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The AAS Education Newsletter
June 2007, Issue 4

Astronomical Education and Outreach on Hawai'i Island

Hawai'i is home to one of the most diverse and advanced collection of astronomical research institutions on our planet. The expertise, technology and infrastructure assembled in our island state is definitely unique, especially to the communities which host us.

Sharing the knowledge revealed by the giant eyes atop Mauna Kea is critical to the enhancement of the human experience but is especially important for the people in our local communities. In the early 2000s the facilities collectively known as the Mauna Kea Observatories established a group called the Mauna Kea Observatories Outreach Committee (MKOOC, irreverently pronounced M-KOOK!), to coordinate and advance local outreach activities on Hawai'i Island (the "Big Island"). Representatives from most of the observatories on Mauna Kea participate in the monthly MKOOC meetings.

Originally MKOOC was established to support and complement the programming of the Mauna Kea Visitor Information Center (VIS) which is located just below the astronomers' quarters at Hale Pohaku at the ~9,000' level of Mauna Kea. The VIS is without doubt at the core of any Big Island outreach/education effort for local students, residents and visitors. With an estimated 100,000 visitors annually, the VIS offers evening stargazing every night of the year through telescopes as large as 16". Recently, the VIS has been renovated to better accommodate the large crowds that can exceed several thousand on nights of special events such as meteor showers.

The VIS is operated by Mauna Kea Observatories Support Services (MKSS) and all VIS programs are free of charge to the public. Funding is provided by the University of Hawai'i Institute for Astronomy (IfA), the University of Hawai'i at Hilo Office of Mauna Kea Management, and contributions by each of the observatories. Additional revenue is provided through sales at the First Light Bookstore/gift center and donations. The VIS is very proud of its active community volunteer program in which about 200 volunteers provide nearly 10,000 man-hours per year.

While the VIS educational programming is highly visible and effective, each of the observatories on Mauna Kea has established innovative outreach programming and partnerships. These partnerships are evident in flagship programs like the annual *AstroDay* program (www.astroday.net), *Journey through the Universe* (www.gemini.edu/jttu), *FamilyAstro*, and three *StarLab* portable planetaria. Combining this sampling of diverse programming with classroom presentations, public lectures, career days, robotics programs, science fairs, teacher workshops, open houses, and tours, it is obvious that Big Island astronomers are heavily engaged in—and committed to—our communities.

In February 2006, a new era of Big Island cultural and astronomical education began with the opening of the 'Imiloa Astronomy Center of Hawai'i (www.imiloahawaii.org). Located adjacent to many of the observatory headquarters in the University of Hawai'i at Hilo's University Park, the new center has rapidly become an icon for sharing Big Island astronomy and Hawaiian culture.

'Imiloa provides residents and visitors with an innovative experience of Hawaiian culture with roots in celestial observation and navigation tied to the modern science of astronomy studied from Mauna Kea. More than 15,000 square feet of exhibits and a state-of-the-art planetarium are integrated under three titanium cones that represent the three primary volcanoes that make up (and are making) the Big Island. In addition to the exhibits on traditional Polynesian culture, navigation and contemporary astronomy, the center hosts the innovative National Oceanic and Atmospheric

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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

With this issue of SPARK, timed to coincide with the 210th Meeting of the American Astronomical Society, in Honolulu, HI, you can read about programs in astronomy education in Hawai'i and the contributions of the Mauna Kea-based observatories to these efforts. Dr. Richard Crowe, professor at the University of Hawai'i – Hilo provides an introduction to the culture of the islands and the navigation and astronomy knowledge that enabled Polynesian voyagers to reach and populate such distant (from the Asian Pacific) lands. Dr. Crowe and the 'Imiloa Astronomy Center of Hawai'i will present a StarLab program on Polynesian Voyaging in the Exhibit Hall at the 210th Meeting on May 29 and 30.

