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HISTORY of Physics NEWSLETTER

Let's Tell the World About Physics Through History – Forum Chair

The end of 1999 was a good time for physics and its history. The selection of Albert Einstein as person of the century by *Time* magazine showed both the importance of science in our lives and the high regard in which science and scientists are held. It showed how far we have come in the public's estimation, but other aspects of the celebrations also showed how far we have to go. As part of the celebration I was interviewed on a local radio station about Einstein, using up eight minutes of my allotted fifteen minutes of fame. Although the interviewers clearly had great respect for Einstein and his achievements, they also had no real idea of what he had done. This further emphasized the need for material on physics and its history intended for the generally educated public.

One disquieting note, which lessened the euphoria, was the fact that in all of the programs, articles, and lists, there were very few other mentions of science. Quantum mechanics, the discovery of the double-helical structure of DNA, the polio vaccines of Salk and Sabin, and countless other significant achievements in science, take your pick, seemed conspicuously absent. We must do a better job of reaching the public.

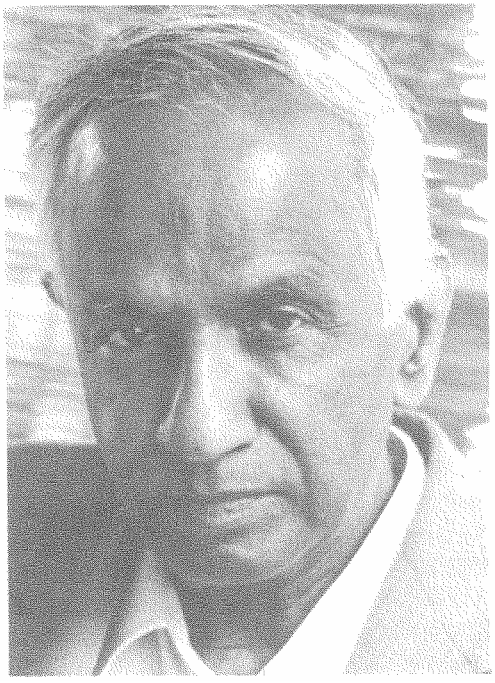

Photo by K.G. Sornsekhar, courtesy AIP Emilio Segrè Visual Archives, Physics Today Collection.

Subrahmanvan Chandrasekhar is the subject of the book, From White Dwarfs To Black Holes; the Legacy of S. Chandrasekhar *(G. Srinivasan, ed.), reviewed by K. C. Wali in this issue. Chandrasekhar's profound influence on physics in the 20th century has been the subject of several historical studies since his death in 1995.*

On the brighter side there is the first contributed paper session ever sponsored by the Forum being held at the April APS meeting. This gives us a chance to present our work to our colleagues. I hope it will become a regular feature of these meetings. There is also the fact that our colleagues keep providing material for historians to work on. History of physics happens. We need to let others know about it.

-Allan Franklin, Forum Chair

FORUM ELECTIONS

The Ballot is on the back cover of this *Newsletter.* Please vote for Chair-Elect, Vice-Chair and two Members at Large of the Executive Committee. Vice-Chair Lillian Hoddeson has had to resign due to accident injuries from which she is recovering, so we must elect both a Chair-Elect and a Vice-Chair this year. We appreciate Lillian's help until she had to drop out and wish her well. She is recovering, and we hope she will be able to work with the Forum again in the future. **Ballots must be returned so they can be received by March 24** in order to notify winning candidates and invite them to the April Executive Committee meeting. Brief resumes and statements from the candidates are printed elsewhere in this *Newsletter.*

INSIDE

Letter to the Editor

Cold Fusion And The "Sokal Affair"

I would be far more cautious than Allan D. Franklin (*Newsletter*, September 1999) in branding cold fusion as "bad" science. The search for possible mechanisms of low-energy chemically-induced nuclear transformations is not necessarily a pathological physics. As Arthur Clarke has recently predicted, Pons and Fleischmann may eventually be the only scientists ever to win both the Nobel and Ig Nobel Prizes (*Science*, 5 June 1998).

Likewise, I am not convinced that the "constructivist" controversy, which was partially (but not entirely) fueled by the "Sokal Affair," is receding. Problems addressed by the "cultural critics" are too serious to be dismissed by a hoax. Furthermore, despite Sokal's own revelations, I do not necessarily see his article as a spoof. After going through tons of second-hand sokaliana, I have reread recently his original *Social Text* article. And I like it. The article discusses alleged links between quantum gravity, chaos theory, holism, interconnectedness, cultural studies, etc. The article is well written and stuffed with extensive comments and bibliography. If I were to assess Sokal's paper for publication, I would likely view several bold assumptions that the paper contains as utterly speculative (*e.g.*, the claimed links between gravity and hypothetical Sheldrake's morphogenetic fields). Nevertheless, I still would consider them as relatively peripheral transgressions and perhaps even leave them "as is" in order to let the author argue his views in full. Most of what Sokal says about quantum nonlocalities, Planck-scale cosmology, catastrophe theory, etc. falls reasonably well within the range of the on-going debate in numerous "mainstream" papers.

His subsequent recants notwithstanding, his original article is an interesting, thought provoking and resourceful document. I think that it actually strengthens the postmodernist criticism, rather than weakens it. His article is far less of a parody than he himself later tried to present it.

-Alexander A. Berezin
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Allan Franklin Replies

Professor Berezin has conflated "bad" with "wrong." It may turn out that "cold fusion" is correct, although there is a considerable amount of evidence against it; that was not the point I was making. The early work of Fleischmann and Pons includes graphs in which the energy of the peak changes from paper to paper along with the number of events in that peak. That is "bad" science.

On the subject of Sokal, I leave it to the reader to judge whether Sokal was serious or not by reading his article in *Lingua Franca* revealing the hoax, or his later article in *A House Built on Sand*, edited by Noretta Koertge. Having read the original article myself, I take Sokal at his word that it was a hoax. Any article that claims, as Sokal's does, that, "It has become increasingly apparent that physical 'reality' no less than social 'reality' is at bottom a social and linguistic construct," or that "The pi of Euclid and the G of Newton, formerly thought to be constant and universal, are now perceived in their ineluctable historicity," cannot be taken totally seriously. I would, however, recommend that Forum members read Sokal for themselves.

- Allan Franklin

The *History of Physics Newsletter* is published by the Forum on History of Physics of the American Physical Society. It is distributed free to all members of the Forum. Others who wish to receive it should make a donation to the Forum of $5 per year (+$3 additional for air mail). Each volume consists of six issues.

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Editor's Note

It is evident from the wide variety of books, programs, web links, etc. that are listed in this *Newsletter* that there is a lot happening in history of physics. People are writing, opening new issues and reopening old ones, meeting and talking. I hope the *History of Physics Newsletter* can help spread the word when interesting work is done, alert the history of physics community to upcoming opportunities, help physicists interested in history who are not doing history of physics to maintain contact with some of the issues and people working in this area, and facilitate research contacts by spreading the word about who is doing what. **You can help:** right now, as you read this issue, write me a paragraph about your research in history of physics that I can include in the next issue; let me know what I am missing that should be included in the *Newsletter*; send me your suggestions and responses, including letters to the editor. I welcome reader participation; it will only make this *Newsletter* better.

-Bill Evenson, Editor

Forum News

Forum Program at March and April APS Meetings

At the APS March Meeting in Minneapolis, the Forum on History of Physics is sponsoring a symposium on "**Twenty Years of the Quantum Hall Effect**." The George Pake Prize talk will also be given in this session. The session will be held on Wednesday afternoon, March 22 at 2:30 and chaired by *Richard Prange* (University of Maryland). The complete program is "A Physicist's Journey In The Nuclear Power World," *Chauncey Starr* (Pake Prize Recipient, President Emeritus, Electric Power Research Institute), "Two-Dimensional Electron Systems," *Alan B. Fowler* (IBM Research Center, Yorktown Heights), "The Integer Quantum Hall Effect and Metrology," *Klaus von Klitzing* (Max-Planck-Institut FKF, Stuttgart, Germany), "The Fractional Quantum Hall Effect: More is Different," *Horst Stormer* (Columbia University and Lucent Technologies), "Aftermath of the Quantum Hall Discoveries," *Bertrand I. Halperin* (Physics Department, Harvard University).

At the April APS Meeting in Long Beach, the Forum is sponsoring its first ever contributed session as well as a symposium on "New Perspectives on the Development of Ancient Astronomy." Both sessions will be held on Monday, May 1, the contributed session 11 am -1 pm, and the invited symposium 2 - 4:15 pm. The theme of the contributed session is "History of 20th-Century Physics." The symposium on ancient astronomy was organized by Michael Nauenberg (U.C. Santa Cruz). The speakers include Owen Gingerich, George Saliba, an expert on Arabic astronomy, and Jim Evans, who recently published a book on the history of ancient astronomy.

