

History of Physics

NEWSLETTER

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Gerald Holton Wins Pais Prize

By Daniel M. Siegel, Chair, Pais Prize Selection Committee, and David C. Cassidy

The American Physical Society and the American Institute of Physics have chosen Gerald Holton to receive the 2008 Abraham Pais Prize for the History of Physics “for his pioneering work in the history of physics, especially on Einstein and relativity. His writing, lecturing, and leadership of major educational projects introduced history of physics to a mass audience.” Holton joins previous winners Martin J. Klein, John L. Heilbron, and Max Jammer in receiving this distinguished prize, which will be awarded to him during the April 2008 APS meeting in St. Louis.

After receiving a certificate of electrical engineering from the School of Technology, City of Oxford, Holton earned his B.A. degree at Wesleyan University in 1941 and his doctorate in experimental high-pressure physics at Harvard in 1948, as a student of Percy W. Bridgman. During World War II, he was an instructor at Wesleyan, Brown, and Harvard; he also served in wartime laboratories and taught naval officers about radar. In 1947 Holton joined the Harvard faculty, where he has remained ever since. He has also served as a Visiting Professor at the Massachusetts Institute of Technology (1976–1994), where he was a founding faculty member of its Program on Science, Technology and Society. He is currently the Mallinckrodt Research Professor of Physics and Research Professor of the History of Science at Harvard University.

While continuing his research on high-pressure physics at Harvard, Holton pioneered the introduction of physics history into the teaching of physics with the 1952 publication of his now-classic textbook, *Introduction to Concepts and Theories in Physical Science*. This book was followed in 1958 by *Foundations of Modern Physical Science*, written with Duane H. D. Roller. The first book is still alive and well in a revised edition (with Stephen G. Brush) titled *Physics, the Human Adventure: From Copernicus to Einstein and Beyond* (Rutgers, 2001). These texts served as the framework for the well-known Project Physics Course, which began in 1964 as

an NSF-sponsored national curriculum-development project co-directed by Holton. With its textbook, films, laboratory exercises, and other materials, the Course brought physics, as seen through its history, to some 200,000 high school

students a year. The book still exists in a revised edition titled *Understanding Physics* (Springer, 2002), coauthored with David Cassidy and James Rutherford. This project not only influenced an entire generation of physics students and educators, but it also inspired recent initiatives by the NSF, the National Research Council, and the American Association for the Advancement of Science to improve U.S. science education.

Holton’s most widely admired study in the history of modern physics is his seminal work, *Thematic Origins of Scientific Thought: From Kepler to Einstein* (Harvard, 1973; revised in 1988). The innovative concept of thematic analysis he presented there has provided a new tool of thought,



Pais Prize Winner Gerald Holton

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Letter from the Chair:

Science is Not Simply a Matter of Faith

By Bill Evenson, Forum Chair

A few days after Thanksgiving, Paul Davies, physicist and writer on science and religion, published an opinion piece in the *New York Times* entitled, "Taking Science on Faith." His thesis was that, at its base, "science has its own faith-based belief system." Davies argues that science is built on "an unexplained set of physical laws" and draws a parallel to religion's faith in "an unexplained God."

The central issue here is that all human knowledge is uncertain and incomplete. Without certainty, some would say, every enterprise is founded on faith of some kind. However, I have three caveats relevant to history of physics. First, not all uncertainty is created equal; there are degrees of certainty, depending on the strength of reasonable grounds for our beliefs. (Rational degrees of certainty or belief were starting points for the probability theories of Laplace, R. T. Cox, E. T. Jaynes, and others.) Second, science has widely accepted strategies for

producing and evaluating evidence that provides firm grounds for scientific beliefs. Finally, science works; it produces reliable knowledge with demonstrable effects.

History of physics works to clarify all these issues: the grounds for our scientific beliefs, the strategies that produce reliable (even though not certain) knowledge, and the extent of the reliable knowledge produced by science. The insights of historians of physics have illuminated the methods, foundations, and products of science. They have shown where the greatest uncertainties remain, and how interesting and complex questions have been resolved. While I recognize both the power and comfort religious faith brings to humanity, I reject the parallels between religious faith and scientific beliefs in the context of uncertainty—parallels that are espoused by Davies and many hopeful believers. Both the nature and degree of the "faith" that lies at the foundation of these approaches to understanding the world are qualitatively different for religion and science. Anyone who takes comfort in characterizing science as "only" a matter of faith should read physics history more deeply, and the perspective provided by this history should be an essential part of science education.

The Forum supports a strong role for the history of physics in the physics community. It will continue to encourage physics historians, provide a venue for discussing their work, and involve practicing physicists in that discussion.

I wish to congratulate the Forum Program Committee on plans for history programs at the March (New Orleans) and April (St. Louis) APS Meetings. Chair-Elect David Cassidy and Vice Chair Gloria Lubkin and their committees have organized these fine programs. Elsewhere in this newsletter (on p. 3), you will find specifics of the excellent sessions planned for these meetings. In addition to the invited symposia organized by the Forum, we continue to have stimulating

contributed sessions at both meetings. I hope you can attend one or both of these meetings.

Quick Reminders: Please consider making a donation in honor of a significant colleague who has passed on. Such donations can either support students presenting contributed history talks or sponsor an invited lecture at one of the APS meetings. The donors can choose who (among deceased physicists) is to be honored, and the Forum Program Committee will select the speaker. Contact me or any other Forum officer if you wish to make such a donation.

The Forum Executive Committee is currently seeking an Associate Editor for the *History of Physics Newsletter*, to be appointed in time to work with the current Editor, Michael Riordan, and take over as Editor for the Fall issue 2009. Please contact me at bill@evenson.ch if you are interested in this possibility or wish to suggest a colleague.

Remember to send a short record of the work of retiring scientists (yourself or colleagues) to the Center for History of Physics, as explained by Virginia Trimble in the February 2007 issue of this newsletter. Likewise, continue to send department histories to the Center for History of Physics and JDJackson@lbl.gov.

Finally, please nominate your deserving colleagues with accomplishments in history of physics for APS Fellowship (more details on p. 4).

