws and university rules prohibited universities from hiring relatives of employees. These rules were devastating for women scientists. Many were married to scientists; even today, almost three out of four married women physicists in the United States is married to another scientist, almost half to other physicists. Exceptions were made for male relatives but seldom for wives. In effect, these rules dictated whether a woman could marry and bear children. By remaining single, some women taught in women's colleges or coeducational state institutions. After marrying research scientists, many other women volunteered in their husbands' laboratories. Anti-nepotism rules, begun during the 1920s, were not repealed until Congress passed the Federal Equal Employment Opportunity Act of 1972.

Maria Goeppert Mayer, who won a Nobel Prize for the nuclear shell model in 1963, experienced both types of discrimination. G"ttingen had two academic high schools for boys but none for girls, so suffragettes prepared her for university entrance examinations. After marrying an American chemist, Mayer worked 30 years without university pay at Johns Hopkins, Columbia, and the University of Chicago.

In 1941, Rosalyn Yalow became the first woman physics graduate student at the University of Illinois since the First World War. Nepotism rules delayed her marriage to another physics student. Unable to get a job in nuclear physics, she worked in a Veterans Administration Hospital where she won a Nobel Prize in medicine in 1977.

Among the factors helping these women were the first women's movement, religious backgrounds that stressed education, support from husbands and male mentors, and a passionate love for scientific discovery. [Further reading: Sharon Bertsch McGrayne, Nobel Prize Women in Science: Their Lives, Sturggles, and Momentous Discoveries; and Margaret W. Rossiter, Women Scientists In America, vols. 1 and 2.]

Centennial Symposium: Physics in the 20th Century: World War II, Accelerators and the Rise of High Energy Physics, Atlanta Centennial APS Meeting 23 March 1999

(Report by Michael Riordan, SLAC, session chair)

More than 500 people attended this Forum-sponsored session. It was impressive and hugely satisfying to see such a large turnout. The speakers - Wolfgang K. H. ("Pief") Panofsky, Peter Galison, and Steven Weinberg - responded with articulate, thought-provoking presentations on particle physics in the postwar era, as witnessed from three widely differing perspectives. Unfortunately, the fourth speaker planned, historian Robert Seidel of the University of Minnesota, fell ill just prior to the meeting and was unable to deliver his paper on the contributions of physicists in World War II. The three speakers present therefore had extra time to elaborate on their subjects, which they used to excellent advantage, and there was also plenty of time available for questions.

Pief Panofsky, Director Emeritus of the Stanford Linear Accelerator Center, opened this Tuesday afternoon session with his paper about "The Evolution of Particle Accelerators and Colliders," a technological survey of the machines that have made high-energy physics a thriving industry in the latter half of the century. After a few introductory words on the electrostatic devices and cyclotrons of the pre-war decade, he launched into the core of his talk, declaring that advances and discoveries in accelerator technology have permitted a steady exponential increase in particle energies. Phase stability, strong focusing, and superconductivity are three technologies that Panofsky singled out for special mention. Since the postwar years, particle energies (in the lab frame) have increased by four orders of magnitude, from hundreds of MeV to the TeV protons supplied by the Fermilab Tevatron. But, he noted, the luminosities (or event rates) of these machines, especially colliding-beam machines or "colliders," have not quite kept pace - given the fact that the cross sections for interesting processes fall as the square of the energy.

Pief concluded his talk with some observations about the "uncertain future" of accelerators and colliders after the collapse of the SSC, with the Large Hadron Collider about to be built at CERN and a TeV-scale linear electron-positron collider high on the list of options for the next multibillion-dollar project. Harvard University Professor Peter Galison, Chairman of its History of Science Department, followed with a paper entitled "Writing the History of the Present: Authorship, Simulation, Realignment." In the first part of this three-part talk, he discussed the growing ambiguity of what it means to be an author of a scientific publication as the scale of particle-physics experiments has swollen to the point where hundreds of physicists (and even engineers) now contribute. This question is especially pertinent due to a "fundamental shift" that occurred in the 1970s transition from fixed-target to colliding-beam experimentation. The lengthy rosters of names on particle-physics papers give physicists in other fields the impression that individuality is submerged in this field.