Discussion on Pluto's "demotion from planethood" continues in this issue with Neil de Grasse Tyson's article on the negative and positive aspects of the scientific discussions surrounding the processes and factors by which we classify astrophysical objects. I'm always pleasantly surprised at how strong is the public's interest in particular astronomical topics, and especially when they develop iconic stature in our culture.

Mary Kay Hemenway, past Education Officer of the Society, offers her insights on the developments in astronomy education over the last decade or so. I note that the undergraduate reception, which she and Peter Boyce started continue (now dubbed the Undergraduate Orientation) to be held at every AAS meeting. Attendance grows every year; about 10-15% of meeting presenters being undergraduates!

HEAD (High Energy Astrophysics Division) gives us news of their Education and Outreach Activities in two articles on page 14 by Kathy Lestition and by Lynn Cominsky. Meet the Solar Physics Division (SPD) new Education and Outreach Committee on page 15.

And for those of you looking for good resources on astronomy education, read the review by Alex Storrs of the NSTA's Handbook of College Science Teaching, and catch up on the latest articles published in the 10th Issue of the Astronomy Education Review (table of contents is listed on page 13).

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Administration's "Science on a Sphere," the Space Telescope Science Institute's "ViewSpace," a 4-dimensional (including time) theater called "4D2U" (sponsored by the Subaru Observatory through the National Astronomical Observatory of Japan) and a mock-up of a real observatory control console donated by the Gemini Observatory presenting a Virtual Tour experience for visitors.

Going beyond K-12 and general public education an public outreach, the University of Hawai'i at Hilo (UHH) offers undergraduate courses and a degree program in astronomy (www.astro.uhh.hawaii.edu). With more than 65 students currently enrolled in this program, it is among the 10 largest undergraduate astronomy programs in the United States. Students enrolled in this UHH program routinely observe from Mauna Kea using a devoted 24" research telescope and plans are underway to replace it with a 0.9-meter remotely operated educational telescope equipped with modern detectors.

Also for undergraduates is the annual *Akamai Observatory Internship Program* which is administered in Hawai'i by the W.M. Keck Observatory (www.keckobservatory.org/article.php?id=7). This program is funded by the U.S. National Science Foundation through the Center for Adaptive Optics and partners with several of the observatories on Mauna Kea to provide real research challenges for undergraduates from Hawai'i Island and beyond. "Mentoring a student in this program was something I would definitely do again," said Dr. Scott Fisher of Gemini Observatory. "The input of the student(s) on the scientific projects we were working on was invaluable. I also think that giving the students "real world" projects to work on really helps them later in their academic careers."

On a global scale the research enabled by Mauna Kea changes humanity profoundly. By engaging observatory researchers and staff in local outreach the connection becomes personal and the impact even more profound.

Peter Michaud
Public Information and Outreach Manager, Gemini Observatory
Mauna Kea Observatories Outreach Committee, Chair

'Imiloa Astronomy Education Center of Hawai'i. Photograph by Kirk Pu'uohau-Pummill, Gemini Observatory

Master Teachers who represented 18 schools on the Big Island, DOE Administration and Astronomy educators who participated in Journey through the Universe 2007 on the Big Island

Astronomers and astronomy educators from the Journey through the Universe 2007 program that was held January 19-27 in Hilo, Hawai'i

Reaching out and Impacting Local Communities

Twice a year AAS members meet in different cities around the country to discuss and share current scientific research. Between 700 and 3,000 scientists, education specialists, and others convene in a selected city for four days only to leave again, most of the time unnoticed by the local community. Yet these different meeting locations provide a unique opportunity for the AAS community to make an impact nationally by sharing our excitement in science and leaving an imprint on every city we visit. Stating this summer, two new events to build connections with local communities will be hosted: an *Educator Reception* and *AstroZone*.