Final Remarks: My greatest pleasure during my term as Forum Chair has been working with physicists and historians to put together the history symposia that have come to play such an important role at the national APS meetings. Working to organize the large and non-standard-format session that commemorated the 20th anniversary of the discovery of high-temperature superconductivity at the 2007 March Meeting was both challenging and satisfying.

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History of Physics NEWSLETTER

The Forum on History of Physics of the American Physical Society publishes this Newsletter semi-annually. Nonmembers who wish to receive the Newsletter should make a donation to the Forum of \$5 per year (+ \$3 additional for airmail). Each 3-year volume consists of six issues.

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Forum Sessions at the 2008 APS Meetings

By David C. Cassidy, Chair, Program Committee

The Forum Program Committee is conducting an experiment this year. At the suggestion of Forum Chair Bill Evenson, we divided the program committee into two subcommittees under the overall direction of the Program Chair: an April committee chaired by Cassidy, and a March committee co-chaired by Vice Chair Gloria Lubkin and George Zimmerman. So far the experiment has succeeded quite nicely. Since each committee can now devote full attention to its specific meeting, the result has been a more carefully selected and broadly based program of invited sessions at each of the two meetings.

An overview of the March and April invited sessions is given below. Among the many highlights of these two meetings is the celebration of the 50th anniversary of *Physical Review Letters*. A session on *PRL* is planned at each of the two meetings with a series of outstanding speakers who will explore the past, present, and the important issue of the future of research publication in the electronic age. Another highlight will be a unique session at the April meeting celebrating the 65th anniversary of the beginning of the Manhattan Project and the work at Los Alamos. Ben Bederson, who worked on the Manhattan Project and organized the session, has invited all physics alumni of the project to attend the meeting and participate in an extended panel discussion following the presentation by Val Fitch, also an alumnus of the project. In addition, the April meeting will have two back-to-back sessions on the "Triumphs of 20th Century Astrophysics," one focusing on instrumentation and the other on discoveries. There will also be an April invited session in recognition of 80 years of quantum mechanics, in which members of a new international project on the history of quantum mechanics will present their latest work. And during the March meeting, a session on the history of physics in industrial settings will occur.

In addition to these invited sessions, Gerald Holton, winner of the 2008 Abraham Pais Prize for the History of Physics (see p. 1), will speak on April 14 in a joint award session co-sponsored with the Forum on Physics and Society. Sessions for contributed papers are also scheduled in both March and April meetings; travel grants are available for students presenting contributed papers in these sessions. Some of the titles of the papers given below are still tentative.

March 10–14, 2008 New Orleans, Louisiana

50th Anniversary of Physical Review Letters, March 11.

Saad Hebboul, *Physical Review Letters*, "PRL at 50: A History of Physics Moving Forward"

H. Eugene Stanley, *Boston University*, "Phase Transitions and Critical Phenomena"

Marvin L. Cohen, *University of California, Berkeley*, "Condensed Matter Theory: From Models to First Principles"

Charles P. Slichter, *University of Illinois, Urbana-Champaign*, "NMR and the BCS Theory"

Jack Sandweiss, *Yale University*, "The Future of Scientific Publishing"

Industrial Physics History, March 13.

Paul Horn, *IBM Watson Research Center*, "Industrial Research at IBM"

James Hollenhorst, *Agilent Labs*, "Reflections on Three Corporate Research Labs: Bell Labs, HP Labs, and Agilent Labs"

Robert A. Frosch, *Harvard University*, "Application Oriented R&D: Aphorisms & Anecdotes" (The John Bardeen Lecture)

David J. Bishop, *Bell Labs*, "The History of Science and Technology at Bell Labs"

Robert Doering, *Texas Instruments*, "50 Years of 'Scaling' Jack Kilby's Invention"

April 12-15, 2008 St. Louis, Missouri

Triumphs of 20th Century Astrophysics, April 12, co-sponsored with DAP.

Chair of both sessions: Ramanath Cowsik, *Washington University*

I. Observatories and Telescopes.

Joseph Miller, *Lick Observatory, UC Santa Cruz*, "Lick Observatory and the Shift of Astronomical Power to California"

Mario Livio, *Space Telescope Science Institute*, "Hubble Space Telescope: Images that Go Around the World"

Elizabeth Barton, *University of California, Irvine*, "Data by the Terabyte: Large, Versatile Telescopes and Upcoming Technology"

II. We Master the Stars.

Matthew Stanley, *Michigan State University*, "How We Learned the Stars Run on Nuclear Energy"

Stirling A. Colgate, *Los Alamos National Laboratory*, "Stars at the Highest Energy"

Mark McCaughrean, *University of Exeter*, "Star Formation as Seen in the Early Years of the Overwhelmingly Large Telescopes" (The Kenneth Greisen Lecture)

Los Alamos and the Manhattan Project: 65th Anniversary, April 13, co-sponsored with FPS.
Chair: Benjamin Bederson, *New York University*

Cynthia C. Kelly, *Atomic Heritage Foundation*, "The Manhattan Project: A History Worth Preserving"

Val L. Fitch, *Princeton University*, "Life on and off the Mesa"

David C. Cassidy, *Hofstra University*, Moderator, "Panel Discussion with Physicist Alumni of the Manhattan Project"

80 Years of Quantum Mechanics: A New International Project, April 14.
Chair: Clayton A. Gearhart, *St. John's University, Minnesota*

Michel Janssen, *University of Minnesota*, "Van Vleck and Slater: Two Americans on the Road to Matrix Mechanics"

Christoph Lehner, *Max Planck Institute for History of Science, Berlin*, "Creative Confusion: Quantum Theory on the Way to Wave Mechanics"

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Crease and Howard Named APS Fellows

By David C. Cassidy

Upon the recommendation of the Forum on History of Physics, the APS Council has named Robert P. Crease and Don Howard Fellows of the American Physical Society.

Robert P. Crease is professor and chair of the Department of Philosophy in the State University of New York at Stony Brook. The fellowship citation reads: "For his extensive historical writings on physics, including *The Second Creation; Making Physics: A Biography of Brookhaven National Laboratory*, and his completion of Robert Serber's memoirs and Abraham Pais' biography of J. Robert Oppenheimer."