Another trend Galison discerned in post-war physics is the growing reliance on computer simulations, which originated with the work of John Von Neumann and Stanislaw Ulam on the hydrogen bomb. In high-energy physics and many other fields, he noted, simulations are now "indispensable to the mediation between experiment and theory."

Finally, the success of the Standard Model of particle physics has apparently spawned a "theoretical realignment" in which theory is no longer the handmaiden of experiment, explaining observations and predicting as-yet undiscovered phenomena. Superstring theorists have turned to a new "experimental community" of abstract mathematicians, who provide them with useful information about the structures they study.

In all these areas - authorship, simulation, and theory realignment - we face "fundamental questions about what it means to be a physicist," said Galison. "There are enormous technical-scientific gains to be realized, but at the same time each carries difficulties with which we are just beginning to grapple." Nobel laureate Steven Weinberg of the University of Texas rounded out the session with a talk entitled "Changing Views of Symmetries and Infinities." He discussed the role of symmetry and broken symmetry - especially the widespread belief that Nature is fundamentally symmetrical at its deepest levels - in the physical thought of the century. This theoretical style, which became dominant in the postwar era, owes its origins and much of its popularity to Albert Einstein, he said, who essentially postulated an invariant value for the speed of light in all inertial reference frames.

Broken symmetry became the vogue in the 1950s and 1960s with the importation of ideas from condensed-matter physics into particle physics by theorists such as Jeffrey Goldstone and Yoichiro Nambu. Even then, Weinberg noted, John Bardeen, Leon Cooper and Robert Schrieffer did not recognize their theory of superconductivity as an example of a broken symmetry; to them it was just a dynamical theory of electron pairs. And there was much confusion in the 1960s between broken symmetries and "approximate symmetries," such as Murray Gell- Mann's and Yuval Ne'eman's SU(3) symmetry.

The Standard Model - today's dominant theory of particle physics, based on quarks and leptons interacting via gauge bosons - is an example of a broken symmetry. But as an "effective field theory," it describes physics at a very low energy scale, compared to that of a truly fundamental theory of elementary entities. Therefore it cannot be the all-encompassing "final theory" that physicists are seeking as this remarkable century ends.

Taken together, Panofsky, Galison and Weinberg thus painted a richly hued, multifaceted portrait of a physics subfield that has grown from brash adolescence to restive maturity in the latter half of the twentieth century. And all of them speculated about routes its practitioners might be taking to break out of the intellectual torpor of its final decade.

I.I. Rabi: Physicist and Citizen, Atlanta Centennial APS Meeting 24 March 1999.

(Report by Bill Evenson, BYU)

This session on the work of I.I. Rabi was organized and chaired by John Rigden (AIP) and sponsored by FHP. A capacity crowd attended. The session began with Norman Ramsey (Harvard) speaking about "Early Magnetic Resonance." (A summary provided by the speaker is printed below.) Then Dudley Herschbach (Harvard) spoke on the subject, "Molecular Beams: Legacy of Stern and Rabi." He pointed out that both Otto Stern and I.I. Rabi, the patriarchs of molecular beams, began their scientific careers as chemists. Herschbach traced "aspects of their cornucopian legacy from which have sprouted major realms of modern chemistry. The legacy includes not only techniques that became pervasive features of molecular state-selection and deflection, resonance spectroscopy, photochemistry, and collision experiments, but a passion for defining incisive questions likely to open up new frontiers."

