



Innovation and Competitiveness: Keys to our Nation's Prosperity

Recommendations for Scientists, Technicians, Engineers, and Mathematicians



For the last year, I was an Albert Einstein Distinguished Educator Fellow in the office Congressman Rush Holt, one of two physicists in Congress. When I arrived in Washington, Members of Congress and key stakeholders were talking about Tom Friedman's book *The World Is Flat*, as well as multiple reports of a similar nature. The books and reports tend to agree that there is an

emerging global *knowledge* economy that will include knowledge creators and users, as well as those who supply the resources to create, use, and share *knowledge*. Our ability to prosper in this global community is dependent on our ability to be active participants in the *knowledge* economy.

What role will the U.S. assume in this global knowledge economy? We are still trying to find our place. What actions are necessary to keep the competitive edge of our nation sharp? This is the challenge that faces not only our nation's leaders, but individual citizens—among them, scientists!

In 2005, Congress charged The National Academies' Committee on Science, Engineering, and Public Policy to determine concrete steps to keep America competitive in the 21st Century. The committee's recommendations were released in a report titled *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. The Executive Summary includes the following:

This nation must prepare with great urgency to preserve its strategic and economic security. Because other nations have, and probably will continue to have, the competitive advantage of a low wage structure, the United States must compete by optimizing its knowledge-based resources, particularly in science and technology, and by sustaining the most fertile environment for new and revitalized industries and the well-paying jobs they bring (pg. 4).

A strong education system which produces citizens with the capability to think critically and make informed decisions—based on technical and scientific information—as well as which nurtures students who pursue innovative and creative work in scientific and technical fields, is critical in a knowledge-driven economy.

In 2001 our high school graduation rate was 68%, with students from historically disadvantaged minority groups having a 50-50 chance of graduating. As the current minority becomes the new majority, students suffering at the low-end of the achievement gap will not necessarily consider college, let alone the pursuit of a scientific or technical degree, the very fields that determine our competitiveness. In concert, nations around the globe *are* making necessary changes to augment their number of scientific and technical professionals to be competitive and innovative in the emerging global knowledge economy.

Members of the AAS have a role as citizens in our democracy, and a duty as scientists, to be involved in the future of our nation. To set the stage, according to the National Science Board's *Science and Engineering Indicators 2006*, the American public:

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The views expressed in this newsletter are those of the individual contributors, and not necessarily those of the American Astronomical Society, the Astronomy Education Board, or the Editors.

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About This Issue

In this issue you will find an article written by Deborah Koolbeck, who as an Albert Einstein Distinguished Fellow worked in Congressional Representative Rush Holt's (D-NJ) office and provides a perspective on the importance of scientists communicating with the public. Mark Sykes weighs in on the Great Planet Debate in the wake of the notorious IAU vote on the reclassification of Pluto, which has sparked the beginning of a discussion on "what is a planet."



We are introduced to the AAS' Astronomy Education Board Members and also to the AAPT's Committee on Space Science and Astronomy. We hear from the Solar Physics and the History of Astronomy Divisions about their education activities. Greg Shultz summarizes the September 2006 ASP conference held in Baltimore, MD, and Rosa M. Ros and Jay Pasachoff describe the IAU's Commission 46 on Education and Development two-day special session – Innovation in Teaching/Learning Astronomy held during the IAU General Assembly in Prague, Czech Republic in August, 2006. Gina Brissenden encourages those of you who teach "Astro 101" to take advantage of the Astronomy Center, and to join that community. And finally, let's not forget that planning for the International Year of Astronomy in 2009 has begun, as Tim Slater reminds us, so get your thinking caps on and contribute your ideas to the AAS IYA program committee.

Susana Deustua is the Director of Education of the Society, and is responsible for managing and implementing the Society's education and outreach programs. She looks for ways to leverage our impact through collaboration with sibling societies, such as the American Physical Society (APS) and the American Association of Physics Teachers (AAPT). Two examples are the annual New Faculty Workshop and ComPADRE. Being in the Executive Office in Washington, DC, she also keeps an eye on education policy and related workforce issues. Susana is also a member of the Astronomy Education Board.

- Has an appreciation for the benefits of science and technology

However,

- Lacks a firm grasp of basic scientific facts and concepts
- Does not understand the scientific process
- Has not experienced a change in the level of understanding in the last few years
- Believes in pseudoscience
- Receives most of their information about science and technology from television

What can a scientist do to address the above troubling indicators? To begin, communicate with, and engage the public in, a discourse about the culture and practice of science. This is a necessity; scientific research is often supported by taxpayer dollars. As the public understanding and enjoyment of science and its practitioners grows, one can envision the federal budget for research and development growing as well. Do you think that you already do this? I think not, or at least not enough. In a 2005 survey, 82% of Americans said they did not *personally know* a scientist.

Here are a few areas to consider as avenues for engaging the public and communicating what scientists contribute to society:

Outreach

Outreach is offering to be of service to the public, and can take many forms. For example, you could run for a local political office such as the school board, volunteer with organizations serving youth or adults, or volunteer at the library, museum, after school programs, or a program of your own creation.

Professional Societies

Until recently, I was against professional societies. In particular, I saw the annual dues as wasted money until I came to Washington D.C., where I observed and experienced professional societies being the voice for science in the clamor of advocacy and lobbying in Washington. Professional societies are conduits for outreach opportunities, educational experiences, networking, and professional development. There are multiple roles that one can assume within professional societies to have an impact on the public or the scientific

community. How involved are you with your society—the AAS?

Congressional visits

Invite your Member of Congress to visit your department or laboratory, meet your graduate students and post docs, and tour your facilities. Are you funded by federal research dollars? Your results are the returns on the taxpayers' investment. You should also come to Washington D.C. and experience the environment in which our nation crafts legislation and meet the staff member who handles science as well the Member of Congress.

Education

Given the state of education in America, the opportunities for scientific professionals to contribute to education are, shall we say, astronomical. A few examples include hiring teachers who have no scientific experience to do research (if you have never *experienced* the process of science, it's hard to properly *teach* the process of science); offer to be of service to local schools and teachers; invite schools to tour your department or laboratory; collaborate with schools of education to create scientific and mathematical teacher professional development programs. If you are teaching, learn the latest research on how students best learn science and adapt your courses accordingly.