Crease received his bachelor's degree at Amherst College and his doctorate at Columbia University, both in philosophy. In addition to his work in philosophy, he has made major scholarly contributions to the history of physics and has been active in physics journalism. He is the historian of Brookhaven National Laboratory, which led to his acclaimed "biography" of the laboratory and his lengthy histories of its ISABELLE project and the National Synchrotron Light Source. He has also written many additional accounts of specific episodes in the history of 20th century physics as well as incisive articles on historical methodology. Among his books not

listed in the citation are: *The Prism and the Pendulum: The Ten Most Beautiful Experiments in Science*; and *The Play of Nature: Experimentation as Performance*. He helped Robert Serber complete his memoir, *Peace and War: Reflections on a Life at the Frontiers of Science*. And following the death of Abraham Pais, Crease completed his unfinished biography, *J. Robert Oppenheimer: A Life*. He has been a contributing correspondent for Science and a contributing editor for The Scientist. He also writes the long-running, popular monthly column "Critical Point" for Physics World, and he translates Dutch works into English.

Don Howard is a professor in the Department of Philosophy at the University of Notre Dame and director of its Program in History and Philosophy of Science. The fellowship citation reads: "For his ground-breaking studies of the interplay between physics and philosophy of science in the 20th century, especially in connection with the work of Einstein and Bohr, and for organizing conference series and editing book series fostering the dialogue among physicists, philosophers, and historians of science."

Howard received his bachelor's degree in physics from Michigan State University, and his master's and

doctoral degrees in philosophy from Boston University, where he wrote his dissertation under Abner Shimony. He has written extensively on Bohr and the origins of quantum mechanics; on Einstein and the foundations of relativity theory; and on the Bohr-Einstein dialogue on interpretations of quantum mechanics. Among his many published studies are: "Reduction and Emergence in the Physical Sciences: Some Lessons from the Particle Physics and Condensed Matter Debate"; "Point Coincidences and Pointer Coincidences: Einstein on Invariant Structure in Spacetime Theories"; and "Revisiting the Einstein-Bohr Dialogue." As a co-founder of the group History of the Philosophy of Science and a member of the International Advisory Committee for the series of History of General Relativity conferences, he has been instrumental in bringing together physicists, philosophers and historians. He has also been a contributor to and co-editor of the two series *Einstein Studies* and *History of Science and Philosophy of Science*, as well as a contributing editor and translation consultant for *The Collected Papers of Albert Einstein*. ■

Call for Fellowship Nominations

The Fellowship Committee calls for the nomination of suitable candidates for APS Fellow through the Forum on the History of Physics. These nominations should be based at least in part upon achievements related to the history of physics. The Forum deadline for the receipt of all materials at APS is 15 May 2008. Procedures for nomination have recently changed. The new procedures are now available at:

<http://www.aps.org/programs/honors/index.cfm> (scroll down to Fellowship).

According to these procedures, all nominations are to be submitted to the APS via the online nomination package provided at the indicated web site. The nominees must be APS members in good standing, which

may be confirmed through the above website. A sponsor (nominator) and a co-sponsor, both of whom must be APS members, are required. Up to two supporting letters from other individuals, who do not have to be APS members, may be also submitted by uploading to the site. Please visit the above web site for further information and to obtain a list of the required documentation.

Nominations will be forwarded to the Forum Fellowship Committee for review. This committee will make its recommendation to the Forum Executive Committee, and after that all nominations will go to the APS Council for approval. Fellowship nominations may be submitted at any time, but must be received by 15 May 2008 for the next review.

For further information, please contact the chair of the Forum Fellowship Committee, Gloria Lubkin at glubkin@aip.org, or the APS fellowship officer at fellowship@aps.org or by telephone at (301) 209-3268. ■

Letter from the Chair

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I am proud of having helped improve the structure of our future Program Committees, which should further strengthen the history symposia offered each year. The physics community, including physics history, is like no other for me, giving both social and intellectual satisfactions. ■

Gerald Holton Wins Pais Award

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used not only in his own work but also in that of many other scholars. Holton's treatment of Einstein's relativity theory in this book established his standing as a major interpreter of Einstein's work and its background; it has shaped scholarly discourse in this critical area of the history of physics for more than a generation. *Thematic Origins* also presents other often-cited studies, such as on the philosophical roots of Bohr's complementarity principle. This book displays one of Holton's major strengths: his attention to the humanistic and societal context of scientific research.

Among Holton's other books are *The Advancement of Science and Its Burdens*; *Einstein, History, and other Passions*; and *Science and Anti-Science*. In these works, he provides technical as well as humanistic analyses of the work of Poincaré, Millikan, Fermi, Heisenberg, and other physicists, reaching back even to the science of Thomas Young and Thomas Jefferson, and he gives an often-needed defense of the scientific enterprise against anti-scientific movements.

Throughout his career, Holton has been active in building and improving a variety of projects and institutions beneficial to the history of physics and related sciences. Working with Edward Purcell in the early 1960s, he was instrumental in initiating and supporting the jointly sponsored APS project, Sources for History of Quantum Physics. The project results have served ever since as a major repository of primary archival sources for the history of quantum mechanics and atomic physics. Similarly, Holton played a key role in preserving the Einstein Archive and in launching the Einstein Papers Project at Princeton University Press. He helped establish the APS Division (now Forum) on the History of Physics, serving as one of its founding chairs and as a frequent member of the Executive Committee. During the early 1960s, he also chaired the AIP committee that initiated the Center for History of Physics. As president of the History of Science Society during the early 1980s, Holton established over a dozen new programs, made possible by a funding drive that he initiated to

raise a substantial endowment for the Society.

Holton remains active today with speaking engagements and a new book underway on the history of twentieth-century physics. His recent research has also led to publications on the career problems of women scientists, on science policy, and on the fate of the children who came to the United States as refugees before World War II, with special attention to those who became scientists.