"Rabi and the Great Tradition" was the title of Daniel Kleppner's talk. Kleppner (MIT) argued that "Rabi was a champion of physics' great tradition of driving forward the frontiers of knowledge by creating revolutionary experimental techniques. His invention of molecular beam magnetic resonance led to experiments on hydrogen and other atoms that pointed the way to the creation of quantum electrodynamics and opened a new world of atomic and molecular physics. His style and influence continue to animate today's field of high precision measurements, where his concepts and techniques have been translated to the optical regime. Notwithstanding the enormous technical advances since his early work, his memorable question to graduate students continues to deserve consideration: 'Why are YOU measuring THAT!' "

The fourth talk in this session was by Martin Perl (SLAC, Stanford), on "The Paradox of Isidor Rabi and High Energy Physics." Perl's summary of this talk is printed below.

Gerald Holton (Harvard) then spoke about "Rabi as Educator and Science Warrior." Holton pointed out that "in addition to his accomplishments in science and science policy, I.I. Rabi dedicated himself seriously to the improvement of science education at all levels. Also, he championed the view that science be considered at 'The Center of Culture.' On both these fronts, Rabi's lessons are still fully applicable today." As an educator, Rabi excelled in inspiring his students. He read widely, and this gave him unusual perspective from which he approached problems of science.

He determined to "put an end to the second-class status of American physics," and he did so by infusing the work of all those he influenced with energy and vision. "Rabi was particularly effective in conveying to his students and coworkers a sense of experimental elegance and the criteria for the choice of a research subject."

After World War II, Rabi got very involved in civic issues as a scientist. "He became one of the most effective statesmen of science that America has had." He had a deep and "passionate commitment to safeguarding a rightful place for science as a necessary and liberating aspect of the total culture of our time." His main points were "(1) Science can act as a unifying force for all humanity, . . . (2) Science can act as a personally ennobling activity, . . . (3) Scientists have to defend themselves against enemies who fail to see it as part of one unified culture. . . . (4) Science teaches how to think objectively, rationally, and therefore productively for solving the real-world problems in society, and especially in a democracy. . . . (5) Finally, science can be a good preparation for a useful life outside science." Holton closed by noting that Rabi's model was Benjamin Franklin - "the figure in American history most worthy of emulation. ... Franklin is my ideal of a whole man."

Finally, an outstanding session was brought to a wonderful conclusion by Hans Bethe (Cornell) with a talk entitled, "Behind the Scenes." Bethe reviewed the wide variety of Rabi's contributions, noting that "before the war his work included measurements of the quadrupole moment of the deuteron. This work was also the basis of the experiements by Lamb and by Kusch, fundamental for modern field theory. During the war, Rabi was associate Director of the MIT Radiations Lab which developed radar. He advised Oppenheimer that the Los Alamos Lab should not be military. He was instrumental in the founding of the President's Science Advisory Committee. He helped President Eisenhower to start the International Atomic Energy Agency."

Early Magnetic Resonance

by Norman Ramsey (Harvard)

To account for spin reorientation transitions when molecules pass through successive magnetic fields pointing in different directions, Rabi in 1937 published his great theoretical paper "Space Quantization in a Gyrating Magnetic Field," which became the fundamental theory for all subsequent magnetic resonance experiments. However, it was six months before Rabi invented the molecular beam magnetic resonance mathod, after C. J. Gorter visited the lab and described his published but unsuccessful attempt to observe resonant heating of a macroscopic sample at the frequency of the nuclear precession. The first successful magnetic resonance experiments were by Rabi, Millman, Kusch and Zacharias in 1938 on a beam of LiCl. These were soon followed by the experiments of Kellogg, Rabi, Ramsey and Zacharias on H2, D2, and HD, which, for the first time, provided a multiple line radiofrequency spectrum, showed the existence of the deuteron quadrupole moment and the nucleon tensor force. These experiments led to many subsequent radiofrequency spectroscopy studies. Soon the resonance method was extended to electric resonance and to atoms, including some resonances suitable for atomic clocks.