I have only scratched the surface of actions that science professionals can do to keep America competitive, and to maintain our nation's prosperity, in the growing global knowledge economy. A web page of resources has been crafted for you to explore these issues further (www.astroed.org/koolbeck.shtml). In addition, please feel free to email me with questions or to engage in a more in-depth discussion (koolbeck@gmail.com).

*By Deborah Koolbeck
Former Albert Einstein Distinguished Educator
Fellow*

Resource Site:
www.astroed.org/koolbeck.shtml

AAS Needs You to Participate in the 2009 International Year of Astronomy (IYA 2009)



2009 presents a unique international opportunity to celebrate the 400th year anniversary of Galileo's use of a telescope to study celestial objects. Starting in the year 1609, Galileo made four critical discoveries by turning his homemade telescope to the heavens:

1. The Moon has mountains—like Earth does.
2. The Milky Way is composed of many more stars than had ever been thought to exist.
3. Venus shows a full range of phases, so it must orbit the Sun, not Earth.
4. Jupiter has moons that orbit it, like planets orbit the Sun.

Some argue that more important discoveries have not been made with any other single telescope (except, of course, Hubble). These four discoveries revolutionized scientific thought and established astronomy as an observational science. To honor Galileo, and his discoveries, the 2009 International Year of Astronomy (*IYA 2009*) was born.

As a coordinated US response to participate in *IYA 2009*, the AAS is hosting a committee of astronomers, astronomy education and outreach professionals, and the organizations that support them. This committee is charged with maximizing the involvement of the US citizenry in *IYA 2009*. The AAS *IYA 2009* committee is chaired by Dr. Tim Slater at the University of Arizona. The *IYA 2009* concept is based on a formal resolution adopted by the UNESCO General Conference in 2005. With a soon-to-come confirmation by the General Assembly of the United Nations, *IYA 2009* will be able to benefit fully from the endorsement of this highest international body.

In addition to the US *IYA 2009* local, regional, and national activities, several other countries have formed committees to prepare activities *internationally* for *IYA 2009*. These committees are collaborations

among professional and amateur astronomers, science communicators, along with science centers and museums. At the global level the International Astronomical Union (IAU) will play a leading role as a catalyst and coordinator. The IAU will organize a small number of global activities such as the opening and closing events. In addition, they will help coordinate the efforts of the nations involved in *IYA 2009*.

Ideas put forward for the US include:

- Thousands of coordinated “Star Parties” and “Street Astronomy” events to get everyone in the nation looking up
- A “24 Hours of Astronomy” webcast documenting a day on Earth in astronomy
- A global astronomy website connecting all national *IYA 2009* committees, events, and people, reporting the latest 2009 astronomical discoveries
- “Astronomers’ Diaries” documenting the lives of the diverse people who make up the astronomical community as they live *IYA 2009*
- An international network to foster global appreciation of the role and value of astronomy as a unifying activity for humankind

IYA 2009 is in its earliest planning phases, and these are just a few of the very exciting ideas put forward to help celebrate. If you would like to contribute ideas for *IYA 2009*, send them via email to: IYA2009-IdeaBank@yahoogroups.com. If you would like to be kept informed about *IYA 2009* developments, please send a blank email to: IYA2009-Information-subscribe@yahoogroups.com.

Tim Slater
University of Arizona
AAS Education Officer

AAPT's Space Science & Astronomy Committee



It won't surprise AAS members that there is a portion of the American Association of Physics Teachers (AAPT) members who have an active interest in astronomy teaching and learning. The use of astronomy as a context for teaching basic physics concepts, as well as inquiry processes and the nature of science, is popular in both

the K-12 and collegiate worlds.

The Committee on Space Science and Astronomy (CSSA) is one of 17 area-interest committees within the AAPT. Nine committee members, including AAS Director of Education Susana Deustua (*ex-officio*), serve three-year terms to help guide the committee in providing sessions and workshops relating to astronomy and space science—both content and instruction—at the AAPT's two annual meetings.

The CSSA's Mission has three components:

1. To strengthen and maintain contacts with national organizations concerned with space science and astronomy, and the teaching thereof.
2. To provide AAPT members with a perspective on current space science and astronomy research through "Frontiers in Space Science and Astronomy" sessions.
3. To promote excellence in teaching astronomy by:
 - a. Sponsoring hands-on workshops that introduce the latest in computer software and observational techniques taught in labs.
 - b. Holding sessions that provide information on resources for teaching materials; on successful and unsuccessful curricula developments; on research in teaching; and on the interrelationships between astronomy and other disciplines.

- c. Working with sister committees to promote areas of joint interest.

Many of our members are also members of the AAS, and collaborations between the two organizations get stronger every year. The CSSA has a full slate for our Societies' joint meeting in Seattle, sponsoring and co-sponsoring several sessions and workshops relating to astronomy and astronomy education.

Some of our sessions have become regulars in recent years. *Frontiers in Space Science and Astronomy* typically involves two or more invited speakers on cutting-edge research in astronomy or space science topics. Recent speakers and topics have included, for example, John Craven (Univ. Alaska-Fairbanks / Geophysical Institute) on the impact of winds on the aurora; John Keller and William Boynton (Univ. Arizona) on detection of sub-surface water ice on Mars using the Mars Reconnaissance Orbiter's Gamma Ray Spectrometer; and Robert Herrick (Univ. Alaska-Fairbanks / Geophysical Institute) on post-Magellan research on cratering on Venus.

Another regular session that has developed is *Astronomy Education Research*. The field of astronomy education research (AER) is frequently modeled after the field of physics education research (PER), with a large community that has developed its own mini-conference held after AAPT's summer meetings. Examples of recent topics presented in AER sessions include investigations into the effectiveness of specific astronomy curricula and student conceptions in astronomy topics. Similarly, *Innovations in Teaching Astronomy* consists of those great ideas that have been tested in the classroom.