New APS Fellows from the Forum

Congratulations to the following four members of the Forum on History of Physics who were recently elected Fellows of the American Physical Society. Their certificates will be presented at the Forum Business Meeting in Long Beach at the April APS meeting, on Monday, May 1, 2000.

- **Robert S. Cohen** of Boston University, "*For his scholarship and leadership in providing critical assessments of the advances made in modern physics and of the structure of the scientific community*."
- **Peter Louis Galison** of Harvard University "*For his numerous and valuable contributions to the history and theory of the working of modern, large-scale physics.*"
- **Michael Riordan** of Stanford Linear Accelerator Center "*For his contributions to particle physics, the history of particle physics and solid state physics and his outstanding science writing.*"
- **David P. Stern** of NASA/Goddard Space Flight Center "*For his stimulating efforts over many years to develop the history of physics, especially geomagnetism, space physics and geophysics and for his work in encouraging historical preservation and library conservation.*"

Other Recent Elections to APS Fellowship

Other Forum members elected Fellows of the American Physical Society in recent years include

- **James T. Cushing**, University of Notre Dame, 1998, "*For his deep analyses of the interpretation of quantum mechanics in an historical and philosophical context.*"
- **John S. Rigden**, American Institute of Physics, 1998, "*In recognition of his distinguished historical research, and his devotion to the advancement of physics through education, administration, and public service.*"
- **Abner Shimony** of Boston University, 1998, "*For his original contributions both to general questions in the philosophy of science, and to the analysis of nonlocality in quantum mechanics.*"
- **Silvan S. Schweber** of Brandeis University, 1997, "*For his deep analysis of the historical development of fundamental physics, particularly in this century, and its relation to the broader intellectual and social context.*"
- **Daniel M. Siegel**, University of Wisconsin, 1997, "*For his unique, detailed study of the nature and development of Maxwell's electromagnetic theory as a high point in nineteenth century physics.*"

Forum Business and Executive Committee Meetings

The annual Forum Business Meeting will be held on Monday, May 1, at 1:00 pm at the April APS meeting in Long Beach. All Forum members and other interested persons are invited to attend. The Forum Executive Committee will also meet at the April APS meeting, on Sunday, April 30. This meeting is for members of the Executive Committee and invited guests.

News Notes

Executive Editor Opening, Einstein Papers Project

Princeton University Press is seeking a new Executive Editor for the Einstein Papers Project. The Executive Editor has overall responsibility for the editing and academic content of the future volumes, as well as managing the project and its staff. The Executive Editor should be a scholar with expertise in the history and philosophy of the late nineteenth- and twentieth-century physical sciences and/or a social and cultural historian focusing on twentieth-century German history. The Executive Editor should also have an excellent command of the German language. The candidate should submit a description of his/her qualifications for the position and a

CV, including a list of publications, to Walter H. Lippincott, Director, Princeton University Press, 41 William Street, Princeton, NJ USA 08540. Only finalists will be contacted.

AIP Center for History of Physics Reception in Minneapolis

To meet with others interested in the roots of scientific discovery, and learn about important steps that are being taken to preserve this history and make it known, please attend a reception for the Center for History of Physics of the American Institute of Physics. Sponsored by the Friends of the AIP Center and the APS Forum, the reception will be held at the Hilton Minneapolis and Towers, 1001 Marquette Avenue South, Minneapolis, on Tuesday, March 21, 2000 from 4:30 - 6:30 pm. This is in conjunction with the 2000 March Meeting of the American Physical Society, but you do not have to register for the conference to attend. If you plan to join us, or if you would like more information, please contact Yvonne Taylor at ytaylor@aip.org or 301-209-3139.

Symposium in Honor of Martin Klein

Last June, after 32 years as Professor of the History of Physics at Yale, Martin Klein retired from active teaching. This spring the Yale Physics Department is organizing "A Celebration of Martin Klein" to honor Martin for all those years of excellence in service and scholarship. They are planning a two-day symposium at Yale on Friday and Saturday, April 14th and 15th, featuring 8-10 speakers, colleagues of his from the history of science, and including a reception and dinner on Friday night at the New Haven Lawn Club.

The present list of speakers includes Diana Barkan (Caltech), Jed Buchwald (MIT), Peter Galison (Harvard - to be confirmed), Gerald Holton (Harvard), Russell McCormmach (Oregon), Alan Shapiro (Minnesota), Daniel Siegel (Wisconsin), Roger Stuewer (Minnesota).

Individuals interested in attending any parts of this Celebration should consult the Yale Physics Department web page (www.yale.edu/physics) and then follow prompts to "calender" and "upcoming special events;" or go directly to www.yale.edu/physics/special.html. The details of this symposium and celebration should be posted at this site before the end of February. Interested individuals may also contact diane.altschuler@yale.edu or peter.parker@yale.edu .

Eight Archives Receive AIP Grants For Collections In Physics And Allied Fields

The Center for History of Physics, American Institute of Physics, is pleased to announce eight grants totaling $73,000 to process and organize collections in physics and allied fields. The 1999 grants are supported jointly by the Richard Lounsbery Foundation and the Friends of the Center for History of Physics, and they have been awarded to the following archives: California Institute of Technology (to process the papers of Robert Leighton and of Robert Walker), Niels Bohr Archiv, Copenhagen (Aage Bohr and Allan Mackintosh papers), Princeton University (survey and organize physics collections), Smithsonian Institution Archives (Riccardo Giacconi papers), Stanford University (Burton Richter papers), University of Alaska (Sydney Chapman papers), University of California-Berkeley (Exploratorium records), and University of California-San Diego (Edward Allan Frieman papers).

The AIP History Center's Grant to Archives program is designed to increase the money available to organize and preserve original sources in our fields (physics, astronomy, geophysics, etc.) The maximum amount of individual grants is $10,000, and applicants are required to provide matching funds. The deadline for grant applications is July 1st. For information check the Center's website at http://www.aip.org/history/grntann.htm or contact the Center at chp@aip.org, (301) 209-3165.

AIP Center for History of Physics Grants-in-Aid for History of Modern Physics and Allied Fields

The Center for History of Physics of the American Institute 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 $2,500 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, 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 the Center's website, http://www.aip.org/history, and feel free to make inquiries about the Library's holdings.

Applicants should either be working toward a graduate degree in the history of science (and include a letter of reference from the thesis adviser), or show a record of publication in the field. To apply, send a vita, 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: 301-2090882 e-mail: sweart@aip.org. Deadlines for receipt of applications are June 30 and December 31 of each year.

AIP and APS Congressional Science Fellowships

The American Institute of Physics and the American Physical Society annually sponsor Congressional Science Fellowship Programs. Applications are typically due in mid-January, so this *Newsletter* is too late for the current round, but those who are interested should plan ahead for next year. 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 one 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. Application information is available on the AIP and APS websites (http://www.aip.org/pubinfo or http://www.aps.org/public_affairs/fellow.html). Qualified applicants will be considered for both programs.

UCLA Center for the History of Physics

A Center for the History of Physics has been established at UCLA with Professors Nina Byers and Claudio Pellegrini of the Physics Department as co-directors. At present the main research interests of the Center are in the area of the early development of modern science in the XVIth and XVIIth centuries, and on contributions of 20th century women to progress in physics; c.f., http://www.physics.ucla.edu/-cwp. The two directors have developed and are giving courses in the history of physics in the Physics Department and in the Honors Collegium. The Center sponsors lectures and symposia on the history of physics for students and faculty of the university and for the general public.

On February 17 the Center will sponsor a one-day symposium on Giordano Bruno called "Bruno's Ashes" to commemorate his burning at the stake for heresy on February 17, 1600. Bruno publicly supported the Copernican system against the Ptolemaic system. He went further than Copernicus, Kepler, and Galileo when he wrote: "Innumerable suns exist; innumerable earths revolve around these suns in a manner similar to the way the seven planets revolve around our sun. Living beings inhabit these worlds." -Giordano Bruno, *On the Infinite Universe and Worlds*, 1584. It is timely to commemorate Bruno now that we have found evidence for the existence of planets around more than 20 stars.