In 1942 Gorter unsuccessfully attempted to detect nuclear magnetic resonance in dense matter by resonant pulling of an oscillator near the nuclear Larmor frequency. Between 1941 and 1945 most research in the magnetic resonance field was interrupted by World War II. In 1946

Purcell, Pound and Torrey and independently Block, Hansen and Packard observed nuclear magnetic resonance absorption and induction in dense matter (NMR) which proved later to have many applications, especially in chemistry, biology and medicine.

In 1947 Nafe, Nelson and Rabi, with the atomic beam resonance method, discovered that the hyperfine separation in atomic hydrogen was different from the theoretical prediction. In the same year Lamb and Retherford discovered the Lamb shift, a large difference from the theory of the atomic hydrogen fine structure. The Lamb shift stimulated the development of a non-relativistic quantum electrodynamics (QED), while the hyperfine shift stimulated Schwinger's development of a relativistic QED, which later became the model for other quantum field theories.Subsequent to these early magnetic resonance experiments, the magnetic resonance methods spread to many laboratories throughout the world and were modified and extended for a wide variety of purposes.

The Paradox of Isidore Rabi and High Energy Physics

by Martin L. Perl (SLAC, Stanford)

Isidore Rabi is usually given much credit for the existence of two of the world's major high energy physics laboratories, the Brookhaven National Laboratory (BNL) in the United States and the laboratory of the European Organization For Nuclear Research (CERN) in Switzerland. The credit is certainly well deserved in the case of BNL because Rabi was a leader in the formation in 1947 of BNL by nine East Coast universities (1), and he had a great deal of influence in the early days of BNL. In the case of CERN, there is some credit due to Rabi (2), but his contribution is somewhat of a legend, particularly on the American side of the Atlantic Ocean.

There is a paradox in this because Isidore Rabi was the most individual of scientists in a small science field - atomic and molecular beams. When I carried out my graduate research under Rabi, our group consisted of myself, another graduate student, Benjamin Senitzky, and Rabi. Occasionally Benjamin and I went to Polykarp Kusch for technical advice. But, paradoxically, Rabi, through his contributions to the formation of the Brookhaven National Laboratory and CERN, helped to set the style of big science, high energy physics with its enormous research groups and its emphasis on group decisions and group cooperation. A young Rabi would not succeed in high energy physics.

There is a deeper paradox in that Rabi knew little about the details of elementary particle theory and practice, yet he had deep intuition about fruitful directions for elementary particle research. Thus although my thesis was in atomic beams, in 1955 Rabi urged me to go into bubble chamber physics. I'm not sure he knew or cared how a bubble chamber worked, but he knew it was the right direction. More generally, quoting Rigden (1), .Rabi never used an accelerator in his own research.(but) he strongly believed that, from a study of the behavior of elementary particles at the high energies made possible by accelerators, a more profound view of matter and antimatter would emerge.

In this talk I begin with the theme of Rabi's organizational contributions to high energy physics. I then build on this theme, using my own journey from atomic physics to a Nobel Prize in high energy physics to contrast the scientific and sociological style differences in those areas of physics. 1. J. S. Rigden, Rabi (Basic Books, New York, 1987) 2.A. Hermann, J. Krige, U. Mersits, D. Pestre, and L. Belloni, History of CERN, Vol. I (North-Holland, Amsterdam, 1987

Centennial Symposium: Physics in the 20th Century: The Revolution: Quantum Mechanics and

Relativity, Atlanta Centennial APS Meeting 24 March 1999

(Report by Ruth Howes, Ball State, session chair)

This Centennial Symposium was part of the Forum on History of Physics' contribution to the enormously successful APS Centennial Celebration held last spring in Atlanta, Georgia. Attendance at this symposium alone was several hundred people. The symposium consisted of four talks: one on Einstein, one on quantum mechanics, one on hydrogen as the source of much new physics, and the last on the development of condensed matter physics.