The Committee for Space Science and Astronomy has thrived in recent years because of an energetic group of people, but we're always looking to add to our numbers! If you are interested in joining AAPT and the CSSA, check out <http://www.aapt.org/Membership/join.cfm>. Then, let us hear from you!

Janelle M. Bailey
University of Nevada, Las Vegas

Meet the Astronomy Education Board!



L-R: Dana E. Backman, Fran Bagenal, Edna DeVore, Gretchen Harris, Rosaly Lopes

Dana E. Backman (SOFIA / SETI Institute)

I'm in charge of the SOFIA (Stratospheric Observatory for Infrared Astronomy) education and public outreach program. SOFIA is a Hubble-sized infrared telescope mounted in a 747 jet that will start its first test flights in early 2007. I am excited about being able to recruit and train teachers to work onboard SOFIA as partners with astronomers in research flights. I teach astronomy in the Stanford University adult night school program. I am co-authoring a college introductory astronomy textbook for non-science majors, "Perspectives on Astronomy", that will be published in 2007.

Fran Bagenal (University of Colorado)

I started teaching introductory astronomy 18 years ago—about the time my current students were born. Early on I looked for ways to involve the students in their learning, experimenting with in-class activities, web-based interactives and student-response systems. I find my experience in teaching general-education astronomy has been useful for education and public outreach activities for the New Horizons (Pluto) and Juno (Jupiter) missions. I see priorities for the AAS AEB to be gathering demographic information about the astronomy pipeline, evaluating future workforce needs and providing career advice to young astronomers.

Edna DeVore (SETI Institute)

I am Deputy Chief Executive Officer and Director of Education and Public Outreach at SETI Institute. I am a life-long astronomy educator engaged in astrobiology, searches for extrasolar planets, infrared astronomy, and SETI. My projects include curriculum for pre-college students, including *Voyages Through Time*, a high school

astrobiology course. My EPO team collaborates to conduct the education and public outreach programs for two major NASA research missions: NASA's SOFIA (Stratospheric Observatory for Infrared Astronomy) airborne observatory, and Kepler, a Discovery Mission that seeks Earth-sized planets around other stars.

Gretchen Harris (University of Waterloo)

I grew up in the US but did my PhD at the University of Toronto; except for a two year stint at Yale University, I've lived in Canada ever since. My research involves understanding stellar evolution and what stars can tell us about how galaxies form and evolve. As a parent and teacher I see how keen people of all ages are to learn about astronomy. And I see the same excitement in politicians whom I am trying to convince that astronomy is worth supporting. Astronomy education has a key role to play in increasing scientific literacy and awareness.

Rosaly Lopes (NASA's Jet Propulsion Laboratory)

My scientific expertise is in planetary geology and volcanology. I am currently Lead Scientist for Geophysics and Planetary Geosciences at JPL, and work on the Cassini mission. I have always had a strong interest in education. I worked as a curator at the Old Royal Observatory at Greenwich, England, in the late 1980s, during which time I focused on science outreach. Since coming to JPL I have lectured frequently to the public, published books and articles at a popular level, and helped scientists become more involved in E/PO by working with NASA's Solar System Exploration Forum.



L-R: Robert D. Mathieu, Jacob Noel-Storr, Stacy Palen, Lawrence Rudnick, Tim Slater

Robert D. Mathieu (Univ. of Wisconsin—Madison)

As Associate Director of the National Institute for Science Education, I led development of the Field-tested Learning Assessment Guide (FLAG), as well as development of research-based resources in collaborative learning and teaching with technology, designed for STEM faculty (www.wcer.wisc.edu/nise/cl1). Presently I direct the Center for the Integration of Research, Teaching, and Learning (an NSF Center for Learning and Teaching) focused on preparing STEM graduate students for future roles as both researchers and teachers. I am also PI of an NSF project upgrading the Student Assessment of Learning Gains (SALG), a widely-used course evaluation instrument that focus on learning instead of instructor popularity.

Jacob Noel-Storr (Rochester Institute of Technology)

I'm a research scientist at the Rochester Institute of Technology Center for Imaging Science where I am busy building up the new Insight Lab for Science Outreach and Learning Research, that I lead. After getting my Ph.D. in astronomy from Columbia (on supermassive black holes), I spent two years working with the CAPER (Conceptual Astronomy and Physics Education Research) Team at the University of Arizona on outreach and K-12 projects. My main activities in education include developing and researching out-of-school-time science learning experiences for youth and families, and conducting professional development and teaching support for K-12 teachers and science graduate students.

Stacy Palen (Weber State University)

As a physics professor, planetarium director, and astronomy researcher, I wear too many different hats. But my favorite is the educator hat, which spans

all of the above. Lately, planetarium work has been consuming most of my energies, with efforts ranging from show production, to scientific visualization, to strengthening ties between planetariums, educators and researchers. The planetarium community's transition to full-dome digital theater creates fantastic opportunities for new collaborations, both within the astronomical community, and between the sciences. My current focus is on seizing those opportunities.

Lawrence Rudnick (Univ. of Minnesota)

I am a Distinguished Teaching Professor at the University of Minnesota, where I do workshops in different departments about using active learning techniques in large lectures. I am also heavily involved in informal education activities, now working to build a new planetarium for the State of Minnesota. Previous educational ventures included being co-PI on an NSF-funded teacher development program for K-8 science teaching, and a long stint as a consultant and guest expert on public television's *Newton's Apple*. My research involves multiwavelength observational studies of supernova remnants and high energy processes in large scale structure.

Tim Slater (University of Arizona)

I am the AAS Education Officer and an associate professor of astronomy at the University of Arizona. My area of scholarship is conducting research on the teaching and learning of astronomy, with a focus on improving learning in the introductory astronomy survey course for non-science majors. In addition to teaching large enrollment sections of ASTRO 101, I also teach courses for the high school science teacher preparation program at U of A. I also work on the EPO teams for several NASA missions, including *Navigator*, *Spitzer*, and the *Astrobiology Institute*.

Pluto Reclassified: Educational Impacts and Opportunities

Part One of a Two-Part Series

Most of us are overly aware that Pluto was *reclassified* this summer. Regardless of our own personal positions in this debate, or our concerns about it, it was fairly clear that “the public” had their own—especially teachers. The phones of many an astronomy department rang loud and clear that day: Is Pluto a planet? Isn't it? Why? Why not? What do I teach now?