The *Educator Reception*, held on Saturday evening, is a reception for local K-12 teachers. Throughout the event, participants are provided the opportunity to gain background knowledge and collect resources to take back to their classrooms that pertain to press releases and scientific presentations planned for the conference week. K-12 educators often express the desire for deeper background scientific content knowledge and one-on-one interaction with scientists. The *Educator Reception* encourages both—through presentations by astronomers and a reception where scientists and teachers have the opportunity to mingle and interact with each other. Armed with the content knowledge gained and the resources collected, educators will have the tools to engage their students throughout the week of the conference—and beyond—using the excitement of current science.

AstroZone: Hawai'i is a four-hour open house for local families, teachers and kids to learn about the cool science currently occurring in the field of astronomy. On the Sunday afternoon prior to the AAS meeting, participants have a chance to meet scientists, do hands-on astronomy and take home lots of cool astronomy related resources collected during their visit. The *AstroZone* program takes its inspiration from an existing and successful model. Held the Sunday prior to each of their annual meetings, the American Meteorological Society (AMS) hosts the *WeatherFest* program, with over 2,000 participants and volunteers, which brings together scientists, area role models and the local community. *AstroZone* will have similar outcomes by providing a venue where the local community and AAS members can come together to share the excitement of science.

Both the *Educator Reception* and *AstroZone* allow the AAS and its members to more actively interact with the local communities in the cities where meetings are held and ensure that we make an impact, and leave and imprint, in every city we visit. The *Educator Reception* allows teachers to build a more concrete and personal connection with current science content which they can then impart on their students, while *AstroZone* makes science more accessible to the general public by making it fun and exciting for families, teachers, and kids while changing their perception of what science is and what scientists are.

The *Educator Reception* and *AstroZone* are sponsored by the AAS and Association for Astronomy Education (AAE) and co-organized by Jake Noel-Storr (AAS AEB/AAE President) of Rochester Institute of Technology, Insight Lab and Emilie Drobnes (SPD EPO chair/AAE Vice-President) of NASA, Goddard Space Flight Center. For more information on these events please visit the AAE website (www.aae.org).

Emilie Drobnes
NASA, Goddard Space Flight Center

Jacob Noel-Storr
Rochester Institute of Technology, Insight Lab

Join us for the Texas Educator Reception and AstroZone: Austin on Jan 5th and 6th 2008. Please contact the organizers Jake Noel-Storr (jake@cis.rit.edu) and Emilie Drobnes (emilie.drobnes@gsfc.nasa.gov) if you are interested in participating in these events!

Developing a Vision for AAS Education and Outreach Activities

The Astronomy Education Board (AEB) of the American Astronomical Society is charged with leading the education mission of the society and has spent the last 12 months deeply engaged in strategic planning. Of the nearly countless aspects that could be done regarding the spectrum of education, and scientific communication in general, our society focuses on five key ideas that prepare students and support members in pursing a wide range of career paths. These are to promote and support: (1) training the next generation of astronomers to be successful scientific researchers; (2) training the next generation of astronomers to be successful educators; (3) research on the teaching and learning of astronomy; (4) increasing the scientific literacy of all and sharing the excitement of astronomy with the public; and (5) increasing the participation of underserved populations in astronomy. Without question, each of these goals is much easier said than done. However, the AEB members feel strongly that these goals are consistent with the overall mission of the AAS and that our AAS members, in particular, have knowledge, skills, resources, and inclination to work together to meet these important goals.

As a first step, the AEB has designated several specific objectives as highest priority, first-steps targets. One of these is to substantially increase the number of interested, well-prepared undergraduates from all backgrounds entering—and successfully completing—graduate school, pursuing astronomy related research along a multitude of career paths. In addition, the AEB is targeting efforts to increase the amount of training in pedagogy that is part of faculty enhancement, and graduate education, nationwide. In support of these two goals, the AEB is striving to increase the number of high-quality papers published by providing peer-reviewed forums for sharing methods and results of astronomy education research by supporting *The Astronomy Education Review* (http://aer.noao.edu) as the premier scholarly avenue for publishing results of astronomy education research. As such, this effort should serve to increase the awareness of AAS members about the value, and nature of, astronomy education research.