John D. Norton of the University of Pittsburgh described Albert Einstein's changing attitude towards the role of mathematics in developing physical theories in his talk, "Einstein and the Canon of the Mathematically Simple." (See the speaker's fuller summary below.) In his early career, Einstein sought to devise theories directly from physical reasoning, ignoring considerations of mathematical simplicity or aesthetics. In his later writings, he stated explicitly that the laws of nature could be uncovered by means of pure mathematics. Norton described Einstein's 1913 formulation of general relativity based on a mixture of physical and mathematical reasoning. Too great a dependence on physical reasoning led to a version of the theory which lacked generally covariant field equations and even assured that a generally covariant theory would be indeterministic. Two years later, when competing with Hilbert to formulate the theory of general relativity, Einstein relied strictly on mathematics.

David Cassidy of Hofstra University spoke on "Quantum Mechanics: Origins and Development." He described the development of non-relativistic quantum mechanics and its acceptance in the early 1930s. Cassidy focused on the interplay of theory and experiment during six phases of the development. (See the speaker's summary below.) Cassidy pointed out that the widespread acceptance of quantum mechanics and its interpretation occurred during the next few years through a variety of circumstances, including both its success as a physical theory and the developing prestige of and publicizing by its founders.

"Hydrogen: The Atom of the 20th Century" was the title of the third talk, given by John S. Rigden (AIP). Rigden pointed out that "since the beginning of the 20th century, the hydrogen atom has commanded the attention of physicists. This fascination arises because of the inherent simplicity of the hydrogen atom and the deuteron which make them ideal targets for testing atomic and nuclear models as well as new theoretical ideas. The simple hydrogen atom has challenged and humbled physicists; it has surprised and guided physicists. Throughout the century, physicists have delightfully heeded the siren call of the hydrogen atom, and today, as the next century dawns, the little atom still beckons." Lillian Hoddeson of the University of Illinois, Champagne-Urbana presented the final talk in the symposium, "The Big Band Era." Hoddeson's talk focused on the development of the band theory and its use to explain electronic transport and the optical properties of solids in the period 1926-1933. The development began with Wolfgang Pauli's pioneering application of Fermi-Dirac statistics to modeling the weak paramagnetism of metals. Sommerfeld extended Pauli's work to a variety of transport properties of metals in 1927. In 1928, Felix Bloch published his thesis on the quantum mechanics of electrons in crystals which Rudolf Peierls used to explain the Hall effect, introducing the notion of a filled band. In 1929, Peierls developed a theory of electrical and thermal conductivity. By 1930, Leon Brillouin had introduced the concepts of band gaps and Brillouin zones, and Alan Wilson's 1931 papers on semiconductors completed the explosive growth in the understanding of solids using the new quantum mechanics.

The Centennial Symposium painted a picture of a time when our understanding of the physical world literally exploded, thanks to the introduction of quantum mechanics. From Norton's description of the new ways of thinking about physics, through Cassidy's tracing of the development of its basic structure and interpretation, and Rigden's reminder of the central role of hydrogen in the development of our understanding, culminating in Hoddeson's portrait of perhaps the most contemporary application of quantum mechanics, the speakers commented on how a major theory like quantum mechanics changes the mindset of the generation of scientists who develop and apply it. By 1930, these workers had laid the basic structures that would guide the development of physics throughout the major part of the twentieth century.

Einstein and the Canon of the Mathematically Simple

by John D. Norton (Pitt)

"Our experience hitherto," Albert Einstein wrote for the Herbert Spencer lecture at Oxford in 1933, "justifies us in believing that nature is the realization of the simplest conceivable mathematical ideas. I am convinced that we can discover by means of purely mathematical constructions the concepts and laws connecting them with each other, which furnish the key to the understanding of natural phenomena.... In a certain sense, therefore, I hold it true that pure thought can grasp reality, as the ancients dreamed."