In this and our following issue of Spark we'll explore these questions by sharing two opinions with you on the educational impacts *and* opportunities afforded us, and teachers, by this change. In this Issue, Mark Sykes of the Planetary Science Institute will share his views on the potential negative educational impacts of this *particular* reclassification scheme, as well as the positive educational opportunity it provides to discuss the nature of science. In Issue 4 (available in concurrence with the summer 2007 AAS Meeting), Neil deGrasse Tyson of the American Museum of Natural History will share his own.

Gina Brissenden & Jake Noel-Storr, Editors

The Great Planet Debate



Both the public and scientists were feeling understandably whiplashed when the International Astronomical Union (IAU) performed a major flip-flop in defining the term “planet” at its General Assembly in Prague this past summer. At the beginning of the meeting a Planet Definition Committee announced its recommendation, after a year of deliberation, that planets are basically round

objects that orbit stars (i.e., massive enough for their gravity to crush them into “hydrostatic equilibrium”). Twelve planets in the solar system would be recognized, including Ceres (the original “missing planet” between Mars and Jupiter), the recently discovered “Xena,” and Pluto and Charon reclassified as a “double planet”. The number of planets would increase over time as more “round” objects were discovered or identified among known distant bodies.

This geological perspective and prospect of more planets was rejected by mostly stellar and galactic astronomers remaining on the last day of the meeting. They voted to adopt a definition focusing on dynamics, requiring a planet to be an object that had “cleared its orbit.” This reduced the number of planets in the solar system to eight (demoting Pluto) and shut the door to the discovery of additional planets in the solar system. The following week, IAU formally gave Pluto an asteroid designation.

Public reaction was strong and negative, focusing on the demotion of Pluto. The procedure seemed arbitrary, and it gave the terrible impression that science was accomplished by voting or by the dictate of an authoritative body.

Scientists had their own problems with the IAU definition (and the procedure by which it was arrived). A quick petition was circulated (www.psi.edu/~sykes/planetprotest/) to protest the IAU's resultant definition.

It was signed by more than 300 scientists (comparable to the more than 400 voters in Prague). The signators were dominated by scientists who study almost every aspect of planets and have been involved in their robotic exploration over the past several decades.

Why were scientists dissatisfied?

Categorization, which includes definitions, is a very useful tool by which *like things* are grouped together. This helps to explore the roots of their similarities. The original “round” definition for “planet” is interesting since that is the point at which an object starts exhibiting geology—their surfaces become more than a mere record of their impact history. The operational part of the IAU definition, on the other hand, has nothing to do with a planet’s physical properties; rather, it focuses on the existence of other objects around it.

The mass required to have “cleared” an orbit increases rapidly with increasing distance from the Sun. An Earth-sized object discovered beyond Neptune (a possibility) would not be a planet, according to the IAU. If Mars were only half an astronomical unit further from the Sun, it would not be a planet either. For many scientists, it seems incongruous that objects orbiting the Sun that share the same physical properties would not be put in the same category.

The IAU definition is inapplicable to more than 200 planets around other stars. It takes time to clear out an orbit. The mere discovery of a non-luminous object around another star and an estimation of its mass is not sufficient to know if it has completed the job of *clearing*. The IAU definition would require an understanding of the dynamical state of much smaller, undetectable bodies in the system. Under the original “round” definition, planetary status is easily determined since the objects discovered are of such mass that they would have to be round. Do we now tell the public that these extrasolar planets we’ve discovered might not actually be “planets”?

On the fun side, some people wondered if the existence of Trojan asteroids straddling the orbit of Jupiter and the existence of Earth-crossing asteroids disqualified these objects as planets under the IAU definition. One can easily imagine high-school teachers having difficulty explaining the apparent internal contradictions to the students pointing this out. Jupiter not being a planet would seem kind of silly.

The decision by the IAU did not *end* a discussion; it sparked the *beginning* of one.

This is a wonderful teaching moment—not just about *planets* and what we know about them, but about *science*. Too often science is presented as a collection of “facts” and “laws” discovered by scientists (whose authority derives from their being “smart”). Science, on the other hand, is actually an open-ended process of trying to explain the universe and continually testing those explanations against observations. The failure of an explanation raises the prospect for new knowledge as new ideas and theories are then brought to bear.

In science, categorizations and definitions are judged on the basis of the applicability and usefulness of the perspectives they provide. Many scientists find the perspective of the IAU definition for “planet” too narrow to be useful. Efforts are underway to come up with an alternative definition based on, or giving rise to, physical properties associated with planetary bodies. This will be an exciting exercise and an occasion to show the public what we are learning about planetary bodies in our own solar system, around other stars, and what we might discover in the future.

The IAU is not the final authority in astronomy—certainly not in planetary science. Only a small fraction of the world’s planetary scientists even belong to the IAU. It is now likely that there will be competing systems on planet categorization. The IAU’s definition may be useful for noting those bodies responsible for the dynamical sculpting of a planetary system. Something like the original more geological definition may have usefulness in identifying bodies exhibiting a broad suite of common physical characteristics. The public will want to know which is “right.” The challenge and opportunity for scientists will be to avoid the simple declarative response and give the public their perspective on the greater or poorer usefulness of the different systems. We need to foster a public understanding that science is a process, not just facts and laws. Maybe *The Great Planet Debate* provides us with the perfect opportunity.

Mark Sykes
Planetary Science Institute

Education Updates from AAS Divisions and Committees

Solar Physics Division (SPD)

The SPD EPO standing committee is now complete and is composed of the following members:

Emilie Drobnes (chair) is the Education and Public Outreach Lead for the Solar Dynamics Observatory out of NASA Goddard Space Flight Center. Emilie is currently responsible for the development, implementation and management of a multitude of formal and informal outreach efforts across the nation with a particular focus on Solar and Heliospheric sciences.