Among his many other honors and awards Gerald Holton was selected to deliver the Herbert Spencer Lectures at Oxford University. He was the first historian of science to deliver the annual Jefferson Lecture of the National Endowment for the Humanities. He has been awarded the Sarton Medal of the History of Science Society, the Oersted Medal, the Joseph Priestley Award, and the AIP's Andrew W. Gemant Award, plus eight honorary degrees. ■

Editor's Note: I am personally delighted by this selection, for I have used Holton's *Thematic Origins* as a text in all the course I've taught in the history of 20th century physics at Stanford and the University of California, Santa Cruz.

Forum Sessions at the 2008 APS March Meeting

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Alexei Kojevnikov, *University of British Columbia*, "Knabenphysik': The Birth of Quantum Mechanics from a Postdoctoral Viewpoint"

50th Anniversary of Physical Review Letters, April 14, co-sponsored with DPF.

Chair: R. Sekhar Chivukula, *Michigan State University*

Robert J. Garisto, *Brookhaven National Laboratory*, "Half a Century of PRL"

Michael S. Turner, *University of Chicago*, "title to be announced"

Michael E. Peskin, *Stanford Linear Accelerator Center* "PRL and Experimental Particle Physics" ■

Preserving Departmental Histories

By J. David Jackson

The APS Forum on History of Physics renews the call (from *APS News*, January 2007) to every physics department to help preserve its history and accomplishments by updating an existing history or preparing a new one. The histories should be deposited with the AIP Niels Bohr Library and entered in the Forum's new Register of Departmental Histories and Records (see below).

A coherent historical narrative may be supplemented by specialized records and documents, such as annual faculty lists and course descriptions from university catalogs. Examples of the diversity of materials already on hand at the AIP are the informal and probably incomplete listings found in the Niels Bohr Library catalog for Cornell University and the University of Michigan, as given below. Note, however, that the most recent of these items are over 20 years old, and most are much older.

Cornell University:

"Seventy years of physics at Cornell," by Harley Earl Howe, 1958.

"The Cornell Physics Department—recollections and a history of sorts," by Paul Hartman, 1984.

Pages from faculty listing of the Cornell University Department of Physics, 1910–1940, by Cornell University.

University of Michigan:

"The University of Michigan Department of Physics, 1843–1944," by Charles F. Meyer, 1944.

"Physics and the Department of Physics since 1900—Definitions and Reflections," by David Mathias Denison, 1967.

"On the history of physics at Michigan: Nuclear physics," by W. C. Parkinson, 1986.

"The Michigan Symposium on Theoretical Physics," by Samuel A. Goudsmidt, ca. 1961.

Pages from catalogs listing faculty of the physics department, 1910–1940, by University of Michigan Department of Physics.

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Catalogs listing of courses in physics and staff of the University of Michigan Department of Physics, 1925–1941, by University of Michigan.

Copies of physics and chemistry examinations, 1896–1901, by University of Michigan.

A directory of research in the Physics Department of the University of Michigan, 1962, by University of Michigan Department of Physics.

To the extent that an up-to-date historical record is not on file at the Niels Bohr Library, the Forum urges a physics department to prepare or update a history of its department and any research laboratories, and to send a copy (in whatever form) to the Niels Bohr Library, in care of Dr. Spencer Weart, AIP Center for History of Physics, One Physics Ellipse, College Park, MD 20740-3843 (email: sweart@aip.org). Placing historical documents on the departmental web site would also give increased access to all.

Separately the Forum has established a Register of Departmental Histories and Records, to be published periodically in the Forum newsletter and on its web site. Entries should be standard bibliographic citations with indications of availability in institutional or departmental libraries, through web links, and (we hope) at the Bohr Library. This Register will provide another tool for finding information about past activities in physics research and education, to serve as a starting point for more focused searches. Please send Register entries for existing histories, other materials and new entries as they are produced to J. D. Jackson, 50A-5104 Lawrence Berkeley National Laboratory, Berkeley CA 94720 (email: JDJackson@lbl.gov). The materials themselves should be sent to the Niels Bohr Library (address above).

The APS Forum on History of Physics congratulates those departments with an up-to-date history on file in its library and at the Niels Bohr Library. If it does not exist, please prepare one! Forum members are encouraged to take the initiative in preparing them. ■

Forum Elections: Candidate Biographies & Statements

The Nominating Committee of the Forum on History of Physics has chosen a slate of candidates for the 2008 elections. You will soon be asked to vote for Forum Vice-Chair and two at-large members of the Executive Committee. The person elected to be Vice-Chair normally becomes the new Chair-Elect in 2009 and Chair of the Forum in 2010.

If you have an email address registered with APS, you will receive a message inviting you to vote electronically. If you do not have such an address, you should have received a paper ballot by mail. If you want a paper ballot but have not yet received one, please either email your request to the Secretary-Treasurer Thomas Miller (thomas.miller@hanscom.af.mil), or contact him postally (Boston College Institute for Scientific Research, Air Force Research Laboratory/VSBXT, Hanscom AFB, MA 01731) or by telephone (781-377-5031). The closing date of the election for online voting is 16 March 2008; the final date for receipt of paper ballots is March 21.

Biographical information and statements by the candidates appear below. Similar materials can be found online at: <http://www.aps.org/units/fhnp/elections/candidates08.cfm>.

Please vote!

Candidates for Vice Chair

Martin Blume

American Physical Society and
Brookhaven National Laboratory
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Biographical Information: Martin Blume is Editor-in-Chief Emeritus of the American Physical Society and Senior Physicist Emeritus at Brookhaven National Laboratory. He received his A.B. degree from Princeton in 1954 and a Ph.D. from Harvard in physics in 1959. He was a Fulbright Fellow at Tokyo University in 1959-1960, and Research Associate at the Atomic Energy Research Establishment at Harwell, UK in 1960-1962. He came to Brookhaven in 1962 where

his research centered on condensed matter theory, particularly on the theory of magnetism, phase transitions, neutron scattering, and synchrotron radiation. He held many research and management positions at Brookhaven, including head of condensed matter theory, Deputy Chair of the Physics Department, Chair of the National Synchrotron Light Source Department, and Deputy Director of the Laboratory. In addition he was Professor of Physics at Stony Brook University from 1972-1980. In 1996 Blume took a leave of absence from Brookhaven to become Editor-in-Chief of the APS, with responsibility for all of the Society's journals. He served two five year terms as Editor-in-Chief, retiring in March of 2007. During his service as EIC he oversaw the transition of the *Physical Reviews* to electronic distribution, including putting all of the journals on-line, back to the origins of *Physical Review* in 1893, and reworking the operation of the editorial process to completely electronic form, with a virtually paperless office.