390th Anniversary of the Discovery of the Galilean Moons of Jupiter

January, 2000 marks the 390th anniversary of the discovery of the moons of Jupiter by Galileo Galilei. Ron Baalke of JPL has written an article on this discovery, containing images of the actual transcripts written by Galileo, available on-line at the Galileo website: http://www.jpl.nasa.gov/galileo/ganymede/discovery.html

Baalke writes, "Probably the most significant contribution that Galileo Galilei made to science was the discovery of the four satellites around Jupiter that are now named in his honor. Galileo first observed the moons of Jupiter on January 7, 1610 through a home-made telescope. He originally thought he saw three stars near Jupiter, strung out in a line through the planet. The next evening, these stars seemed to have moved the wrong way, which caught his attention. Galileo continued to observe the stars and Jupiter for the next week. On January 11, a fourth star (which would later turn out to be Ganymede) appeared. After a week, Galileo had observed that the four stars never left the vicinity of Jupiter and appeared to be carried along with the planet, and that they changed their position with respect to each other and Jupiter. Finally, Galileo determined that what he was observing were not stars, but planetary bodies that were in orbit around Jupiter. This discovery provided evidence in support of the Copernican system and showed that everything did not revolve around the Earth."

Physics History Anniversaries in *APS News*

Jennifer Ouellette, associate editor of *APS News* is requesting the help of historians of physics for a new monthly column, beginning with the March issue, detailing physicists' birthdays and major physics related events and discoveries. While there is a wealth of historical data available on the web alone, much of it does not identify events by month - and in the case of anything prior to the 1800s, sometimes even the year can be sketchy. She would welcome volunteer help both to add to the information she has and to check the accuracy of the information she and other colleagues will gather. Request a copy of her preliminary listing and/or offer to help at Iucrezia@mindspring.com.

History Items To Be Highlighted in *Physical Review Focus*

Physical Review Focus is a web and email publication highlighting new developments in physics as found in *Physical Review*. Last year they published a historical note about a *Physical Review* article by Millikan, published in 1916. The *Focus* article was "Centennial Focus: Millikan's Measurement of Planck's Constant," 22 April 1999, by Gerald Holton. This story can be seen on the web at focus.aps.org/v3/st23.html. David Ehrenstein, editor of *Physical Review Focus*, would like to do more historical stories and would welcome suggestions and other offers of assistance. Contact him at ehrenste@ aps.org (301) 209-3201.

German Geophysical Society Preserves History

The German Geophysical Society includes an active History Commission, founded in 1982, and the Society has been publishing the journal *Mitteilungen des Arbeitskreises* since then. *Mitteilungen* is a discussion forum for the history and philosophy of science, especially the geosciences and related disciplines. Among special issues are *From Newton to Einstein: Festschrift for Professor Treder on the Occasion of his 70th Birthday, Physics and Geophysics* (a compilation of historical case studies), and *Emil Wiechert: Physiker, Geophysiker Wissenschaftsorganisator*. For further information contact Dr. Wilfried Schröder, Hechelstrasse 8, D-28777 Bremen-Roennebeck, Germany.

National Endowment for the Humanities Summer Seminars & Institutes

NEH sponsors Summer Seminars & Institutes for College and University Teachers, with grants for travel, books and research expenses, and living expenses. Of possible interest this summer to readers of this *Newsletter* are "Descartes and His Contemporaries:

Scholastics and *Novatores*," June 19-July 14, and "Campania Felix: Nature, Mythology, and the Works of Man," May 28-June 30. Application deadline is March 1, 2000. Information is available from 202 606-8463, sem-inst@neh.gov, or www.neh.gov.

Rockefeller Archive Center Grants

The Rockefeller Archive Center awards grants for researchers engaged in work that requires use of the collections at the Center. 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.

Recent and Forthcoming Books and Special Journal Issues

One Hundred Years of the American Astronomical Society, an AAS Centennial Supplement to *The Astrophysical Journal*, edited by Helmut A. Abt, appeared in December, 1999. It is available in both cloth and paper. This collection captures much of the excitement, discovery, and progress of the last hundred years of astronomical scholarship. Organized by *Astrophysical Journal* editor Helmut A. Abt, this centennial volume collects 53 of the most significant articles published in *The ApJ* and *The Astronomical Journal*. Each article is accompanied by a commentary that provides the scientific and historical context essential to understanding the original impact of the paper. Many commentators were contemporaries of the original authors, and provide first-person accounts of the earliest reactions evoked. Arranged in chronological order, beginning with Schuster, Hale, Russell, Shapely ... on to Michaelson, Hubble, Hoyle, Chandresekhar in the mid-century ... and through the 1970s, these are articles by some of the great names of astronomy and astrophysics. For a listing of the contents of articles and commentaries, please see http://www.journals.uchicago.edu/ApJ/centennial.pdf. This publication may be ordered from The University of Chicago Press, with information on the website listed above.

Their Day in the Sun: Women of the Manhattan Project by Ruth H. Howes and Caroline L. Herzenberg was published last fall by Temple University Press. More information is available at http://www.ocis.temple.edu/tempress/titles/1222 reg.htm, and we expect to have a review in the next issue of the *History of Physics Newsletter*.

A special theme issue of *Physics in Canada* (March/April 2000) entitled **"A Century of Physics in Canada: Much to Celebrate"** is about to be published. The issue was coordinated by guest editor, Erich Vogt of TRIUMF. This special issue of *Physics in Canada* will include the following articles: "A Century of Canadian Physics: Much to Celebrate," *E. Vogt*, "The Canadian Association of Physicists since 1945," *D.D. Betts*, "Rutherford and His Legacy to Canada," *J.M. Robson*, "The Life of Sir John Cunningham McLennan," *C. Brown*, "Rasetti a Laval," *J. LeTourneux*, "The National Research Council's Impact on Canadian Physics," *PA. Redhead*, "Atomic Energy in Canada: Personal Recollections of the Wartime Years," *P.R. Wallace*, "Neutron and Other Stories from Chalk River," *W.J.L. Buyers*, "Nuclear Physics Activities at Chalk River," *J.S. Geiger* and *T.K. Alexander*, "Emergence of Physics Graduate Work in Canadian Universities: 1945-1960," *M. Preston*. In addition, the issue contains vignettes on Robert Bell, Lloyd Elliott, Gerhard Herzberg, Walter Kohn, George Laurence, Bennett Lewis, D.K.C. Macdonald, Bruno Pontecorvo, Arthur Schawlow, Gordon Shrum, Frederick Soddy, Richard Taylor, Harry Welsh, and Tuzo Wilson. Abstracts for each of these articles can be found on the PiC online section of the CAP's website, http://www.cap.ca/pic/upcoming/source.htm.

Web Resources

American Physical Society (APS) Centennial Celebration Web Archive

Because of the interest of many APS members in the special Centennial Symposia and Plenary sessions from last March's APS Centennial Meeting, a web archive has been developed. A large number of presentations are preserved in this archive, including the remarkable talk by Hans Bethe at the Rabi session that was mentioned in last fall's issue of the Newsletter. The archive is available for viewing at http://www.apscenttalks.org/

Century of Physics Timeline on the Web

Many of our readers will be interested in the Century of Physics Timeline which is available at the APS website, or directly at http://timeline.aps.org/APS/home_HighRes.html.

Physics Internet Resources

The American Physical Society has a collection of useful physics internet links on its website. Go to the APS home page (www.aps.org) and follow the "Physics Internet Resources" link.

AIP History Web Links

The AIP Center for History of Physics maintains science history web links on their home page, http://www.aip.org/history/

Links to Science History Journals

John Agar of the University of Manchester has put together a page of links to 44 journals for history of science, philosophy of science, sociology of science, history of technology, history of medicine. It can be found at http://www.man.ac.uk/Science_Engineering/CHSTM/journals.htm

Upcoming Conferences

A conference on **Barometers** will be held at Blythe House, West London, on 8 March 2000. Details from Jane Insley, Science Museum, London, SW7 2DD, UK.

The German Geophysical Society will hold a session on the **History of Geophysics and Space Physics** in Munich in March 2000. Contact Dr. Wilfried Schroder, 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.

ACE2000,18-19 May 2000, at London and Teddington, UK, a meeting on the **History of Computing**, fifty years after the completion of the Pilot Automatic Computing Engine (ACE) designed by Alan Turing: details from David Anderson (andersond@sis.port.ac.uk), Janet Burt (burtj@sis.port.ac.uk), Jack Copeland (bjcopeland @canterbury.ac.nz).

The Canadian Society for History and Philosophy of Science will have its annual meeting May 25-27, 2000 at the University of Alberta, in Edmonton. The CSHPS meeting occurs as a part of the annual Congress of the Social Sciences and Humanities. Information about the Congress (including details about accommodations) can be found at http://www.hssfc.ca/. Information about CSHPS can be found at http://www.uwo.ca/philosophy/cshpsinf.html.