Dr. Richard Wolfson is the Benjamin F. Wissler Professor of Physics at Middlebury College, where he teaches a range of undergraduate courses from introductory physics to laboratory electronics to advanced electromagnetic theory. His SPD-related research involves theoretical work on the magnetohydrodynamics of the solar corona, especially the buildup of energy prior to the onset of coronal mass ejections. Rich is the author of several books, including a calculus-based introductory physics text and trade books on nuclear energy and relativity. His broader outreach efforts include video courses for The Teaching Company, an article on the solar corona in *Scientific American*, and ongoing contributions to the *World Book Encyclopedia*.

Dr. Jie Zhang is an assistant professor in space weather at the Department of Computational and Data Science and the Department of Physics and Astronomy at George Mason University. His research interest is in the areas of solar and heliospheric physics with a focus on solar flares and coronal mass ejections, and their effects on geo-space.

Dr. Pete Riley is a Senior Scientist at Science Applications International Corporation and the current chair of the SHINE (Solar, Heliospheric, and Interplanetary Environment) organization. His research focuses mainly on: (1) the structure of the solar corona and inner heliosphere; and (2) the initiation and evolution of coronal mass ejections. He is an editor for *Reviews of Geophysics* and an associate editor for *Geophysical Research Letters*.

Dr. Zoe Frank is a staff physicist for the Lockheed Martin Technology Center Solar and Astrophysics Lab in Palo Alto. Zoe primarily assists with instrument operations and data analysis for various solar satellites the lab is involved in. Zoe is also involved in the informal and public outreach efforts for these missions. Using available local databases, software, and printing/video services, Zoe facilitates access to images and information for educators, news organizations, and the public in general.

The committee also contains five ex-officio members: Craig Deforest - SPD Press Secretary, Gordon Emslie - head of SPD Studentship Awards, Mark Linton - SPD Popular Writing Awards Committee chair, Terry Forbes - SPD Summer School Committee chair and Jacob Noel-Storr - AAS AEB representative.

The committee's primary short-term goal is to develop a strategic plan to help guide the implementation of its education and public outreach efforts. Some initial efforts will be aimed at increasing student attendee numbers at SPD meetings, increasing the diversity of SPD Summer School participants and increasing public awareness of the SPD and the community's accomplishments. Efforts will also be made to begin to develop an extensive web-based resource and online community for all SPD members currently actively participating in education and outreach and for those interested in becoming involved.

History of Astronomy Division (HAD)

While the AAS-History of Astronomy Division (HAD) does not have any formal educational outreach activities, many of our members are engaged in astronomical education.

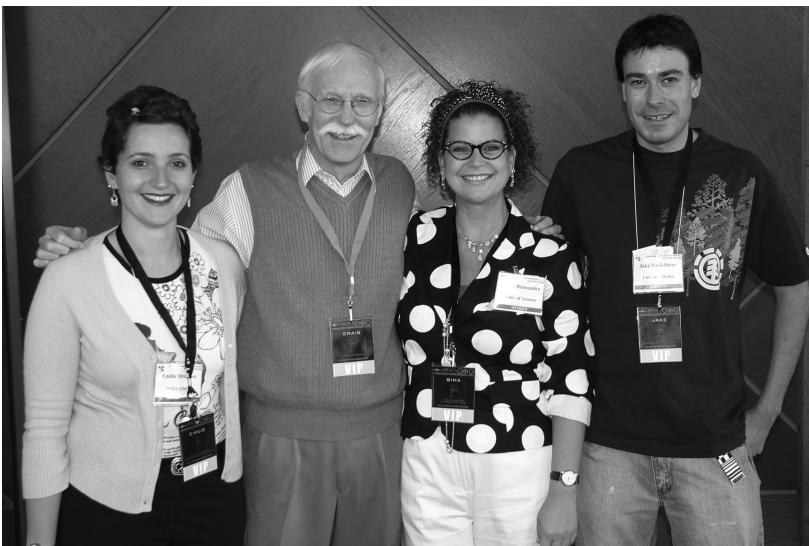
For example, Sara Schechner, the HAD incoming Chair and Curator of the Collection of Historical Scientific Instruments at Harvard, not only creates exhibitions on the history of astronomy, but is currently active in developing an object-based curriculum, in which historical instruments have been used in 50 different courses at Harvard in the last five years. Schechner also

develops and leads innovative hands-on astronomy programs for museums, community groups, and research centers. Past projects included a "Total Solar Eclipse Camp-In," organized for the Girl Scout Council of the Nation's Capital at the National Air and Space Museum with the support of NASA; "Discovering Time Under the Sun," a series of hands-on workshops at the Smithsonian Institution for teachers, underprivileged DC children, and adult-child pairs; and an interactive sundial for an outdoor learning center in Newark, NJ. For the 2004 Transit of Venus, Schechner organized a sunrise festival at Harvard that included observations of the transit with both modern and historical instruments, museum exhibitions, the Harvard Band performing John Philip Sousa's *Transit of Venus* March, and special talks. Currently, she is designing kits for an astrolabe, nocturnal, and sundial (to be distributed by Learning Technologies) so that students may learn astronomy and its cultural history by making measurements and observations with replica instruments. Thomas Hockey, the incoming HAD Vice-Chair, uses a laboratory exercise based upon a Spirograph in order to help introductory students understand the Ptolemaic universe. (The exercise is free for educational use; see <http://www.earth.uni.edu/epicycles.doc> or [.pdf](http://www.earth.uni.edu/epicycles.pdf).) HAD member Virginia Trimble helped organize an AAPT session in which people who had worked with notable physicists like Fermi and Feynman shared

stories illustrative of how these mentors thought about physics and doing physics. David DeVorkin, Curator of the History of Astronomy at the National Air and Space Museum, set up the permanent gallery entitled "Explore the Universe," and Steve Dick, Chief NASA Historian, is active in educating the public with regard to the NASA's significant activities (see: <http://history.nasa.gov/>)

Moreover, various HAD members are involved in the Antique Telescope Society and the Scientific Instrument Commission of the International Union for the History and Philosophy of Science, organizations whose purpose is to unite colleagues interested in historical telescopes and related instruments, and to promote the preservation of these instruments through conservation and education. (For more on their activities, see <http://webari.com/oldscope/> and www.sic.iuhps.org.) HAD also plans to form an AAS Preservation Working Group that will be instrumental in preserving our astronomical heritage in the form of research papers, instruments, observatory locations, and significant astronomical sites.