Blume received the 1981 E. O. Lawrence Award in Physics of the Department of Energy for his research on Neutron Scattering and Synchrotron Radiation, and the Argonne National Laboratory Advanced Photon Source A. H. Compton Award for his theoretical research on resonant X-ray scattering in 2003. In 2005 he received from the Council of Science Editors their highest award for his innovations and accomplishments in scientific publication. He has served on many committees of the APS, including election to the Council and Executive Board as well as Chair of the Nominating Committee. He has served also on committees of the National Research Council, the National Science Foundation, the Department of Energy, the Institute of Pure and Applied Physics, and on many visiting committees of institutions around the world. He is a Fellow of the American Academy of Arts and Sciences, the American Physical Society, the American Association for the Advancement of Science, and the British Institute of Physics.

Statement: My interest and involvement in the history of physics goes back to my administrative positions at Brookhaven, which required justification for locating research efforts at national laboratories, and the history of the national laboratories provided such justification. My interest intensified during my terms as Editor-in-Chief: The on line availability of all of the content of the APS journals is a treasure trove of historical information both about the Society and about the physics of the 20th (and now 21st) century. During the 2005 celebration of the World Year of Physics I gave a well attended invited talk on Scientific Publication Since Einstein at the German Physical Society meeting in Berlin, where Einstein's involvement with the Physical Review was highlighted. The often "Standing Room Only" status of invited sessions of Forum shows the great interest in the history of our science, and we should take advantage of this, first to increase membership in the Forum, and then to arrange more such sessions at the smaller meetings of the Society, focusing on historical developments relevant to the location and topics of the meetings. Also of importance is the relationship between the history of physics and the policy, international, and educational programs of the Society, so joint sessions with the other forums in those areas should be promoted, and an aggressive campaign to obtain more nominations for APS Fellowship through the Forum, separately and with other Society divisions, is in order. Finally, 2008 will be the 50th anniversary of the start, by then Editor-in-Chief Sam Goudsmit, of *Physical Review Letters*, the first—and widely imitated—"Letters" journal. Both Goudsmit and many of the articles published in *PRL* have been of considerable importance in the history of physics in the 20th century and, in addition to invited talks (already planned) at the APS March Meeting, an electronic collection of those articles could be promoted.

Daniel Kleppner

Massachusetts Institute of Technology
Email: kleppner@mit.edu

Biographical Information: Daniel Kleppner received the B.Sc. degree from Williams College, B.A. Degree from Cambridge University and Ph.D. degree from Harvard University. He joined the physics faculty at MIT in 1966 and in 2003 became Lester Wolfe Professor of Physics Emeritus. His research has been in atomic physics including high precision measurements, quantum optics, and ultracold atoms. He helped to found the MIT-Harvard Center for Ultracold Atoms where he is currently Co-Director. His awards include the Davisson Germer Prize, Lilienfeld Prize and Leo Szilard Lectureship Award of the APS, the Meggers Award and Frederick Ives Medal of the Optical Society of American, the Oersted Medal of the American Association of Physics Teachers, the Wolf Foundation Prize and the National Medal of Science. He is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, the Academies of Science (Paris), and the American Philosophical Society.

In the APS Kleppner served as Counselor (1986-89) and member of the Executive Committee (1986-1988), Panel on Public Affairs (1989-1992) and the Physics Planning Committee (1989-96, chair 1992-96). He was Chair of the Division of Atomic, Molecular and Optical Physics (1983-84), and member of the Editorial Boards of *Physical Review A* (1982-88) and *Reviews of Modern Physics* (2004-). He was co-chair of the APS Study on Boost-Phase Intercept for National Missile Defense (2002-04). His AIP activities include the Development Committee for the Center for History of Physics, which he has chaired since 2004. He is the co-author of two textbooks and writes occasional essays for *Physics Today*.

Statement: The history of physics is invaluable for teaching physics at every level and for communicating the process and values of physics to a society that increasingly depends on science but appears to be increasingly mistrustful. The Forum has a unique opportunity to stimulate the creation of histories, disseminate historical information on physics, and assist the physics community in transmitting its values to the public.

Candidates for At-Large Member of the Executive Committee

Robert G. Arns

University of Vermont
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Biographical Information: Bob Arns is an experimental physicist with a background in nuclear and particle physics whose professional interests have turned in the last few years to the history of physics and the history of technologies based in physics. A B.S. graduate of Canisius College, he received M.S. and Ph.D. degrees in Nuclear Physics from the University of Michigan. He has served as a physics faculty member at the State University of New York at Buffalo, Ohio State University, and the University of Vermont, where he is currently Physics Professor Emeritus. At Vermont he also served as a Dean and as Provost. He is a member of The American Physical Society, the American Association of Physics Teachers, the History of Science Society, the Society for the History of Technology, Phi Beta Kappa, and Sigma Xi. In 1998 he was awarded the Institute of Electrical and Electronics Engineers Life Members' Prize for the "best research reported in any journal in 1997 on any aspect of the history of electrical/electronic technologies."

Statement: My current research has involved the painfully slow rate at which special relativity and other modern physics concepts have made their way into the teaching of introductory and intermediate physics; and the life and scientific legacy of Ettore Majorana, who was born in 1906 and disappeared mysteriously in 1938. Recent publications include studies of the role of resonant cavities in acoustics; of J. E. Lilienfeld and the development of high-vacuum x-ray tubes; of the history of the field-effect transistor; and of the early history of neutrino detection. As might be inferred from the foregoing, my interests include not only physicists and their accomplishments, but also the evolution of scientific thought, and factors affecting the processes and rate of acceptance of new concepts. These efforts in the history of physics have provided an historical perspective that

has enriched both my physics teaching and my own awareness of the complexity of scientific change. If elected I will endeavor to bring these qualities to my work on the Forum Executive Committee.