Conference on **Portraiture and Scientific Identity** at the National Portrait Gallery, London, 23-24 June 2000. 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' in the subject line) or http://scistud.umkc.edu/hopos/index.html.

The American Institute of Aeronautics and Astronautics is planning two history sessions at its Joint Propulsion Conference in Huntsville, Alabama on Monday, July 17, 2000. The two sessions will deal with historical perspectives on rocket propulsion and historical perspectives on air breathing propulsion. Information on the conference is available on AIAA's website at www.aiaa.org.

A conference on **History of Science, the Public Understanding of Science and Education** will be held in July 2000. Details from Dr. J. Hughes, CHSTM, Maths Tower, The University, Manchester, M13 9PL, hughes@fs4.ma.man.ac.uk

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. 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, PO. 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.

On 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 e-mail: biggslb@mail.auburn.edu.

The XIX Scientific Instrument Symposium of the International Union for the History and Philosophy of Science will be held at Oxford, 4-8 September 2000. Details from Dr. J.A. Bennett, Museum of the History of Science, Broad Street, Oxford, OX1 3AZ, UK.

On 12-15 October 2000 St. Louis University is sponsoring, **Writing the Past, Claiming the Future: Women and Gender in Science, Medicine, and Technology**. Contact Charlotte G. Borst, Department of History, St. Louis University, 3800 Lindell Blvd., P.O. Box 56907, St. Louis, MO 63156.

Symposium on "The Foundations of Quantum Physics before 1935," Berlin, Germany, December 14-16,2000. The Division of the History of Physics of the German Physical Society, the Max Planck Institute for the History of Science, the Commission on the History of Modern Physics of the IUHPS Division of the History of Science, and the Interdivisional Group on History of Physics of the European Physical Society will sponsor a three-day symposium on the above subject in Berlin to commemorate the centenary of the foundation of quantum theory by Max Planck in 1900. The symposium will place particular emphasis on the experimental foundations of quantum physics and will take place in conjunction with other symposia of the German Physical Society celebrating Planck's discovery. The symposium will include topics such as the interplay of experiment, observation and theory in quantum physics; key instruments in the development of quantum physics; 19th-century experimental and theoretical roots of quantum theory; cross-disciplinary perspectives on quantum physics; and collaborative research in the emergence of quantum physics. The language of the symposium will be English.

The symposium will consist of both invited and contributed papers. For contributed papers, a short abstract (maximum one page) should be sent before May 31, 2000, to the secretary of the Program Committee, Dieter Hoffmann, Max-Planck-Institut fur Wissenschaftsgeschichte, Wilhemstrasse 44, D-10117 Berlin, Germany, e-mail: dh@mpiwg-berlin.mpg.de. The papers to be presented will be determined by the Program Committee, whose other members are Fabio Bevilacqua (University of Pavia), Helge Kragh (University of Aarhus), Jurgen Renn (Max-Planck-Institut fur Wissenschaftsgeschichte), and Roger H. Stuewer (University of Minnesota). Further information may be obtained from Dieter Hoffmann.

The American Institute of Aeronautics and Astronautics is currently accepting abstracts for history papers to be presented at a history session scheduled for its 36th AIAA Aerospace Sciences Meeting, January 8-11, 2001. The topic for papers in support of this meeting relate to historical perspectives on rocketry in commemoration of the 75th anniversary of Robert Goddard's first liquid-fueled rocket. Email or fax a brief abstract or synopsis of proposed papers, along with paper title and author contact information, to Tony Springer (703 406 5788, Fax 703 406 2116, tony.springer@msfc.nasa.gov) by May 12, 2000. Information on the conference is available on AIAA's website at www.aiaa.org.

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." 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 the History of Science will be held in Mexico City July 8-14, 2001. Information can be obtained from Prof. Juan Jose Saldana, Chairman of the Organizing Committee of the XXIst ICHS. Apartado postal 21-873, 04000 Mexico D. F., MEXICO; xxiichs@servidor.unam.mx; or at the IHUPS/DHS web site: www.cilea.it/history/DHS.

Forum Elections

The Ballot is on the back cover of this *Newsletter*. Please vote for Chair-Elect, ViceChair and two Members at Large of the Executive Committee. Brief resumes and statements from the candidates begin on this page.

Nominees for Chair-Elect

Benjamin Bederson is Professor of Physics Emeritus at New York University and Editor-in-Chief Emeritus, American Physical Society. He received the BS from CCNY (1946); MA, Columbia (1948); and PhD, New York University (1950). During WWII he served in the US Army, including two years at Los Alamos as an "SED"-the Special Engineering Detachment. After a postdoctoral term in the laboratory of Jerrold Zacharias at MIT, where he was exposed to atomic beam techniques, he joined the faculty at NYU and set up a beams laboratory to study atomic collisions and structure problems. He was Chair of the Physics Department and Dean of the Graduate School of Arts & Sciences for periods of three years each. He became Editor of Physical Review A (Atomic, Molecular and Optical Physics) in 1978 and Editor-in-Chief of the American Physical Society in 1992, serving in that position for five years. He retired from NYU in 1992. He is co-Editor (with Herbert Walther) of *Advances in Atomic, Molecular, and Optical Physics*, published annually by Academic Press. He has served on many ("probably too many") government, industrial and academic committees, task forces, etc. His research interests focus on the use of beam methods to study fundamental interactions between atoms, molecules and electromagnetic radiation. He is a Fellow of APS and of AAAS and an honorary member of Sigma Pi Sigma.

Statement: While my primary professional work has centered on the subject of physics itself, my interest in societal problems and physics history has always been strong. In 1969 I instituted a course on Physics and Society at NYU, half of which was concerned

with the history of physics and the other half with contemporary societal problems. I gave this course for many years, including once on the nationally televised Sunrise Semester. Recently I edited a special volume in honor of the APS Centenary published jointly as a special issue of *Reviews of Modern Physics* and as a book entitled *More things on heaven and earth*, published by Springer. This volume included a major section on the history of physics, covering the major fields of physics, written by distinguished "eyewitnesses." In my view the practice of physics and intimate knowledge of its history are, or should be, closely intertwined, and as an officer of the Forum I will do my best to encourage this symbiosis.

David C. Cassidy is Professor of Natural Science at Hofstra University, Hempstead, New York. He is the author of *Einstein and Our World* (Prometheus, 1995) and *Uncertainty: The Life and Science of Werner Heisenberg* (NY: Freeman, 1992). The latter work received the AIP Science Writing Award as well as the Pfizer Award of the History of Science Society. Together with Gerald Holton and F. James Rutherford, he is presently completing a new physics text and related materials, titled *Understanding Physics*, for non-science undergraduates as well as future and in-service K-12 teachers. The content and approach of the new work, to be published by Springer-Verlag, are based upon those of the former *Project Physics*. He served on the Forum Executive Committee from 1991-1998, first as member-at-large and chair of the nominating committee, then for four years as Secretary-Treasurer. He is presently a member of the Fellowship Committee.

Statement: The FHP is one of the few venues where physicists interested in historical questions and historians of science interested in the history of physics are able to come together to discuss matters of mutual interest. The Forum has also worked to provide our colleagues and the general public with a broader appreciation of physics and its role in our society and culture. As an officer of the Forum, I will work to continue and to expand these important contributions of the Forum.

Nominees for Vice-Chair

Hans Frauenfelder received his Dr. sc. nat. in physics in 1950 at the Swiss Federal Institute of Technology (ETH) in Zurich. His thesis concerned the study of surfaces with radioactivity. In 1951, he discovered perturbed angular correlation. He came to the U.S. in 1952, joining the Department of Physics at the University of Illinois in UrbanaChampaign as a research associate. Despite the absence of mountains, he stayed at the UIUC till 1992, ultimately as Center for Advanced Study Professor of Physics, Chemistry, and Biophysics. His research interests included nuclear physics, particle physics, conservation laws, Mossbauer effect, and biological physics. In 1992, Frauenfelder moved to the Los Alamos National Laboratory where he is currently the director of the Center for Nonlinear Studies and continues research in biological physics. He wrote three books, *Mossbauer Effect*, and together with Ernest Henley, *Nuclear and Particle Physics,* and *Subatomic Physics*. Frauenfelder is a member of the National Academy of Sciences, the American Philosophical Society, and a Foreign Member of the Royal Swedish Academy of Sciences.