The chairs and education representatives of all AAS Divisions and Committees are invited to submit updates to the editors.



Emilie Drobnes, Education Officer for the Solar Physics Division, with AAS President J. Craig Wheeler and *SPARK* editors Gina Brissenden and Jake Noel-Storr, at the 208th AAS Meeting in Calgary, Alberta, Canada.

Reflections on the 2006 ASP Conference – *Engaging the EPO Community: Best Practices, New Approaches*



This past September in Baltimore, the Astronomical Society of the Pacific put on its 118th Annual Meeting, and again focused their conference on serving the developing community of education and public outreach (EPO) professionals in astronomy and space science. The conference theme this year was *Engaging the EPO*

Community: Best Practices, New Approaches, and the conference organizers were very successful in fostering such professional engagement, through a variety of learning and networking opportunities.

For me, this was the eighth ASP conference I've participated in, dating back to 1993 during my early grad school days, and it was probably the best one I've been to so far. It's been tremendous to see the organization, its membership, and its conference attendees come a long way over the years in their awareness, learning, implementation, and sharing of successful strategies in astronomy EPO. As has been well summarized in past articles (including notably Andy Fraknoi's excellent 2005 *Mercury* article, "Steps and Missteps Toward and Emerging Profession"), the number of scientists, educators and others involved in astronomy and space science EPO has increased substantially over the last 10-15 years, and the community has been undertaking an important process of professionalization. One of the key elements of such professionalization is an opportunity for practitioners to regularly attend and discuss their work at major conferences, and that's where the ASP has stepped up and provided the necessary venue for our field's EPO professionals (or EPOPs, a term which some of us have affectionately used). Beginning with the ASP conference in 2005, we now have a major annual meeting dedicated to the astronomy and space science EPO community.

The opportunities for professional development and networking at the ASP conference were numerous, with 5 plenary speakers, 18 ninety-minute workshops, 35 half-hour "clinics," 81 posters, 5 special events, 10 exhibits, and countless informal meetings and collegial discussions throughout the 3 days. A couple highlights for me were the two plenary talks by Iris Weiss and Paula Apsell, speaking respectively on research on science teacher professional development, and the presentation of science to the public via the PBS series NOVA. Both gave very informative presentations that made me think a lot about the EPO work that myself and colleagues are involved with primarily through NASA.

But the heart of the conference and what was most engaging were the numerous opportunities to hear from and discuss with presenters of workshops, clinics, and posters. What I was able to take in through these opportunities was just a very small fraction of the collective experience for all conference participants, so it wouldn't really be fair to point out favorite workshop sessions or presenters. But one impressive thing worth noting is the increased number of presentations which included data addressing the effectiveness of EPO projects and programs. Overall, I heard from a number of attendees that there were so many quality sessions offered that it was often difficult making tough choices between sessions. I sensed a lot of very eager learning happening, and it's a tribute to our community and to ASP that we now have this wonderful annual conference to look forward to, serving as a venue for important professional development for all of us.

*Greg Schultz, Education/Outreach Scientist and Teacher Educator
(UC Berkeley, Space Sciences Lab, Center for Science Education)*



Winning the Meade is always a highlight of any ASP meeting. This year's winner Susana Deustua (AAS) is being congratulated by ASP Executive director, Michael Bennett.



ASP Prize Winners smile for the press: Leo Connolly (SCU San Bernadino), Michael Skrutskie (U Virginia), Jeff Rosendhal (GSFC), Frank Low (Emeritus Member), Thomas Morin (U Plymouth), and Steve Furlanetto (Yale)



Meet the ASP Education Team— Vivian White, Anna Hurst, & Suzy Gurton—talking with Connie Walker (NOAO; second from left).

Education at the International Astronomical Union Meeting - Prague, Czech Republic



IAU *Innovation in Teaching/Learning Astronomy* participants pose before the beginning of their special session. Let's hope they were this happy two days later when the session ended.

Astronomy attracts many young people to education in important fields in science and technology. But in many countries, astronomy is not part of the standard curriculum, and teachers do not receive adequate education and support. Still, many scientific and educational societies and government agencies have produced materials and educational resources in astronomy for all educational levels. In addition, technology is used in astronomy both for obtaining observations and for teaching.

For two full days, IAU members studied how to introduce innovative points of view regarding methods of teaching and learning in a special session sponsored by Commission 46 on Education and Development entitled: *Innovation in Teaching/Learning Astronomy*. Astronomers from all countries—developed or developing—were equally interested. IAU members who participated represented 5 continents. In total, the session presented 43 oral contributions (16 of them were invited speakers) and 60 posters. Rosa Maria Ros of

Spain and Jay Pasachoff of the United States organized the event.

The topics discussed were distributed into 4 themes:

THEME 1: General Strategies for Effective Teaching
Presenting new ideas in order to teach more and better astronomy; connecting astronomy with the environment; presenting classical topics using more simplified methods; using interdisciplinary approaches; mixing with cultural background and/or history of astronomy; and revitalizing astronomy teaching through research on student understanding.

THEME 2: Effective Use of Instruction and Information Technology
Modern technology as a tool for current teaching/learning; and availabilities of new technologies in different schools and information on newly implemented facilities (including remote observing) that allows school students to use telescopes in other time zones and in better observing locations.

THEME 3: Connecting Astronomy with the Public.

Future education and public information projects from astronomical institutions involving schools; introducing new results from astronomy education research; mixing with cultural background and/or the history of astronomy; the role of Public Information Offices of observatories and space missions; planetarium attendance and astronomical content; television and radio media; and the role of light pollution in liaison with the public; the 2009 International Year of Astronomy.

THEME 4: Practical Issues Connected with the Implementation of the 2003 IAU Resolution.

What is the situation in various countries, three years later, for implementing the resolution passed at the IAU General Assembly in 2003 endorsing the importance of education in astronomy? New suggestions after three years of experience in order to include astronomy in school curricula; to assist schoolteachers in their training; to inform teachers about available resources; and to contribute to the training of teachers.