Ramanath Cowsik

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Biographical Information: Ramanath Cowsik is a Professor of Physics and Director, McDonnell Center for the Space Sciences at Washington University in St. Louis, MO. He received his Ph.D. in Physics from the University of Bombay in Mumbai, India. His current research interests include astroparticle physics, experimental gravitation, cosmology, high-energy astrophysics and seismology. Professor Cowsik was formerly the Distinguished Professor at the Tata Institute of Fundamental Research (1996–2001) and the Director of the Indian Institute of Astrophysics (July 1992–December 2003). He has received the Vikram Sarabhai Award for Space Sciences (Hari Om Prerit) in 1981, the Shanti Swarup Bhatnagar Award in Physical Sciences in 1984, the National Aeronautics and Space Administration Public Service Group Achievement Award in 1986, the Third World Academy of Sciences Award in Basic Sciences (Physics) in 1995, and the Padma Shri Award by the Government of India in 2002. Professor Cowsik is a member of the U.S. National Academy of Sciences (as a foreign associate), a Fellow of the Indian Academy of Sciences, and the Third World Academy of Sciences and a Life Member of the American Physical Society. He also served on the International Union of Pure and Applied Physics in 1999–2002.

Statement: Research activities in Physics, as in all other intellectual endeavors, are influenced by the nature of society and the historic conditions that are prevalent at the time major advances are made in the field. Though this interconnection is extensively explored in other fields such as art, music, or technology, there exist only a few studies that bear on this in the context of the progress in fundamental physics. Through the Forum on the History of Physics in association with other units

such as the Divisions of Particles and Fields, Condensed Matter Physics, and the Forum on Physics and Society, I plan to stimulate such investigations.

Michael Demkowicz

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Biographical Information: Michael Demkowicz received B.S. degrees in Physics and in Aerospace Engineering from the University of Texas at Austin in 2000. He also received a B.A. in Liberal Arts through UT's Plan II Honors program, where he was first introduced to the history of science. His undergraduate senior thesis entitled "An undergraduate's research experience in physics"—supervised by M. P. Marder—contrasted experimental work as it is taught in undergraduate laboratories with how it is practiced by professional physicists. It received a Plan II model thesis award in 2000. Demkowicz joined the Mechanics of Materials group at the Massachusetts Institute of Technology in 2000 as a National Science Foundation fellow and MIT Presidential Fellow. He received his M.S. in 2004 and Ph.D. in 2005 for his research on plasticity of amorphous silicon, done with A. S. Argon. He is currently a Director's Postdoctoral Fellow at Los Alamos National Laboratory working with R. G. Hoagland on radiation damage in solids.

Statement: I believe there is currently an important gap in the typical curriculum of undergraduate and graduate education in physics: although students are given extensive technical training in experimental and theoretical methods, they do not study the intellectual processes by which observations were interpreted to form theories. As a result, in addition to being poorly prepared to critically evaluate equally plausible alternative interpretations of their own work, they also lack the "big picture" perspective on the development of science that would help them to plan their careers. Furthermore, a physicist educated in the current curricula finds it difficult to defend scientific perspectives to skeptical non-scientists. I propose that the history of science—and of physics in particular—can play a decisive role in filling this educational gap: situations drawn from the history of physics illustrate the processes of theory formation,

cast individual research projects in the broader context of physics as a coherent discipline, and provide examples of "physics in action" that make the intellectual processes of scientific research accessible to non-scientists. As a member of the executive committee of the APS Forum on History of Physics, one of my goals would be to encourage ideas on how the study of the history of physics could enhance the typical course of a physicist's education by filling the gaps described above. Since my own undergraduate and graduate studies are still fresh in my memory, I stand to bring to this question a perspective that bridges that of a student and a professional researcher. By the end of my term, I would like to make available a document presenting the gathered suggestions, examples of their implementation, reflections on their impact, and recommendations for future action. Furthermore, as a researcher in the solid state/materials science side of physics, I plan to lobby for increased interest in the Forum on History of Physics among the traditional attendees of the APS March Meeting by organizing Forum sessions at the March Meeting and encouraging participation in ongoing projects such as the Niels Bohr Library and Archives.

C.W. Francis Everitt

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Biographical Information: Francis Everitt did his undergraduate and graduate work at Imperial College, London (Ph. D., 1959, with P. M. S. Blackett and J. A. Clegg). His thesis was on paleomagnetism of the Carboniferous period (~ 300 million years ago), establishing among other things with J. C. Belshé that during that period Britain was 10 degrees south of the equator, a key result in the emerging field of continental drift and plate tectonics. Changing fields in 1960 to cryogenics, he transferred to the University of Pennsylvania where, with K. R. Atkins and A. Denenstein, he was responsible for the discovery of third sound in superfluid helium. Since 1962 at Stanford, he has maintained two separate, sometimes overlapping, interests, fundamental physics in space, and the history and philosophy of physics. He is Principal Investigator

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Edmund C. Stoner and the Discovery of the Maximum Mass of White Dwarfs

By Michael Nauenberg, University of California, Santa Cruz

The existence of a mass limit for white dwarfs is usually attributed solely to Subramanyan Chandrasekhar, and this limit is now named after him. But as is often the case, the history of this discovery is more nuanced. Actually, the existence of a maximum mass was first established by Edmund C. Stoner, who a few years earlier had played an important role in Pauli's formulation of the exclusion principle in quantum physics. Stoner's interest in dense stars was aroused by Ralph Fowler's application of this principle to solve the puzzle of the origin of the extremely high density of white dwarfs, which could not be explained by classical physics. Stoner subsequently applied the minimum-energy principle to obtain the equilibrium properties of dense stars in a constant-density approximation, substituting for the internal energy Fowler's non-relativistic equation of state for a degenerate electron gas. In particular, he found that the density increases with the square of the mass of the star. But alerted by Wilhem Anderson that for white dwarfs with masses comparable to the Sun's this result implied that the electrons become relativistic, Stoner obtained the fully relativistic equation of state for a degenerate electron gas.