Statement: My interest in the history of science and particularly physics goes back to my high school time. I attended the Kantonsschule (Gymnasium) in Schaffhausen, a small town at the Rhine in Switzerland. My physics teacher was Conrad Habicht, one of the three members of the *Akademie Olympia*, the other two being Albert Einstein and Maurice Solovine. Habicht was not a good teacher, but he stimulated interest in physics, and the history of physics, in those who listened. My interest was further stimulated at the ETH, where Paul Scherrer, Gregor Wentzel, and Wolfgang Pauli were my main teachers. Through Pauli, I also got to know many of the leading scientists such as Kramers, Heisenberg, Hans Jensen, and Wolfgang Paul ("Pauli's real part"). The interest in the flow of history in physics was again stimulated in Urbana, particularly by contact with John Bardeen, David Pines, and Charlie Slichter. As a result of these contacts with physicists, and later also with biologists, I felt and still feel that progress in science is intimately linked to the flow of ideas that goes back many generations. The APS Forum on History of Physics is essential in guarding the past, making certain that essential knowledge is not lost, and pointing the way to the future, in stressing what can be learned from the past.

Michael Nauenberg received his PhD in physics at Cornell (with H. Bethe) and taught at Columbia and Stanford before coming to the University of California at Santa Cruz in 1966. He was one of the founding members of its Physics Department, where he is now a Professor emeritus. His primary research interests are in particle and condensed matter physics, and nonlinear dynamics, and he has written numerous articles in these areas. His most recent work is on a new quantum mechanical treatment of neutrino and neutral meson oscillations (*Physics Letters*, 1999), and on the dynamics of wave packets in weak external fields. He has had a longstanding interest in the history of physics and mathematics, particularly during the 17th century, and published about a dozen articles on the works of Hooke, Newton and Huygens, and several reviews of recent books on Newton's *Principia*, including an essay review, "The mathematical principles underlying the *Principia*, revisited" *(J. Hist. of Astronomy* **29**,(1998) 286-300), and *The Foundations of Newtonian Scholarship*, edited with R. Dalitz (World Scientific, 1999). He has collaborated with J. B. Brackenridge on an article for *The Cambridge Companion to Newton*, edited by I.B. Cohen and G. Smith, (Cambridge U. Press, 1999). He is the organizer of the FHP symposium on the development of ancient astronomy at the April, 2000 APS meeting in Long Beach.

Statement: The history of physics enriches the understanding of our field and illuminates its role in our culture and society. Biographies and studies of original writings of great physicists provide us with new insights and a deeper appreciation of their creative work. It also helps to inspire young students. During the past years I have given many lectures and participated in conferences on the history of science, keeping in regular contact with historians of science. The Forum activities are designed to enhance awareness and to encourage research in the history of physics, and my experience will help me to foster this goal. I have been involved in various activities in the history of physics which have brought historians of science and physicists together. Recently I helped organize: 1) a session on Hooke and Newton at the 1993 meeting of the History of Science Society (with E. Drake); 2) the FHP session at the 1995 March meeting of the APS which featured a talk by Chandrasekhar; 3) a symposium on Newtonian scholarship which was held at the Royal Society of London in 1997 (with R. Dalitz and J.B. Brackenridge); 4) in light of recent criticism of our field by science studies advocates, a well-attended two-day debate at UCSC which brought together some of the principal contenders, including Alan Sokal and David Mermin who represented physics. Under the auspices of the Forum, I propose to stimulate and help organize similar activities which promote the history of physics and a better understanding of our field.

Nominees for Executive Committee

Elizabeth Urey Baranger received her bachelor's degree from Swarthmore College and her Ph.D. from Cornell University, where she completed her dissertation under the direction of Hans Bethe. After two years as a postdoc at Cal Tech she joined the University of Pittsburgh, rising to the rank of full professor. In 1969-1973 she worked as a Senior Research Scientist at M.I.T. in the field of nuclear theory. She returned to the University of Pittsburgh in 1973 as Professor of Physics and Associate Dean for Graduate Studies. She currently holds the administrative position of Vice Provost for Graduate Studies. Her administrative interests have been in increasing the numbers of women and improving the climate for women in academia, the effective evaluation of academic programs, and improving the graduate student experience.

Statement: I believe it important that working physicists understand their heritage and the impact physics has had on the intellectual and material life of the world. The last century has seen an unprecedented growth in the science of our discipline and those who participated in this growth or were the recipients of the knowledge generated by this growth can both learn from and contribute to the compilation of the history of this century. The Forum serves to keep physicists aware of their heritage and of the efforts made by historians of science to understand this heritage. If elected a member of the Executive Committee, I would work to support and enhance efforts currently made through the *Newsletter*, the web, and sessions at APS meetings to communicate what is happening in the history of physics with the membership of the American Physical Society.

Michael E. Fisher is a theoretical physicist who has made major contributions to the theory of critical phenomena and phase transitions, as well as working in the larger areas of statistical mechanics, condensed matter theory, physical chemistry and associated foundational and mathematical problems. He received a Ph.D. in physics from King's College London in 1957. He is Distinguished University Professor and Regents Professor at the University of Maryland at College Park, having previously been a professor at King's College London and Cornell University. He is a Fellow of the Royal Society of London, where he presented the Bakerian Lecture in 1989 and served as Vice President (1993-95). He is a Foreign Associate of the U.S. National Academy of Sciences, and Honorary Fellow of the Royal Society of Edinburgh, and a Foreign Member of the Brasilian Academy of Sciences. He has honorary doctorates from Yale University and Tel Aviv University, and is a Fellow of the American Academy of Arts and Sciences, the American Philosophical Society, AAAS, the Physical Society (IoP) London, and APS. He has published over 350 scientific papers and one book. Among many awards, he has received the Irving Langmuir Prize in Chemical Physics from APS, the Guthrie Medal and Prize of the Institute of Physics, the Wolf Prize in Physics (with L.P. Kadanoff and K.G. Wilson), the IUPAP Boltzmann Medal for Statistical Physics, the Hildebrand Award of the American Chemical Society, and the Lars Onsager Memorial Prize of APS. He also presented the 65th Josiah Willard Gibbs Lecture of the American Mathematical Society. In the Forum on History of Physics, he played a large role in organizing, as well as speaking in, the well-received symposium on "History of Critical Phenomena" at the APS March Meeting in 1998.

Statement: History and philosophy are basic aspects of human culture; and since science, and physics in particular, are increasingly important aspects of our modern culture, it behooves the American Physical Society to do its crucial part in encouraging interest and respect for the history of physics. That includes facilitating the preservation of documentary and other materials with which present and future historians of science can work. That, I believe, is the main role of the Forum: if elected, I will do my best to support these aims. As a matter of fact, I also feel that the history of physics frequently has lessons to teach us even for current research and its "direction." Personally, my pretensions as a historian are minimal. However, in *Reviews of Modern Physics* **70**, 653-681 (1998) I attempted to address informally from a historical perspective "Renormalization Group Theory: Its basis and formulation in statistical physics."

Charles H. Holbrow, Charles A. Dana Professor of Physics at Colgate University, received his Ph.D. in physics from the University of Wisconsin, Madison (supervised by H. H. Barschall) and is a fellow of the APS. In addition to his degrees in physics Holbrow holds degrees in history from Wisconsin (B.A.) and Columbia (A.M.). His physics research is in nuclear physics and in laser spectroscopy of accelerator produced exotic atoms. At the same time he has pursued interests in the history of physics. He has written and published about the origins of the Kellogg Radiation Laboratory at Caltech and about how changes in physics are reflected in introductory physics textbooks over the past 150 years. Last year, on behalf of the Forum on Education, he organized, prepared and presented a well-received exhibit of historically significant physics texts at the APS Centennial celebration in Atlanta. Currently he is preparing a study of the historical origins of nuclear astrophysics, and he is teaching the history of development of the atomic bomb.

Statement: I have always found the history of physics deeply interesting. I believe that it enriches the understanding and appreciation of physics both by its practitioners and by the general public. It reveals how various are the ways of doing physics. It shows how arduous it is to advance human understanding of the natural world and how intellectually rewarding those advances can be. It brings alive the fascinating personalities who have helped to build our profession. It reminds us of the tangled origins and buried complexity of physics as it actually evolves. In a valuable way the history of physics humanizes our subject in our own eyes and in the eyes of the greater public. I am dedicated to fostering the study of the history of physics in a range that will include scholarly histories, autobiographies and memoirs, and popular histories. The Forum on History of Physics has an admirable history of enriching APS meetings with fine presentations by professional historians and by actual makers of the history themselves. It has great potential to reach broader audiences. I am eager to help the Forum's efforts to advance the history of physics and would be delighted to serve on its executive committee.