Along another avenue of education and outreach, the AEB believes that the AAS has an important role in ensuring the availability of high quality, accurate, and effective astronomy content for the public. This can be accomplished in a variety of print and online resources including providing useful information, tools and training for AAS members who conduct outreach. *The Ancient Universe* booklet is an ideal example of such an activity. This effort can also provide pathways to increase the number of members who are actively engaged in outreach to the public.

Finally, the AEB believes that the AAS has a responsibility to increase access to, and pathways through, education programs for underserved populations to participate in AAS activities, and astronomy in general, by (i) ensuring that the design of all AAS educational activities incorporate the best practices related to diverse populations and (ii) increasing the number of AAS members who incorporate this perspective in their scholarly endeavors. The primary strategy to accomplish this is to actively seek genuine collaborations with AAS committees e.g. the Committee on the Status of Women in Astronomy (CSWA) and the Committee on the Status of Minorities in Astronomy (CSMA), on cross-cutting activities such as increasing visibility at other professional and scientific meetings that emphasize the inclusion of a diverse population of scientists and bring the results of these activities to the AAS membership.

Tim Slater
AAS Education Officer
Univ. of Arizona

Pluto Reclassified: Educational Impacts *and* Opportunities

Part Two of a Two-Part Series

In our last issue of Spark (Issue 3), we explored Pluto's reclassification through the insights of Mark Sykes of the Planetary Science Institute in his article *The Great Planet Debate*. He shared 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 this issue, Neil deGrasse Tyson of the American Museum of Natural History—where, in 2000, they were the first public institution to classify Pluto with its icy brethren of the Kuiper Belt—shares his own views on the negative educational impacts of emphasizing simple planet counting and name memorization, as well as the positive educational opportunities provided by considering multiple-classifications based on the potential for scientific research and discovery.

Gina Brissenden & Jacob Noel-Storr, Editors

Pluto's Requiem

It's official. Pluto is not a red-blooded planet, as decreed in August by a vote of the General Assembly of the International Astronomical Union. Pluto is now a "dwarf."

At first the IAU seemed ready to defend Pluto. On August 16, the union's seven-member Planet Definition Committee released a draft *Planet Definition Resolution*, which stated that round objects in orbit around the Sun are planets. Pluto is a round object in orbit around the Sun. Therefore Pluto is a planet. This definition would have given everyone the right to utter Pluto and Jupiter in the same breath, even though Jupiter is a quarter-million times larger. The draft resolution would also have opened the door to granting planet status to at least three objects that had, until recently, been considered unworthy.

Plutophiles had about a week to rejoice before the assembled IAU delegates voted. According to the final, amended IAU definition, a planet should still be round, but must also dominate the mass of its orbital zone. In other words, a full-fledged planet must not have competitors in its zone. Poor Pluto is crowded by thousands of other icy bodies in the outer solar system, some of which are bigger than Pluto itself, so it fails the test. To soothe Pluto's boosters, the IAU's elected to call it a "dwarf planet," without entirely quantifying what a dwarf is.

All this embarrassment stems from a simple problem. The term "planet" had not formally been defined since the times of ancient Greece, where the label originated. The word simply means "wanderer" and referred to the seven prominent celestial objects that moved against the background of stars. They were Mercury, Venus, Mars, Jupiter, Saturn, the Sun, and the Moon. So influential were these celestial wanderers on classical culture that the names of our seven days of the week can be traced to them.

Life got more complicated in 1543, when Nicolaus Copernicus described a newfangled, heliocentric

universe. Instead of remaining stationary in the middle, Earth moved around the Sun just like the others. From that moment onward, the term "planet" had no official meaning, and astronomers tacitly agreed that whatever orbits the Sun is a planet, and whatever orbits a planet is a moon.