Based on solid theoretical foundations, Stoner then calculated the properties of white dwarfs for arbitrary densities, and obtained the critical mass in the limit that the density approaches infinity. His paper, "The Equilibrium of White Dwarfs," appeared in 1930—a year before publication of Chandrasekhar's first short paper on his calculation of the critical mass. Chandrasekhar acknowledged that his result was in "agreement" with Stoner's, but he also claimed, without giving a valid proof, that the critical mass was a maximum. But this result had already been demonstrated by Stoner, who had shown that the mass is a monotonically increasing function of the density, while it took Chandrasekhar several additional months before he found a valid argument for this conclusion and he was able to show that the density becomes infinite



Edmund C. Stoner

at the critical mass. At about the same time, Lev Landau, who was a visitor in Zurich collaborating with Pauli's assistant, Rudolf Peierls, also evaluated the critical mass.

Stoner was encouraged by Arthur S. Eddington to pursue further the implication of his relativistic equation of state for stellar structure, and he communicated Stoner's last two papers on this subject to the *Monthly Notices of the Royal Astronomical Society*. His correspondence with Stoner deepens the mystery why several years later, in a devastating public attack on Chandrasekhar's similar work on white dwarfs, Eddington rejected Stoner's relativistic equation of state, and its profound implication for the existence of a white dwarf mass limit. Eddington's criticisms were entirely unfounded, but his enormous prestige led to the acceptance of his views by a majority of the astronomical community, and to the initial rejection of Chandrasekhar's work.

In Kameshwar Wali's excellent biography of Chandrasekhar, Stoner is never mentioned. More recently, in his book *The Empire of Stars*, Arthur Miller remarked, "It was indeed extraordinary that a nineteen-year-old Indian youth had managed to make a discovery that had eluded the great minds of European astrophysics." Although Miller refers briefly to Anderson and

to Stoner, he claimed that "they had never examined the ramifications" of the relativistic equation of state. With regard to Stoner, however, this claim is incorrect. In his 1983 Nobel prize lecture, Chandrasekhar gave a historical review of his work on white dwarfs but did not cite Stoner's prior work.

This universal neglect of Stoner's seminal work on white dwarfs explains why, with a few notable exceptions, his contributions to the discovery of the maximum mass of white dwarfs have been forgotten until now. ■

Editor's Note: Nauenberg's complete article on Stoner will appear in the May issue of the *Journal of the History of Astronomy*.

Candidates

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of the National Aeronautics and Space Administration's Gravity Probe B and Satellite Test of the Equivalence Principle programs. His historical writings have included a biography of James Clerk Maxwell and studies from various viewpoints of Fritz and Heinz London, Leonard Schiff, William Fairbank, and, most recently, the complex transition from classical to modern physics in the thinking of Kelvin, Maxwell and Einstein.

Statement: One of the strengths, but also one of the problems, of the evolution in studies of the history of science over the last few decades and, in particular, the history of physics, is that the field has become a profession in its own right. Historians address their discourse to each other rather than to us physicists, and to us that discourse often seems remote. It is a loss to both sides. History matters, and the collection of myths that we physicists too often suppose to be the history of our field is profoundly misleading. My hope, as a Forum member, would be to aid in constructing bridges across this divide and to enable APS members to realize how enlightening a truer history of physics can be, culturally and in the actual contemporary practice of our field. ■

Thinking with Objects: The Transformation of Mechanics in the Seventeenth Century

By Domenico Bertoloni Meli

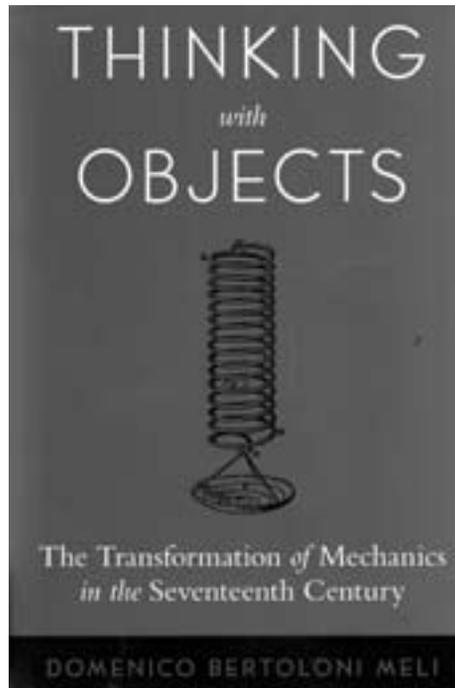
Baltimore, MD: Johns Hopkins University Press, 2007, illustrated, 389 pages

Reviewed by Michael Nauenberg

Thinking with Objects is a comprehensive book that describes some of the outstanding developments in mechanics that occurred during the seventeenth century. The “objects” in the title are the familiar ones found in undergraduate physics labs—the lever, the spring, the pendulum, rolling balls on inclined planes, etc.—that are employed to illustrate the principles of mechanics. Until the seventeenth century, however, most of these principles were not yet known, and experiments with these mundane objects were carried out to find possible mathematical regularities that would describe their observed properties. Any rules found were then applied to understand the properties of a much wider variety of objects, including the motion of celestial bodies.

In recent years, valuable scholarly work has contributed to a deeper understanding of various aspects of the development of mechanics. A professor in the Department of History and Philosophy of Science at Indiana University, Domenico Bertoloni Meli has incorporated the newly found insights in his book, but on some still controversial matters he expresses his own, often strongly held, views. The book contains an excellent and up-to-date list of bibliographic references, and the text is often supplemented by reproductions of original diagrams; there are lengthy explanatory captions and informative notes at the end of the book.

In general, physics students learn that the development of mechanics in the seventeenth century began with Galileo and culminated with Newton’s magisterial *Principia Mathematica*, where the principles discovered in experiments with the pendulum and colliding balls were successfully formulated into precise mathematical laws of motion. But there were also other important figures who contributed to



this transformation of mechanics, and Meli discusses their work, too. For example, in the seventeenth, Robert Hooke was undoubtedly the most prolific practitioner in the arts of experimentation. In his investigations he employed not only mundane objects, but also elaborate devices, including the air pump, the microscope and the telescope, which Meli distinguishes here as “philosophical” instruments. In fact, the book cover shows Hooke’s drawing of the spring balance (not identified until it appears in Figure 8.8 on p. 245), which he used to illustrate his famous law, *Ut tensio, sic vis* [As the extension, so the force].