The proceedings will be published in 2008 by Cambridge University Press, with Jay Pasachoff, Rosa Ros, and Naomi Pasachoff as editors.

Rosa Ros
Universitat Politècnica
de Catalunya

Jay Pasachoff
Williams College



Lick-Wilmerding High School teacher, Mark Hurwitz poses with his students (L-R) Michael Deliso, Alex Braman, Cyrus Stoller, Kosuke Hata, and Logan Pierce. They attended the meeting as part of their prize for winning the Suzaku competition. Their fellow winners who were unable to attend are Kate Hancock, Rafael Wabl, and Eric Soifer. Here's to the next generation!

AstronomyCenter.org - Your Online Destination for Astronomy Education Resources



Many, many years ago some very thoughtful people at the AAS had this crazy idea... Wouldn't it be great if we could somehow collect all the pre-existing education materials related to "Astro 101" in some convenient, online, searchable, and *reviewed* format? It was this crazy idea that was the genesis of AstronomyCenter.org, the "Astro 101" archive of the NSF

National Science Digital Library. AstronomyCenter.org has been in existence for about two years now, but its success depends on you—members of the astronomy education community.

Currently, there are approximately 600 items in the archive. Instructors can use the archive (or "collection" as the NSF likes to call it) to find curriculum materials, images, classroom demonstrations, labs, online learning resources, evaluation instruments, and articles about approaches to astronomy education. Items in the archive are categorized by *type* of material (e.g. labs, images, pedagogy) and by *topic* (e.g. cosmology, stars, astronomy education). Each item includes a brief description and a link to where it can be found, as well as author, publisher, cost, and copyright information.

Here's where you come in! Join the AstronomyCenter.org community. Add items to the archive that you use in your courses that you find to be exemplary at promoting student learning. Add reviews to items already in the archive that you have used—good, as well as bad. Let your voice, and your expertise, be heard.

What will AstronomyCenter.org do for you? In addition to the archive itself, AstronomyCenter.org can help you organize your life. Okay, so not your whole life, but the part of it related to teaching. The "filing cabinet" feature allows you to file items you've found into a personalized folder system, with your own annotations, so they'll be easily available to you in the future. You can also share the items in your filing cabinet with other members of the AstronomyCenter.org community.

So, visit AstronomyCenter.org. Check out the resources, add your own, and critique those of others. Together we can build a brighter site.

Gina Brissenden
Managing Editor, AstronomyCenter.org

To Participate:

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To help our editors, please be sure to:

- a. Include authors' names,
- b. Provide a concise and specific
description
of the material,
- c. Let us know about intended user
level and costs.



AstronomyCenter.org is a service provided by the American Astronomical Society in collaboration with the American Association of Physics Teachers and the ComPADRE project. It is supported, in part, by the National Science Foundation

Ninth Issue of *Astronomy Education Review*

The ninth issue of *Astronomy Education Review* (AER), the web-based journal/magazine for everyone involved in astronomy education and outreach, is now available at <http://aer.noao.edu>. Featured papers and articles in this issue include:

Research and Innovation

- Astronomy Podcasting: A Low-Cost Tool for Affecting Attitudes in Diverse Audiences by Pamela Gay (Harvard U.), Aaron Price & Travis Searle (AAVSO)
- A History and Informal Assessment of the Slacker Astronomy Podcast by Aaron Price (AAVSO), Pamela Gay (Harvard U.), Travis Searle (AAVSO) and Gina Brissenden (U. of Arizona)
- Effectiveness of Collaborative Ranking Tasks on Student Understanding of Key Astronomy Concepts by David Hudgins (U. of S. Africa), Edward Prather (U. of Arizona), Diane Grayson (U. of Pretoria) and Derck Smits (U. of S Africa)
- Astronomy in the K–8 Core Curriculum: A Survey of State Requirements Nationwide by Stacy Palen and AmyJo Proctor (Weber State U.)
- Astronomy for the Blind and Visually Impaired: An Introductory Lesson by Bernd Weferling (U. of Dortmund)
- Clickers: A New Teaching Aid with Exceptional Promise by Douglas Duncan (U. of Colorado)
- The Design and Development of a Simple Spreadsheet-Based Tool that Enables Students to Make Measurements on Astronomical Images by Richard Beare (U. of Warwick)

Resources

- The Music of the Spheres in Education: Using Astronomically Inspired Music by Andrew Fraknoi (Foothill Coll.)
- Resources for Making Astronomy More Accessible for Blind and Visually Impaired Students by Noreen Grice (You Can Do Astronomy)

Opinion and Commentary

- Textbooks as Intellectual Activity? Supporting Textbooks without Outlawing Used Books by Robert Knop (Vanderbilt U.)
- Getting Unstuck: Strategies for Escaping the Science Standards Straitjacket by Sandra Laursen (U. of Colorado)

Plus announcements of conferences, awards, and other opportunities.

When you go to the AER site, you may see that the next issue is already under way. If so, you can find the full 9th issue by clicking on “back issues” and then on “vol. 5, no. 1”. One article in the next issue will be a roundtable discussion that looks at the science, politics, and educational implications of the Pluto controversy. It includes an historical time-line and a guide to educational resources concerning the definition of a planet.

Sidney Wolff & Andrew Fraknoi, AER Editors



“Chef” Jordan Raddick (Johns Hopkins) is *Cooking with Sloan*. Maybe he’ll whip a little something up for us in Seattle.