Not a problem if cosmic discoveries had ended in 1543. But shortly thereafter, we learned that comets orbit the Sun too and are not, as long believed, local atmospheric phenomena. Comets are icy objects on elongated orbits that throw off a long tail of gases as they near the Sun. Are they planets too?

How about the craggy chunks of rock and metal that orbit the Sun in a region between Mars and Jupiter? When Ceres, the first of these objects, was sighted by Giuseppe Piazzi in 1801, everyone called it a planet. With the discovery of dozens of more, however, this new community of objects clearly deserved its own classification. Astronomers called them asteroids, and now have catalogued tens of thousands of them.

Even the traditional planets don't fit into one neat category. Mercury, Venus, Earth and Mars form a family because they are relatively small and rocky, while Jupiter, Saturn, Uranus, and Neptune are large, gaseous, have many moons, and bear rings.

The story took another twist in 1992, when David Jewitt and Jane Luu of the University of Hawai'i began finding frozen objects on the solar system's fringes, out beyond Neptune. They had discovered a new swath of space traffic, akin to the discovery of the asteroid belt two centuries before. Known as the Kuiper belt, in honor of the Dutch-born American astronomer Gerard Kuiper who predicted its existence, this region of the solar system contains Pluto, one of its largest members. But Pluto has been called a planet since it was discovered in 1930. So should all Kuiper belt objects be called planets?

Without a consensus definition for the word *planet*, these questions provoked years of pointless debate among people for whom counting planets matters. The geocentric universe contained seven planets. Then what became the heliocentric solar system contained six. With the discovery of Uranus in 1781, the figure rose to seven again. Then it jumped to 11 with the discovery of the four largest bodies in the zone between Mars and Jupiter. Then it dropped back to seven once again, after these four planets—and any others yet to turn up in the zone—were demoted to asteroids. Once Neptune was discovered in 1846, the total became eight.

After the discovery of Pluto, the tally rose to the now-familiar nine. Astronomer Clyde Tombaugh had found Pluto through a dogged search for a long-suspected "Planet X" beyond Neptune, and everyone initially assumed he had found something large. Refined measurements showed the object to be much, much smaller than originally thought, smaller in fact than six satellites in the solar system, including Earth's moon.

Then, for that one week in August, there were 12 planets. The IAU's roundness criterion added Ceres, the only gravitationally round asteroid; Pluto's moon Charon, which is unnaturally large compared with Pluto; and 2003 UB313, temporarily but affectionately called Xena, after the leather-clad, medieval Warrior Princess from cable television. Now, officially, we are back to eight—the nine you memorized in grade school, minus Pluto.

If my overstuffed email inbox is any indication, this game of planetary enumeration remains a deep concern of elementary school students and the mainstream media. After all, counting planets is what allows you to invent clever mnemonics to remember them in sequence from the Sun, such as "My Very Educated Mother Just Served Us Nine Pizzas." Or its likely successor: "My Very Educated Mother Just Served Us Nachos."

But such exercises have stunted the curiosity of an entire generation of children by suggesting that memorizing a sequence of names is the path to understanding the solar system. The word *planet* seems to hold an irrational sway over our hearts and minds. That level of fascination made sense in the days before telescopes could observe details in planetary atmospheres; before space probes had explored Mars and bulldozed into a comet; before we understood the history of asteroid and comet collisions that links celestial bodies large and small. But today, the rote exercise of planet-counting rings hollow, and stands in the way of appreciating the full richness of our cosmic environment.

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Suppose other properties are what matter to you. Interested in cyclones? You might lump together the thick, dynamic atmospheres of Earth and Jupiter. Interested in the chemistry of life? Icy moons like Jupiter's Europa and Saturn's Enceladus may be the best extraterrestrial places to find liquid water, a crucial ingredient for biology. Or suppose instead you care about ring systems, or magnetic fields, or size, or mass, or composition, or proximity to the Sun, or formation history. And the discovery of planets around other stars has exposed entire new categories like "hot Jupiters"—giant, gassy worlds heated to near-incandescence by their astonishing proximity to their suns.