Allan A. Needell is Chairman of the Space History Division of the Smithsonian Institution's National Air and Space Museum. He has published on the history of physics, the origins of American national laboratories, and government/science relations. He has recently completed *Cold War, Science and the American State*, a study of
the career of American science administrator, Lloyd V. Berkner (Harwood Academic Press). Needell joined the National Air and Space Museum in 1981, when he led the museum's efforts to commemorate the twenty-fifth anniversary of the beginning of space flight, and edited a collection of essays: *The First 25 Years in Space: A Symposium* (Smithsonian Press, 1983; paperback, 1989). He is responsible for the museum's manned space flight collection - Mercury through Apollo. From 1978-81, Needell served as associate historian at the Center for History of Physics, American Institute of Physics, where he had responsibility for a three-year, federally funded project to investigate and recommend ways of improving the identification and preservation of records documenting the history of the U.S. Department of Energy's research laboratories. Needell was born in Paterson, New Jersey in 1950. He graduated (BA Physics) from Cornell University in 1972 and (Ph.D. History of Science) Yale University in 1980.

Statement: As a member of the Executive Committee of the APS History Forum my major goal would be to help continue and expand communications between the physics, historical and museum communities. I sincerely believe that the professional interests and public responsibilities of all three communities intersect at various places in many ways. I believe that my Museum and the Smithsonian can benefit greatly from close association with the efforts of physicists to preserve, understand and celebrate their history and accomplishments. I look forward to having a chance to work more closely with them in those efforts.

Book Reviews

G. Srinivasan, ed., *From White Dwarfs To Black Holes; the Legacy of S. Chandrasekhar*

(University of Chicago Press, 1999) xiv + 240 pages, $40 (cloth), $18 (paper)

Reviewed by Kameshwar C. Wali, Syracuse University

S. Chandrasekhar, popularly known as Chandra, had often expressed his strong dislike for the conventional memorials and eulogies after the death of a person. He abhorred adulation and vague praise of his own or someone else's work and also the religious overtones generally associated with memorials. He did not want any such memorial for himself, and had made this imperative in a sealed letter left with his colleague and friend Robert M. Wald to be opened after his death. In deference to his wishes no memorial was held. But those who knew Chandra, knew also his deep and abiding interest in history, and his genuine appreciation for intellectual achievement. They also knew his own efforts in commemorating other scientists by providing a genuine appraisal of their contributions and placing their work in proper perspective. From that point of view, Robert Wald thought it appropriate to organize a "working scientific symposium" on recent developments in the theory of black holes and relativistic stars, which was an important preoccupation of Chandra during the last phase of his life. Proceedings of this symposium are published in the form of a book, *Black Holes and Relativistic Stars* (edited by Robert M. Wald, University of Chicago Press, 1998). The present reviewer has also edited a volume containing a collection of articles of a complementary nature. Chandra was a highly private individual, and in spite of his extraordinary accomplishments, had remained unknown to the world at large. Only a small number of people among his associates, admirers, students and close relatives were able to penetrate a seemingly impenetrable barrier. In the book *S. Chandrasekhar; the Man Behind the Legend*, (Imperial College Press & World Scientific 1997), they write, not so much about Chandra's scientific accomplishments, but about him as a person. Through their recollections, encounters, and reminiscences, they portray Chandra's rich

and multi-faceted personality.

The book under review is still another attempt to pay tribute to Chandra's wideranging contributions to physics, astrophysics and applied mathematics. As is widely known, Chandra followed a distinct pattern of research. This pattern is best described in his own words in the autobiographical account published with his Nobel lecture:

> *After the early preparatory years, my scientific work has followed a certain pattern motivated, principally, by a quest after perspectives. In practice, this quest has consisted in my choosing (after some trials and tribulations) a certain area, which appears amenable to cultivation and compatible with my taste, abilities, and temperament. And when after some years of study, I feel that I have accumulated sufficient body of knowledge and achieved a view of my own, I have the urge to present my point of view* ab initio*, in a coherent account with order, form, and structure.*

Following over six decades, Chandra's researches spanned a wide spectrum consisting of the following distinct periods: 1) stellar structure, including the theory of white dwarfs (1929-39); 2) stellar dynamics, including the theory of Brownian motion (1938-43); 3) the theory of radiative transfer, the theory of the illumination and the polarization of sunlit sky, the theories of planetary and stellar atmospheres, and the quantum theory of the negative ion of hydrogen (1943-50); 4) hydrodynamic and hydromagnetic stability (1952-61); 5) the equilibrium and stability of ellipsoidal figures of equilibrium (1961-68); 6) the general theory of relativity and relativistic astrophysics (1962-71); 7) the mathematical theory of black holes (1974-83); 8) the theory of colliding gravitational waves and non-radial perturbations of relativistic stars (1983-95). And finally, *Newton's Principia for the Common Reader* (Clarendon Press Oxford, 1995).

This vast landscape of theoretical physics and astrophysics makes it almost impossible for a single person to undertake a review and comment upon the achievements of Chandra. Consequently, Srinivasan has wisely found some eminent experts to write about the separate topics in each period. Collectively the essays in the book provide a grand tour of the colossal scientific edifice Chandra has left behind. After a brief biographical account in the preface, G. Srinivasan describes in the first essay the historical background leading to the discovery of the so called *Chandrasekhar limit* in the theory of white dwarfs and also his subsequent contributions to the structure and evolution of stars. This first essay is followed by James Binney, who under the title "The Stellar-Dynamical Oeuvre" undertakes an evaluation of Chandra's contributions to stellar dynamics. Chandra's most productive, and from his own point of view scientifically the happiest period of his life (period 3, 1943-50), is covered by George Rybicki and A.R.P. Rau. A description of Chandra's joint work with Enrico Fermi on magnetohydrodynamics is to be found in E.N. Parker's essay. Norman Lebovitz and John L. Friedman, both Chandra's students, speak of their association and collaboration with Chandra. Their joint work, along with Chandra's own contributions, on classical ellipsoidal figures of equilibrium and the stability of relativistic stars, is discussed in their essays. Bernard F. Schutz gives an account of Chandra's post-Newtonian approximation scheme to calculate radiation reaction and its significance in establishing the validity of the prediction of gravitational waves in general relativity. Roger Penrose traces the history and the problem of space-time singularities. This chapter includes Chandra's pioneering work on white dwarfs, which led to the belief that excessively massive stars must collapse into space-time singularities. A personal account of how the Chandra-Eddington controversy led to his own work is the subject matter of E.E Salpeter's essay. Finally, Donald E. Osterbrock, another of Chandra's students, provides a description of Chandra's years at Yerkes Observatory and subsequently at the University of Chicago. He surveys Chandra's contributions to teaching and research, colloquia and seminars at Yerkes. Drawing from letters, emails and phone calls of several former students of Chandra, Osterbrock writes about Chandra as a teacher and mentor. Although not always flattering, Chandra emerges as an awesome figure of a "great scientist, an excellent teacher and thesis advisor of graduate students." His article ends with a list of all Chandra's Ph.D. students and their thesis topics.

Writing broadly about the nature of Chandra's work, Friedman and Penrose each emphasize Chandra's quest for mathematical elegance in model building. "... Chandra was, to my knowledge, unique in the way he treated equations," Friedman writes, "as objects in themselves, their structure clear in the manner he displayed them, their meaning to be found in this structure. That mathematics was the language of nature he never doubted, and he served nature all his life." Penrose voices a similar opinion. He writes that Chandra's work was driven more and more by the quest for mathematical elegance, coupled with a deep belief in a profound underlying connection between physics and mathematics. He concludes that the problems associated with space-time singularities and their solution may lie in this deep faith. However, for Binney, this mathematical overpowering was a shortcoming of Chandra. He says, "His mathematical orientation ensured that his papers were heavy going for a theoretical astrophysicist and completely impenetrable to the average astronomer. After pages of detailed calculations of particular integrals, integrability conditions, and the roots of equations, one longs for relief in the form of the description of the physical picture which emerges from the mathematics. Too often one longs in vain."

Over all Srinivasan has assembled an impressive collection of essays covering most of Chandra's work. Each article while providing a summary of the important contributions to a particular area, describes also the impact of Chandra's work on further development of the subject. Consequently the book should appeal to a broad audience of astrophysicists. As the scholarly essays span astrophysics over six decades, the book should be of value to historians of science as well.

Robert P. Crease, ***Making Physics: A Biography of Brookhaven National Laboratory, 1946-1972***
(University of Chicago Press, 1999). xii+434 pages, $38.00

Reviewed by Catherine Westfall, Michigan State University. She has done historical research by contract at Jefferson Laboratory, Fermilab, Lawrence Berkeley National Laboratory, and Los Alamos National Laboratory, studying the funding, implementation, and organization of research in post-World War II America.