This powerful manifesto, written later in his life, stands in direct contradiction with Einstein's earlier attitude to mathematics. He had then sought to devise his theories directly from physical reasoning, ignoring considerations of mathematical simplicity or aesthetics. Indeed, he frequently disparaged that latter, calling it "superfluous learnedness" and "pure luxury." What changed Einstein's mind was largely his experience with general relativity. In devising the theory, he had consciously alternated between physical reasoning and inferences based on mathematical naturalness. In heeding the physical reasoning more, he temporarily decided in 1913 in favor of a disastrous version of the theory that lacked generally covariant field equations. The physical reasoning had even assured him that a generally covariant theory would be indeterministic. Over two years later, Einstein found himself in a race with Hilbert to perfect the formulation of the theory. Now aware that his physical reasoning had misled him and with disaster threatening his misshapen theory, a desperate Einstein threw himself at the mercy of the mathematics and quickly found the generally covariant gravitational field equations that now bear his name.

This close call was a lesson he never forgot. While he always maintained that any theory must stand the test of experience, he now concluded, as he recalled in his later Autobiographical Notes, that "...equations of such complexity as are the equations of the gravitational field can be found only through the discovery of a logically simple mathematical condition that determines the equations completely or almost completely."

Quantum Mechanics: Origins and Development

by David Cassidy (Hofstra)

The presentation focused on the development of non-relativistic quantum mechanics and its acceptance through the early 1930s. In order to encompass the many outstanding discoveries, people, applications, and debates that occurred during this period, I divided the history rather crudely into six phases: discovery of the quantum, 1900-1911; semi-classical atomic models, 1912-1922; darkness before dawn, 1922-1925; quantum mechanics, 1925-1927; interpretation, 1926-1927; and triumph, 1926-1933. I noted how, in each phase, experimental and theoretical work went hand-in-hand. While this leaves out most of the cultural and institutional dimensions to the story, it does enable a brief, 30-minute overview of the formulation and triumph of quantum mechanics - an overview attained only because (borrowing from Newton) we all stand on the shoulders of giants in the history of quantum physics.

While Einstein's discoveries dominated developments during the first phase, which culminated in the Solvay Congress of 1911, the Bohr and Sommerfeld quantum models of the atom provided the foundation of the "old quantum theory" during the second phase. However, by 1924 these and many newcomers to the field had shown that the old quantum theory definitely failed in three major areas: atomic spectroscopy, atomic and molecular models, and the wave-particle dualism for light. The breakthrough to quantum mechanics arrived surprising rapidly in the period 1925 to 1927, but at first in two seemingly incompatible forms: wave mechanics and matrix mechanics. The equivalence of these two forms and the unification of their formalisms, achieved by 1927, set the stage for the Copenhagen Interpretation of the new formalism. On the basis of the new formalism and their interpretation of it, the Copenhagenites proclaimed to the Solvay Congress of 1927 that quantum mechanics is a complete theory and "not further susceptible of modifications." The widespread acceptance of quantum mechanics and its interpretation occurred during the next few years through a variety of circumstances: its many successful applications and extensions; the establishment of its proponents at major universities; their world-wide lecture tours, especially throughout the U.S.; and the Nobel-prize awards in 1933 to three of the founders of quantum mechanics.

The Seven Pines Symposium

by Roger H. Stuewer (Minnesota)

The Seven Pines Symposium is dedicated to bringing historians, philosophers, and physicists together for several days in a collaborative effort to probe and clarify significant foundational issues in physics, as they have arisen in the past and continue to challenge our understanding today.

The symposium takes its name from Seven Pines Lodge, located near Lewis, Wisconsin, which was built in 1903 as a trout-fishing camp and since 1978 has been on the National Register of Historic Sites. In the past, President Calvin Coolidge and other notables vacationed there. Today, its idyllic setting and superb cuisine make it an ideal location for small informal meetings. The third annual Seven Pines Symposium was held from May 5-9, 1999, on the subject, "The Field Concept in Physics." Twenty-seven historians, philosophers, and physicists were invited to participate in it.