These classifications say much more about an object's identity than whether its self-gravity made it round, or whether it is the only one of its kind in the neighborhood. Why not rethink the solar system as multiple, overlapping families of objects? Then, the way you organize the properties is up to you. The fuss over Pluto doesn't have to play out as a death in the neighborhood. It could mark instead the birth of a whole new way of thinking about or cosmic backyard.

This article is adapted from Neil's "Requiem for a Solar System," which appeared in Discover magazine, November 2006.

Neil deGrasse Tyson
Hayden Planetarium
American Museum of Natural History

Full Circle

It's been ten years since I completed my term as Education Officer for the AAS. When I began my service, I did not foresee the huge advancements in astronomy education that would occur over a six-year period. Among the initiatives for the AAS, Peter Boyce (then Executive Officer) and I obtained NSF funding to sponsor awards for undergraduate research; as part of this effort, we began to host a special undergraduate reception at meetings. NASA funding was used to sponsor two-day workshops for schoolteachers that were held in conjunction with Society meetings across the country. In addition, regular education sessions were held at the Society meetings.

But the big change came from outside forces. On the national scene, the book *Science for All Americans* had come out the year prior to my election. It answered the 1983 publication *A Nation at Risk* with a belief that producing a science-literate populace was a solution for our country's problems. The National Academies began the process of devising national science education standards. Astronomers came to the table rather late—after the decision had already been made to group space science with earth science rather than with physical science. The Society was invited to provide input to the National Committee on Science Standards and Assessment of the National Research Council. Each new version of the content standards had a different colored cover, and they arrived periodically for review by the Education Advisory Board. My role in the review process expanded when I was invited to join the Coalition for Earth Science Education to provide input on standards. The earth science community seemed to me to be a swarm of separate groups that had previously been more in a *competition* mode than in a *cooperative* mode. The standards project provided a reason for their communication and cooperation. As the "token astronomer," I found myself in the midst of a group of geologists of various flavors with an occasional oceanographer or meteorologist appearing. Since everyone felt that the essential material from their discipline was necessary for every student to learn, it made for many interesting conversations, discussions, debates, and compromises. If everyone had succeeded, a basic education in the US would not be grades K-12,

but something like K-25. Eventually we worked our way to a final document. I recall my passionate (and useless) pleas for including "comparative planetology" as a link between the earth and space sciences. The inclusion of a topic entitled "origin and evolution of the universe" seemed like a victory. Of course, working with the standards project meant more than arguing over what content was essential. It was an opportunity to learn about the other standards—the standards on how to teach, on professional development for teachers, the use of inquiry in the classroom, and new ideas on alterative assessment.

Many of the ideas that were so well presented in the *National Science Education Standards* were simultaneously, but perhaps more slowly, creeping into the college classroom. Just as government agencies supported K-12 teacher professional development to promote the standards, support from government agencies and college authorities promoted new efforts in teaching science to undergraduates; and with these funds, came forth efforts to show what was effective—in other words, astronomy education research.

I feel I've come full circle since completing my term as Education Officer. I've sampled astronomy education research and participated in the University of Texas *Discovery Learning* project for undergraduates. I've continued presenting teacher professional development workshops at McDonald Observatory, on a smaller scale than the American Astronomical Society Teacher Resource Agent program, but now impacting annually a larger number of teachers. And, most recently, I found myself last month as the "token astronomer" at the Earth and Space Systems Summit—a national meeting held to identify the essential principles and concepts of Earth and Space Science for an eventual high school capstone course.

The AAS and the Astronomical Society of the Pacific (for which I now serve as secretary to the Board of Directors) offer all astronomers opportunities to become involved in various aspects of astronomy education, public outreach, and astronomy education research. Both societies provide support for those just starting their involvement, as well as a venue for sharing ideas. Astronomers have an opportunity to bring the excitement of our science to students at all levels, and to answer the appeals made so many years ago to increase the science literacy of the general public as well as prepare the next generation of scientists and engineers. Take advantage of these opportunities.