Brookhaven National Laboratory was established by the Atomic Energy Commission in 1947 as one of the first three AEC national laboratories. Unlike its sister laboratories at Oak Ridge and Argonne, Brookhaven's mission was to pursue basic rather than applied research. Indeed, in the next few decades this multi-purpose laboratory, which was operated by a consortium of universities in the Northeast called the Associated Universities Incorporated (AUI), developed research expertise in a wide range of fields, including chemistry, physics, biology, engineering, and medicine.

Robert Crease's book traces the history of Brookhaven from the post-World II maneuvering by I. I. Rabi and others that led to the creation of the laboratory to the mature laboratory of the late 1960s. Crease's account is not comprehensive - he focuses mainly on Brookhaven's reactor and accelerator programs and the community relations problems experienced, in large part, because of fears about radiation safety that these two programs inspired.

The resulting story has much to offer to those of us interested in the history of federally sponsored research institutions. In particular, I was fascinated to learn how local factors and personalities shaped a distinctive Brookhaven approach to building and using research equipment which was characterized by a dependence on theory, decentralized authority, and an unusual willingness to accommodate visiting scientists. When addressing this and other issues, Crease demonstrates solid scholarship; he documents his research with an abundance of primary and secondary sources, and he carefully situates his discussion within ongoing scholarly dialogues about the development of large-scale research. He also demonstrates a clear, even-handed perspective of his subject matter and describes technical matters cogently and carefully.

Of course, some readers might have quibbles about Crease's book. For example, some might note that his narrow focus on reactor and accelerator history pushes Brookhaven's other scientific programs to the sidelines. Others might object to the lack of detail in the scientific descriptions of Brookhaven physics. In particular, some might be bothered by Crease's approach, which relies heavily on numerous oral history interviews. In the place of lengthy scientific discussions Crease has spiked his account with anecdotes rich in human detail, quotes, and biographical sketches. In fact, Crease refers to his book as a biography of the Brookhaven community. Rather than producing an exacting, technical treatise, Crease has chosen to write in an engaging, personal way about the people who shaped Brookhaven.

Although Crease did not write a book for specialists, his account should be attractive to those in the physics community for at least two reasons. For one thing, Crease bucks the scientist-bashing trend that has recently become so popular. In fact, he explains that he relies heavily on oral history and emphasizes the personal in order to portray scientific life in a positive light from the point of view of scientists and thus avoid the current tendency of journalists as well as "contemporary scholars of science" who "are prone to dismiss the suggestion that science at the fundamental level might be something more than a business of apology, popularization, or the refusal to accept accountability." Crease argues that others should follow his lead and consider the love that scientists have for their work because "if you know science only by its politics, interests, and funding, or material achievements, you don't know science." (p. 5)

Crease's account of Brookhaven's community relations problems will also be of interest to physicists. Crease points out that the laboratory was plagued with such problems right from the beginning. The laboratory had its first public relations disaster in 1948, when newspaper columnist Drew Pearson linked attempts to monitor emissions from the Brookhaven Graphite Research Reactor with a disaster in Denora, Pennyslvania, where accumulated smog from smoke stacks caused the deaths of twenty people. According to Pearson, the Brookhaven monitoring revealed that: "Deadly waste gases" as well as "deadly atomic energy" from the BGRR might produce "another Danora smog tragedy just outside of New York City." (p. 100)

Lurid and misleading reports about the dangers of Brookhaven continued to circulate. When a former medical department worker, Kenneth Koerber, died in 1956, the medical examiner declared that Koerber's death was due to radiation poisoning and announced that his bones had "1,000 times the maximum safe concentrations of radiation," even though Koerber could not have received that amount of radiation even if he had ingested all the radiotracers then in use at the laboratory. (p. 102) In 1960, a young physicist John Gibson was killed when his car was struck by a truck carrying casks of spent reactor fuel, which were left intact in the accident. The *New York Times* story nonetheless carried the headline: "Atomic Scientist Killed by Radioactive Waste." (p. 103)

Crease identifies several factors that laid the groundwork for the atmosphere of mutual mistrust between Brookhaven and its surrounding community which led to such media coverage: the cloistered nature of the laboratory and the fact that Brookhaven personnel and the rural community members had little in common; the close juxtaposition of the bombings that ended World War II and the founding of Brookhaven; and the longstanding public terror about radiation and the related tendency of the media - and in particular the New York media - to sensationalize radiation danger. He goes on to argue that such troubles were exacerbated by the conflicting perspectives of Brookhaven scientists and community members. On the one hand scientists tended to expect the public to simply accept their expert judgment that Brookhaven posed no threat. On the other hand, community members tended to expect that all their fears - including those deemed foolish by scientists - be addressed and assuaged.

Crease judges that bridging the gap between Brookhaven and community perspectives would have taken large-scale participation by scientists in community activities "so as to destroy stereotypes of their profession and to defuse fears of their craft," as well as

Brookhaven-sponsored "safety-related improved projects," well beyond those required by "existing safety regulations and designed to address remote dangers or extremely low-level risks," to "show the community that its perceptions mattered." (p. 106-107) In the event, no such actions were taken, and Brookhaven's community relations continued to worsen.

Like many good writers, Crease provides a teaser for the next book he plans to write. At the end of his discussion on community relations through the 1960s, Crease explains that Brookhaven's political vulnerability crested "in 1997, on its fiftieth anniversary, when the Department of Energy used the occasion of a slow leak at the spent fuel pool of a reactor, posing no health threat, to cancel the agency's contract with AUI to manage the lab." Many will be interested in reading the sequel to this biography of Brookhaven to learn more about this and other episodes in the life of this important national laboratory.

Rinat M. Nugayev, ***Reconstruction of Mature Theory Change***

(Peter Lange, Bern, 1999). 199 pages (paper) $37.95

Reviewed by James T. Cushing, University of Notre Dame

This is a book with a grand aim in the philosophy of science: to provide a (really, *the*) general, unitary model for or account of all theory change in (at least modem) science. Below I shall attempt to outline and discuss Rinat Nugayev's project (to the extent that I can understand it). However, I feel that I must first begin by listing and commenting on the considerable organizational and production shortcomings of this book, since they substantially interfere with (perhaps, almost totally block) a reader's sincere efforts to comprehend and evaluate the case the author claims to be making about this important and certainly long-standing foundational problem in the philosophy of science.

In order to convince the reader of the value of his own "simple" model of theory change, Nugayev finds it necessary first to list and then try to demolish several of the standard (actually, largely old war-horse pieces by now, at least as far as the professional philosophy of science literature in the West is concerned), putatively *complete* models or accounts of theory change (*e.g.*, the hypothetico-deductive model and those associated with the names of Karl Popper, Imre Lakotos and Thomas Kuhn). This seems largely an unnecessary exercise, since this book, if it is aimed at anyone, is intended for the professional philosopher of science (a general reader would be thoroughly lost, even if initially interested in the topic) - someone who will already be more than just a little familiar with these criticisms (and with others perhaps even more effective). It seems that the author feels he must begin by clearing the field (of even straw-man) competitors before he can proceed. In other words, the Introduction and Chapter 1 could be left out with little loss to the reader and to better effect to focus on whatever positive Nugayev has to say. In Chapter 2 Nugayev lays out what he considers to be the necessary *desiderata* for a model of theory change. Chapter 3 is to present his *simple* model of theory change, yet nowhere does he give in simple outline form the key elements of his scheme. Instead, we find a series of (mini-) examples from the history of fairly modern physics, criticisms of older proposals by others and elements of a theoretical structure that are to constitute his model. A clean, concise statement of his proposed model here would motivate the reader to go on. Chapter 4 is advertised as comparing his new model with actual problem situations (*i.e.*, choices among theories). This touches on, but cannot really consider in great detail, several examples from electrodynamics, relativity (both special and general), quantum mechanics and quantum field theory. Some of the technical issues involved are quite complex and it is not clear that Nugayev's glosses on them are the only reasonable ones. Finally, Chapter 5 (over one-third of the book) is a reconstructed case study of the transition from Hendrik Lorentz' theory of the electron to Albert Einstein's special theory of relativity, all in the service of Nugayev's model. The author devotes much effort to arguing, once again, that previously proposed models of change are inadequate. He outlines the development of Lorentz' and of Einstein's programs (based largely on excerpts from earlier reconstructions by others). He then gives his own explanation of how the choice between them was made. The book has too much and too little: too many examples and grand claims and too little clear and concise presentation of his own ideas. Perhaps this is simply a "cultural" difference in style between East versus West in presenting a case. (This East-West distinction is one used by Nugayev himself.)