Recent historical research has also shown that Hooke’s experiments with a conical pendulum and with a rolling ball in an inverted cone led him to fundamental insights on the general principles of orbital motion. In a very fruitful correspondence, Hooke communicated his physical ideas to Newton, who then combined them with his own insights into a precise mathematical formalism of mechanics—without, however, giving Hooke any credit.

Another important contributor, Christian Huygens, also experimented with the conical pendulum, and developed sophisticated mathematical methods including the use of infinitesimal quantities, predating the invention of the calculus by Newton and Leibniz. This work led Huygens to discover that the centripetal acceleration of a body revolving uniformly around a circle is proportional to the square of its velocity and inversely proportional to the radius of the circle. Thus Huygens—and independently Newton—was able to explain, for the first time, why a body on the surface of our rotating earth does not fly off, and in the process resolved one of the major objections to Copernican astronomy.

Thinking with Objects is however marred by a lack of clarity and some serious errors in explaining the physics and mathematics underlying the historical experiments. For example, in footnote 56 on p. 348, Meli claims that “a correct way to prove isochronism [of a mass oscillating at the end of a spring] would be to use the average speed, which is proportional to AC [the maximum displacement], therefore time [the period] is indeed constant.” In addition, he indicates that this manifestly incorrect argument is to be found in Newton’s proof of Proposition 10 in the *Principia*, given in corollary 2.

Describing Leibniz’s calculus, Meli explains that “the differential of an incomparably small distance ds gives a distance dds that is twice incomparably smaller than a finite magnitude” (p. 291). This explanation, however, is meaningless mathematically. In fact, at that time, Newton already had given in the *Principia* a precise mathematical definition to such first- and second-order differentials by considering the ratios of these quantities, and obtaining the limiting value of these ratios when the differentials vanish, which

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conforms with modern calculus.

In his introduction, Meli observes that the “choice of endpoints of a historical narrative is crucially important.” For the period under consideration, he bestows the honor for these two nodal points to Guidobaldo dal Monte, who was a patron and collaborator of Galileo, and to Pierre Varignon. Meli describes dal Monte’s work in considerable detail (the book’s index has about the same number of page references to dal Monte and to Newton), and he makes a good case for attributing to dal Monte a pivotal role at the start of the transformation of mechanics in the seventeenth century. But naming Varignon as an end point of this transformation is not justified. Together with Jakob Hermann and the Bernoulli brothers, Varignon contributed to the translation of Newton’s geometrical formulation of mechanics

in the *Principia* into the differential language of the calculus, first introduced into the continent by Leibniz. But Varignon did not make any original contributions to mechanics, and therefore it cannot be argued that he had any special role as an endpoint to the century-long transformation of this subject.

Some mathematical descriptions in the book are unnecessarily difficult to follow, because Meli often avoids using modern equations. He properly regards such equations as an anachronism that obscures the difficulties of using the mathematics of proportions that was available in the seventeenth century. But why impose these difficulties on modern readers?

In the last chapter of his book, Meli goes a bit overboard by introducing an elaborate “mapping” scheme—drawing lines and arrows connecting

objects and systems to illustrate the main thesis of his book. But this mapping does not convey any useful information, nor can I make sense, while referring to these objects, of remarks like “I find their amphibious and ambiguous nature helpful . . . because it reflects the status of mechanics as a mixed mathematical discipline.”

On the whole, however, *Thinking with Objects* is an excellent historical account that I highly recommend. ■

Michael Nauenberg is Professor of Physics, Emeritus, at the University of California, Santa Cruz, and a well-regarded scholar on Hooke and Newton.

Correspondence

I have several objections regarding the Fall 2007 review of *Out of the Shadows*, edited by Nina Byers and Gary Williams. Reviewer Eugenie Mielczarek appears to have had preconceived ideas regarding the book and details her disparate expectations extensively. Through most of her discussion, she misses the book’s emphasis on physics and imposes her own desiderata.

As a contributing author to that volume, I can knowledgeably say that it’s indeed a resource for “working women scientists”—and men scientists, too—notwithstanding Mielczarek’s “reluctant conclusion” in finally realizing this. The book is foremost an anthology of twentieth-century physics developments, and necessarily “presupposes a fair knowledge of physics.” In addition, it quite literally brings out of the shadows the women who accomplished these scientific advances. Contrary to Mielczarek’s perceptions, the book’s strength is not “as a historical record of . . . discrimination.” It is simply a history of some physics that is not as widely known as it should be.

The need for such a volume can be illustrated by an all-too recent incident.

At an AAPT meeting a few years ago, a young woman described her ongoing project in cosmic rays. She first summarized the historical background, detailing the work of Victor Hess. In a comment afterward I advised her to include the contributions of Marietta Blau, too. She reacted with visible shock: “I never heard of her!” That is exactly why this book is needed—to inform physicists of history that has been omitted from their customary studies.

Mielczarek gratuitously urges Byers and Williams to adapt their work “for high-school level readers.” But the information provided in the book is a trove of reference material for any author moved to write a book appropriate for young readers.

Finally, Mielczarek should recognize that an invitation to review a book is not a solicitation for an autobiographical sketch.

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Mielczarek replies:

Frieda Stahl disagrees with my assessment that this book is an important history of discrimination rather than of physics. But nearly half the sketches in it are about women working in nuclear science in academic settings. Where are the women who advanced materials science, plasma physics, biological and chemical physics, or atomic, molecular and optical physics? For example, materials science is represented by only three women; women in industry are also vastly under-represented. And although Stahl is offended by my autobiographical comments, she offers her own personal anecdote.

After my review appeared, I received several emails from other scientists commenting favorably on my review. There is no magic solution; it’s impossible to please all authors and readers. ■

Eugenie Vorburger Mielczarek
Emeritus Professor of Physics
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History of Physics

NEWSLETTER

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