Mary Kay Hemenway
University of Texas at Austin

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Lastly, you will find a schedule of all education-related sessions and workshops at the 210th Meeting on page 16.

All submissions, including letters to the editors, should be sent to the editors, Gina Brissenden (gbrissenden@as.arizona.edu) and Jake Noel-Storr (jake@cis.rit.edu).

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I hope you enjoy this issue.

Sincerely,

Susana Deustua
Director of Education
American Astronomical Society

Susana Deustua is the Director of Education of the Society, and is responsible for managing and implementing the Society's education and outreach programs.

Handbook of College Science Teaching

Edited by Joel Mintzes & William Leonard
Published by National Science Teachers Association (NSTA) Press

The literature on teaching science at the college-level is voluminous and can be intimidating to the instructor who is not trained in the field. Landmark publications like *How People Learn* (Bransford et al 2000; see *Spark*, Issue 1, for a summary) are monolithic, with each chapter depending on the previous, and are thus difficult to absorb.

The *Handbook of College Science Teaching* is a breath of fresh air. The editors issued a "call for proposals" to the science education community, and from this have assembled a collection in which each chapter stands on its own. The fairly short (less than 10 pages per chapter) format allows even the busiest of adjunct instructors to gain an introduction into the latest techniques for teaching science. Chapters on attitudes and anxiety, experiential learning and interactive engagement, concept mapping and peer instruction, and many more innovative techniques are elegantly laid out. There is an entire section (six chapters) on "Innovative Teaching Approaches". It's like having a faculty coffee room available on your bookshelf.

For the practitioner of education research, there is a good deal here as well. Questionnaires that have been used to assess student's attitudes and knowledge are available at the end of many chapters, as are references to many more. Standardization of such instruments and metrics cannot help but improve the comparison of different pedagogical approaches. There is also good advice for the instructor who wants to break into the education research field.

Another section (three chapters) addresses pre-college science teaching, although as may be expected the emphasis is on producing students who are successful in undergraduate science courses. In particular the suggestions at the end of chapters 4, 8, 13, 16, 31, and 33 can help focus the intentions of a college teacher at any level or institution.

The major weakness, acknowledged by the editors, is completeness. The authors are writing about *their* particular interests, and so not all topics are well covered. In addition, the editors have minimized the problem of continuity by grouping the chapters into sections; however, frequently a chapter contains information pertinent to other sections. Perhaps the best way to approach the collection is to look at the chapter titles and see which of them pique your interest. You would be well served to dip into other chapters, though—you never know what might be applicable to your situation.

As more and more of the general population goes to college, a smaller and smaller proportion of our students in general science will be prepared to absorb the material via traditional methods. In *NSTA Reports* (vol. 18 no. 8, April 2007) we read that "nearly 15% of public school graduates from the class of 2006 achieved an AP exam grade of three or higher (the score indicative of college success) on a scale of one to five during their high school years." So, if 85% of incoming students did not achieve scores "indicative of college success," it behooves all of us to find better ways to encourage success. The *Handbook of College Science Teaching* provides many possibilities for us learn about some of these better ways.