Each day four speakers set the stage for discussion by addressing major aspects of the field concept in physics. Ernan McMullin (Notre Dame) and Friedrich Steinle (G"ttingen) spoke on "The Origins of the Field Concept." Daniel M. Siegel (Wisconsin) and Jed Z. Buchwald (MIT) spoke on "The Physical Reality of the Field." James T. Cushing (Notre Dame) spoke on the "The Historical Development of Quantum Field Theory." Serge Rudaz (Minnesota) spoke on "The Need for a Field Theory." Jeremy N. Butterfield (Oxford) and Gordon N. Fleming (Pennsylvania State) spoke on "Conceptual Issues in Quantum Field Theory." Robert M. Wald (Chicago) and John Earman (Pittsburgh) spoke on "Quantum Field Theory in Curved Spacetime." Roberto Torretti (Chile) spoke on "Why Gravity Should be Thought of as Curved Spacetime." Robert P. Geroch (Chicago) spoke on "Unsolved Problems in Classical General Relativity." A closing roundtable discussion was chaired by Roger H. Stuewer (Minnesota). Unlike the typical conference, twice as much time was devoted to discussions following the talks as to the talks themselves, and long mid-day breaks permitted small groups to assemble at will. As preparation for the talks and discussions, the speakers prepared summarizing statements and selected appropriate background reading materials, which were distributed in advance to all of the participants. Lee Gohlike, the founder of the Seven Pines Symposium, has had a life-long interest in the history and philosophy of physics, which he has furthered through graduate studies at the Universities of Minnesota and Chicago. To plan the symposia, which will be held annually, he established an advisory board consisting of Roger H. Stuewer (Minnesota), Chair, Jed Z. Buchwald (MIT), John Earman (Pittsburgh), Geoffrey Hellman (Minnesota), Erwin N. Hiebert (Harvard), Don Howard (Notre Dame), and Alan E. Shapiro (Minnesota). Also participating in the third annual Seven Pines Symposium were Moritz Epple (Mainz), Joseph D. Harris (Dartmouth), Anne J. Kox (Amsterdam), Alberto A. Martinez (Minnesota), John D. Norton (Pittsburgh), Goran Prstic (Minnesota), Robert D. Purrington (Tulane), Jos, M. Sanchez-Ron (Madrid), and Paul Teller (UC Davis).

The fourth annual Seven Pines Symposium will be held from May 10-14, 2000, on the subject, "Issues in Modern Cosmology."

Forum News

Forum Officers

Allan D. Franklin, Department of Physics, University of Colorado (Allan.Franklin@ colorado.edu), became Chair in April 1999 at the end of Roger Stuewer's term. Laurie M. Brown, Department of Physics and Astronomy (emeritus), Northwestern University (brown@nuhep.phys.nwu.edu), became Chair-elect and will succeed to Chair in April 2000. Lillian Hoddeson, Department of History, University of Illinois (hoddeson@ uiuc.edu), was elected Vice-Chair and will succeed to Chair-Elect in April 2000.

A.P. French, Department of Physics, MIT (apfrench@mit.edu) and Michael Riordan, SLAC (michael@slac.stanford.edu), were elected to three-year terms on the Executive Committee. The remaining members of the Executive Committee are Dudley Herschbach, Department of Chemistry, Harvard University (herschbach@chemistry .harvard.edu), and Abner E. Shimony, Department of Physics, Boston University (shimony@bu.edu), whose terms expire April 2000; and Alanna Connors, Department of Physics, University of New Hampshire (aconnors@ christa.unh.edu), and Martin C. Gutzwiller, IBM Yorktown Heights (retired) (MoonGutz@ aol.com), whose terms expire April 2001.

Bill Evenson, Department of Physics and Astronomy, Brigham Young University (evenson@byu.edu), continues as Secretary-Treasurer until 2001; Gloria Lubkin, Physics Today (gbl2@aip.org), continues as Forum Councillor until 2002, and Spencer R. Weart, Director of the AIP Center for History of Physics (sweart@aip.org), continues to serve as Ex Officio member of the Executive Committee.