Education and Related Sessions at the AAS/AAPT Meeting, January 5-10, 2007, Seattle, WA

Friday, January 5

8 am - noon

AAPT Workshop. W01. Video Based Motion Analysis for Homework and Classroom
UW, Phy.-Astro Bldg., Northside, Wing B, Room B108

AAPT Workshop. W02. Building TYC/University Partnerships in Teacher Preparation, Room 306

AAPT Workshop. W06. Making Pretty Pictures: How Astronomers Make Images, Room 211

AAPT Workshop. W08. Physics of Supernovae, Room 307

AAPT Workshop. W09. Using Large Data Sets to Teach Astronomy
UW, Phy.-Astro Bldg., Northside, Wing B, Room B128

AAPT Workshop. W10. Problem Solving, Room 213

AAPT Workshop. W11. Interactions in Physical Science: A Standards-based, Inquiry-oriented Middle School Curriculum, Room 214

9 am – 5 pm

AAS Workshop. Strategies for Creating a Learner-Centered Introductory College Astronomy Course, Room 608

1 – 5 pm

AAPT Workshop. W12. Energy in the 21st Century
UW, Phy.-Astro Bldg., Northside, Wing B, Room B108

AAPT Workshop. W14. General Relativity Labs
UW, Phy.-Astro Bldg., Northside, Wing B, Room B176

1 – 7 pm

AAS Workshop. NSF Astronomy & Astrophysics Postdoctoral Fellows Symposium, Room 605

Saturday, January 6

8 am – noon

AAPT Workshop. W17. Environmental Physics & Global Warming
UW, Phy.-Astro Bldg., Northside, Wing B, Room B110

AAPT Workshop. W18. Exploring Special and General Relativity with Interactive Curricular Material
UW, Phy.-Astro Bldg., Northside, Wing B, Room B128

AAPT Workshop. W19. A Primer for Doing Astronomy Education Research, 213

AAPT Workshop. W21. Beyond Clickers: Using Interactive Learning Devices for Student Collaboration in the Classroom, 214

8 am – 5 pm

AAPT Workshop. W23. Using Research-based Curricula and Tools to Revitalize Your Introductory Course
UW, Phy.-Astro Bldg., Northside, Wing B, Room B108

AAPT Workshop. W24. Teaching Astronomy with Technology
UW, Phy.-Astro Bldg., Northside, Wing B, Room B356

1– 5 pm

AAPT Workshop. W28. Experiencing the Pedagogical Process
UW, Phy.-Astro Bldg., Northside, Wing B, Room B128

AAPT Workshop. W31. Cosmic Evolution: the “Astro” in Astrobiology, Room 211

9 am – 4 pm

AAS Workshop. Career Workshop Room, Room 610

9 am – 7 pm

AAS Workshop. NSF Astronomy & Astrophysics Postdoctoral Fellows Symposium, Room 605

9 am – 5 pm

AAS Workshop. Strategies for Creating a Learner-Centered Introductory College Astronomy Course, Room 608

9:30 – 11:30 am

AAS Workshop. ComPADRE in the K-12 Classroom, Room 613

Noon – 4 pm

AAS Workshop. EPO Programs by NASA Research Grant Awardees, Room 609

1 pm – 3 pm

AAS Workshop. ComPADRE in Undergraduate Physics, Room 613

1 pm – 5 pm

AAS Workshop. Exploring Magnetism in Earth and Space Science, Room 607

3pm – 5 pm

AAS Workshop. ComPADRE AstronomyCenter, Room 613

Sunday, January 7

10 - 11:30am

AAPT Oral. 046. Innovations in Teaching Astronomy, Room 615

10 - 11:30 am

AAS Special. 031. Clickers in Astronomy Teaching, Room 201

2 -3:30pm

AAS Special. 048. Cool Astronomy For Everyone, Room 613-14

AAS Special. 106. Education with Large Astronomical Surveys, Room 613-14

6:30pm – 8 pm

AAPT Special. 065. Astronomy and the Two-Year Colleges, Room 615

6:30 7:30pm

AAPT Special. 066. Effective Features of Online Tutorials, Room 303

7 – 9 pm

AAS/AAPT/SPS Undergraduate Science Evening, Room 6A

Monday, January 8**9:20am–6:30pm**

AAS Poster. 073. Astronomers in Public Education, Exhibit Hall 4

AAS Poster. 075. Astronomy Research by Students of All Ages and the Public, Exhibit Hall 4

AAS Poster. 94. Putting Education into Outreach, Exhibit Hall 4

AAS Poster. 096. Research in K-12 Astronomy Education for Students, Their Teachers, and Their Families both in and out of the Classroom, Exhibit Hall 4

10–11:30am

AAS Special. 050. NSF Astronomy Division Senior Review Outcome, Room 6B

AAS Special. 107 The Future of Astronomy and Astrophysics at NASA, Room 611-12

AAPT Special. 119. Resource Collections and Communities Online through ComPADRE, Room 303

AAPT Invited. 117. The Once and Future Role of Women in Astronomy, Room 615

2 pm – 3:30pm

AAS Oral. 128. Education Across the Spectrum, Room 605-07

AAS Special. 126. Job Applicants: Top 10 Questions You Should Ask, Room 201

2 pm - 3:30pm

AAPT Oral. 137. Undergraduates Research Astronomy and Physics, Room 616

6 pm–8 pm

AAPT Poster. 146. Apparatus for Astronomy Education, Room 617

Tuesday, January 9**9:20 am – 6:30 pm**

AAS Poster. 7. Professional Development for Scientists and Educators, Exhibit Hall 4

AAS Poster. 170. The Undergraduate Astronomy Course for Non-Majors, Exhibit Hall 4

10 – 11:30am

AAS Special. 174. Impact of Intelligent Design and Responses to It, Room 204

Wednesday, January 10**9:20 am – 4 pm**

AAS Poster. 213. How To ... Resources for Scientist Educators, Exhibit Hall 4

AAS Poster. 14. It's All About Clear Skies, Exhibit Hall 4

AAS Poster. 218. The 3Ts: Telescopes, Technologies and Techniques for Astronomy Education, Exhibit Hall 4

AAS Poster. 220. Fortune and Fame: Fellowships, Textbooks, Cartoons, Exhibit Hall 4

10 - 11:30 am

AAPT Panel. 184. Helping Faculty/Teachers Become More Adept at Working with Under-represented Groups, Room 615

AAPT Special. 187. Virtual Observatories Room 618

AAPT Special. 232. Demonstrations for Teaching Astronomy, Room 617

2 - 3:30pm

AAPT Invited. 201. Effective Mentoring of Women and Minority Students in Physics and Astronomy, Room 615

AAPT Oral. 245. Instructional Technology in Physics and Astronomy Courses, Room 303

SPaRk

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