As for the production of the book, what was most needed was the firm hand of a competent copy editor. There is absolutely *no* index (something that is virtually never seen these days, at least in professional books published in the West) to this involuted and often meandering book, so that it is extraordinarily difficult to locate again a term or topic once the hapless reader has moved on. There are frequent typographical errors and citations are too often missing or incorrect in the References section at the end of the book.

However, in spite of all of these roadblocks, the diligent reader may still be able to ferret out the author's main claims (even though it is unreasonable to expect someone new to Nugayev's ideas to be willing to invest that effort without some reasonable expectation that there may be a meaningful reward in the end). So, let me pass over the Introduction and Chapter 1 (for the reasons I gave above) and begin with Chapter 2, "What is a Theory-Change Model?" Nugayev suggests that there are various "levels of understanding" of theory change: a descriptivist, or empirical, one (based on the historical record of how scientists *actually* made their choices), and a theoretical, or normative, one (above the fray, so to speak). It is the latter level that allows one (retrospectively) to organize and evaluate the historical record and it is at this level that his model is to function. Such an ideal model of theory change makes contact with "reality" only through partial theoretical models based on them. (p. 48) This is a grand project in the heroic mold: a normative theoretical model based on (a selective) rational reconstruction of real history to set standards for problem solving, even in current scientific development. (The overall structure and several of the elements of his model borrow heavily from the older methodology of scientific research programs of Lakatos and from the paradigms of Kuhn.) Nugayev presses an analogy with science in which one seeks an overarching ideal representation of all of reality (even though contact with actual physical phenomena can be made only thorough approximate models). All of this seems somewhat dated in an era when some question the reasonableness of such

a goal even for the "hard" sciences. The goal is to provide one overarching theoretical framework into which all theory choice can be fit and in terms of which it can be understood.

The title of Chapter 3 promises us the *simple* model itself. This begins with a distinction between *basic* and *derivative* theoretical objects in a mature physical theory *T*. The former are idealizations, while the latter are (approximate) representations of reality and are obtained from the basis *B* by a process of "reduction" (essentially, nonalgorithmic, creative application to specific, often *gedanken*, situations). It is the bases *B* of competing theories that typically (first) come into conflict. A central claim made (but not sufficiently established in general) by Nugayev is that a revolution can take place *only* when the bases from two different theories come into conflict because they are *both* needed to explain some class of phenomena. These derivative objects he terms "crossbreeds." (Actually, a welter of unfamiliar terminology is introduced in the discussion of this chapter and there is not space here to go into all of it.) In such a situation, a new, global theory T_3 is required to resolve the contradictions between T_1 and T_2. Examples are given of this process, but (as one might expect) there is no universal, definite procedure that can be followed to insure success. Still, we are told that *one* theory will always, in the long run, emerge and prove decidedly superior to the rest. This chapter is long on general discussion and claims, but short on helpful specifics, about his model.

Chapters 4 and 5 are intended to be applications of this new model to actual situations. Much of this overarching framework (containing theoretical schemes, empirical schemes, cross-theories, cross-contradictions, invariant contents, cross-bred objects, paranormal anomalies, crucial experiments, synthetic and reductionist global theories and much more) seems so complex and amorphous that one can wonder whether there is any unique, or even reasonably compelling, way to fit all of the pieces together in establishing a correspondence with reality (*i.e*., with the history of science). That is, even though Nugayev does apply his scheme to, or illustrate it with, case study summaries, it is far from obvious that much more has been done than simply to *fit*, definitionally, the history of these episodes into a matrix - as opposed to providing any genuine understanding of what happened.

I am not saying that Nugayev's model *cannot* possibly have any value as a scheme for understanding theory change in modern science. Rather, I did not find on offer a sufficiently tight and definite structure (as opposed to a loose collection of partially articulated ideas) to allow me to make such a claim. If the author wants his resolution to this central question of the philosophy of science to gain currency in the West anytime soon, he should consider presenting his case in a more user-friendly manner.

Mara Beller, *Quantum Dialogue: The Making of a Revolution*

(University of Chicago Press, 1999). xvi+366 pages, $35 (cloth)

Reviewed by William Evenson, Brigham Young University.

This remarkable and original book addresses the conceptual foundations of quantum mechanics and the process by which the Copenhagen interpretation became dominant, and even dogma, in the physics community. In addition, Mara Beller advances a new approach to history of science, what she calls the dialogical approach, focusing on the "intricate flux of dialogues" among physicists in the development of a "scientific revolution."

Beller challenges much of the received view of the history of quantum mechanics and dispels long-standing myths by the thoroughness of her scholarship and her detailed analysis of original texts: documents, letters, and manuscripts, both published and unpublished. She takes full advantage of the many excellent collections and archives of important documents on the history of quantum mechanics to provide a carefully developed argument distinguishing the roles of physical, philosophical, political, and polemical arguments and motives in the early development of quantum mechanics. Her copious quotations and careful analysis of context as well as content make her arguments convincing even when they are at times surprising.

The book consists of an introductory chapter, discussing the roles of dialogues in creativity and of rhetorical strategies in winning allegiance to theoretical or interpretative viewpoints, then two parts: "Dialogical Emergence," and "Rhetorical Consolidation." One gets a flavor of the book's contents and the author's thesis just from the chapter headings, which are given below.

Part One, "Dialogical Emergence," includes six chapters: "Matrix Theory in Flux," "Quantum Philosophy in Flux," "The Dialogical Emergence of Heisenberg's Uncertainty Paper," "The Polyphony of Heisenberg's Uncertainty Paper," "The Dialogical Birth of Bohr's Complementarity," and "The Challenge of Einstein-Podolsky-Rosen and the Two Voices of Bohr's Response."

Beller shows convincingly in these chapters that the founders of quantum mechanics did not proceed from a prior philosophical commitment to an inevitable conclusion, as the development is portrayed in too many textbooks. Rather, the philosophy developed with the physics or even after developments in the theory, and often in response to perceived challenges for dominance in the new field. Heisenberg even argued for the superiority of matrix mechanics over wave mechanics *after* he knew of Schrodinger's and Pauli's proofs of equivalence of the two theories.

She shows the roles of discussion and disagreements ("dialogues") among the principal participants, as well as with lesser known scientists, in developing the ideas. She shows the inconsistencies ("polyphony") within the views of individual scientists over time and even within the same document at crucial times when a particular view was not yet settled. She shows the polyphony among the views of collaborators who professed public agreement while maintaining private divergence of positions. And in Part Two she shows the polyphony of statements by individual scientists to different audiences.

Part Two, "Rhetorical Consolidation," includes eight chapters: "The Polyphony of the Copenhagen Interpretation and the Rhetoric of Antirealism," "The Copenhagen Dogma: The Rhetoric of Finality and Inevitability," "Constructing the Orthodox Narrative," "The Myth of Wave-Particle Complementarity," "Complementarity as

Metaphor," "Hero Worship, Construction of Paradigms, and Opposition," "Dialogues or Paradigms?" and "Dialogical Philosophy and Historiography: A Tentative Outline."

Beller argues that the Göttingen-Copenhagen physicists developed a strong rhetorical advantage relative to Schrodinger, Einstein, and others who disagreed with the Copenhagen views by presenting a unified public position even when they disagreed privately. Schrodinger, on the other hand, found much sympathy for his views among other physicists, but no concerted common effort to promote his point of view.

The "rhetorical consolidation" of the Copenhagen interpretation of quantum mechanics led, by the time this reviewer studied quantum mechanics in graduate school in the 1960s, to a virtual dogma that was difficult to challenge. I remember Lande's 1965 article in *American Journal of Physics*, "Quantum Fact and Fiction," and the not so subtle hints from older physicists that this was not to be taken seriously - Lande had done good work in the early years, but simply couldn't accept what Bohr and his school had established beyond question. That has changed. There has been much work by physicists probing the foundations of quantum mechanics and reopening the kinds of questions Lande addressed, but generally without looking carefully at the ways in which the dogma was established in the first place or reassessing the founders. Beller has done a great service by so carefully addressing these previously under-emphasized issues. As in Part One, she makes her case thoroughly, so it is convincing by its painstaking detail and careful argument. She closes with two chapters discussing issues in the history of science which are raised by this book's analysis of the foundations of quantum mechanics.

Certainly there will be those who disagree with Beller's views of the players and of the means and motives for the philosophical choices made in the early history of quantum mechanics. But she has set a high standard of scholarship for the ensuing discussion. Her arguments are thoroughly supported and her conclusions are meticulously argued. Her proposal for a "dialogical philosophy and historiography" of science promises new directions and new insights.

This is an important book that all who are interested in the emergence of quantum mechanics will want to read.

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