Many thanks to Roger H. Stuewer, School of Physics and Astronomy, University of Minnesota (rstuewer@physics.spa.umn.edu), for his good work as Chair during 1998-99, and C. Stewart Gillmor, Department of History, Wesleyan University (sgillmor@wesleyan.edu), for his continued help as Past Chair this year. Thanks also to Ruth H. Howes, Department of Physics and Astronomy, Ball State University (00rhhowes@ bsuvc.bsu.edu), and Bertram Schwarzschild, Physics Today (bschwarz@aip.org), for their help for the last three years on the Executive Committee.

Executive Committee

The annual meeting of the Executive Committee was held on March 22, 1999, in conjunction with the Atlanta APS Centennial Meeting. It was chaired by Roger Stuewer. Stuewer thanked the many Forum members who helped with FHP projects this year, especially with the many activities connected with the Centennial. About twice the number of FHP members participated in this year's elections compared to the recent past; this was attributed to email encouragement to vote that was sent at about the same time as the ballots.

The Executive Committee unanimously approved the following resolution and transmitted it to APS Council: "The Executive Committee of the Forum on History of Physics heartily praises the History of the American Physical Society Exhibit displayed at the APS Centennial Meeting."

The possibility of an APS History of Physics Prize or Award was discussed. Incoming Chair Franklin appointed an Award Committee to consider this further and return recommendations.

Membership increased slightly during the past year (by 53 members).

Forum Committees

For 1999-2000, the standing committees of the Forum are:

Program Committee: Laurie Brown (chair), Allan Franklin, A.P. French, Michael Nauenberg

Nominating Committee: Dudley Herschbach (chair), Alanna Connors, Stewart Gillmor, Gloria Lubkin, Elizabeth Paris (APS)

Fellowship Committee: Lillian Hoddeson (chair), David Cassidy, Martin Gutzwiller, Roger Stuewer

Publications Committee: Bill Evenson (chair), Michael Riordan, Spencer Weart

Editorial Board: Bill Evenson (chair), Spencer Weart

Membership Committee: Bill Evenson (chair), Abner Shimony

Prize Committee: Laurie Brown (chair), Martin Gutzwiller, Michael Riordan, Abner Shimony

APS Meeting Sorting Committee Representative: Allan Franklin

APS Fellow Nominations

Lillian Hoddeson is chair of the Forum's Fellowship Committee for 1999-2000. Any Forum members who wish to nominate a candidate for Fellow in APS are invited to send her their suggestion(s), along with a c.v. and letter describing the candidate's achievements in history of physics. Mail suggestions to Prof. Lillian H. Hoddeson, Department of History, University of Illinois, 309 Gregory Hall, Urbana IL 61801, or email: hoddeson@uiuc.edu

Contributed Papers for the April 2000 Meeting

As Forum Chair Allan Franklin mentioned above, in addition to our usual symposia at the March and April meetings, we will have contributed paper sessions on the history of physics at the April meeting in Long Beach, California. The leadership of the APS has recognized that historical work does not fit conveniently into the 10-minute contributed paper format, and they have allowed us, as an experiment, to have 20-minute contributed papers. The deadline for submitting abstracts for our contributed paper sessions at the April meeting is January 7, 2000.

Guggenheim Fellow in Physics History

Michael Riordan, who joined the FHP Executive Committee this year, has been named a Guggenheim Fellow for his contributions to writing the history of the Superconducting Super Collider. From September 1999 to May 2000 he will be working in Washington, DC, directing a multi-institutional collaboration that includes Lillian Hoddeson. The group plans to publish its findings in a volume entitled "Tunnel Visions: The Rise and Fall of the Superconducting Super Collider." In addition to leading the group, Riordan will be researching and writing a chapter of the book, "The Politics of Big Science: Washington and the World, 1989-1993" during his Guggenheim year. Physicists, historians and others who have relevant insights, recollections or documents concerning the SSC should contact him at michael@slac.stanford.edu.