Reviewed by Alex Storrs
Towson University

New Issue of Astronomy Education Review Is Published

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

Research and Innovation

- Different Reward Structures to Motivate Student Interaction with Electronic Response Systems in Astronomy by Patrick M. Len (Cuesta College)
- Astronomy Diagnostic Test Results Reflect Course Goals and Show Room for Improvement by Michael C. LoPresto (Henry Ford Community College)
- What's Educational about Online Telescopes?: Evaluating 10 Years of MicroObservatory by Roy Gould, Mary Dussault, and Philip Sadler (Harvard-Smithsonian Center for Astrophysics)
- Learning about Gravity I. Free Fall: A Guide for Teachers and Curriculum Developers by Claudine Kavanagh (Tufts University) and Cary Sneider (Museum of Science, Boston)
- Learning about Gravity II. Trajectories and Orbits: A Guide for Teachers and Curriculum Developers by Claudine Kavanagh (Tufts University) and Cary Sneider (Museum of Science, Boston)
- Development and Validation of the Light and Spectroscopy Concept Inventory by Erin Bardar (Boston University and TERC), Edward Prather (University of Arizona), Kenneth Brecher (Boston University), and Timothy Slater (university of Arizona)
- Effectiveness of Amateur Astronomers as Informal Science Educators by Michael Gibbs and Margaret Berendsen (ASP)
- Towards a Methodology for Informal Astronomy Education Research by Nicholas Stroud (Teachers College, Columbia University), Meghan Groome (National Governors Association), Rachel Connolly (American Museum of Natural History), and Keith Sheppard (Stony Brook University)

Innovation and Resources

- The Human Orrery: A New Educational Tool for Astronomy by D. J. Asher, M. E. Bailey, A. A. Christou, and M. D. Popescu (Armagh Observatory, Northern Ireland)
- Survey of Introductory Astronomy Textbooks: An Update by David Bruning (University of Wisconsin-Parkside)
- SABER: The Searchable Annotated Bibliography of Education Research in Astronomy by David Bruning (University of Wisconsin-Parkside), Janelle Bailey (University of Nevada, Las Vegas), and Gina Brissenden (University of Arizona)
- Planetfinder: An Online Interactive Module for Learning How Astronomers Detect Extrasolar Planets by Richard McCray, University of Colorado

Opinion and Commentary

- Astronomy Education Review: A Five-Year Progress Report and Thoughts about the Journal's Future by Andrew Fraknoi (Foothill College) and Sidney Wolff (NOAO)
- Teaching What a Planet Is: A Roundtable on the Educational Implications of the New Definition of a Planet conducted by Andrew Fraknoi (Foothil College and the ASP)
- A First Glimpse of Student Attitudes about Pluto's "Demotion" by Michael LoPresto (Henry Ford Community College)

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 10th issue by clicking on "back issues" and then on "vol. 5, no. 2".

Sidney Wolff & Andrew Fraknoi, AER Editors

Education Updates from AAS Divisions and Committees

High Energy Astrophysics Division (HEAD)
The High Energy Astrophysics Division (HEAD) of the AAS carries out a very active E/PO program, generally related to the high energy missions.

Chandra E/PO activities
Kathy Lestition
Smithsonian Astrophysical Observatory

The Chandra program continues to offer a variety of workshops through the NSTA national and regional meetings, and in other geographical settings. Our short course at the 2007 national meeting, "Decoding Starlight: From Pixels to Images" was selected as one of five short courses to be highlighted as a part of the Technology: Research and Practical Applications (ISTE) strand. In addition to a number of short term workshops, we are planning three week-long programs this summer in conjunction with Taylor Observatory, McDonald Observatory, and with the AAVSO at the University of New Orleans. The Cycle 8 EPO peer review selected 9 proposals for funding. The multi-wavelength Braille book, *Touch the Invisible Universe*, produced with Cycle 6 funding, has been printed and will be released this summer. The deadline for EPO proposals in Chandra Cycle 9 has been extended to Friday, Nov. 2, 2007. The public web site was reviewed by Schoolzone, the UK's leading evaluation service for online educational resources and rated "Highly Recommended". We have developed a series of podcasts about Chandra operations and science. The first episode was awarded the 2007 International Pirelli award for science and technology communications, physics division. More details on all of the above can be found on the Chandra public web site at www.chandra.harvard.edu or contact Kathy Lestition at kathy@head.cfa.harvard.edu.

Black Holes: The Other Side of Infinity
Lynn Cominsky
Sonoma State University

On October 11, 2006, the Sonoma State University Education and Public Outreach Group held a teacher's workshop in conjunction with the AAS/High Energy Astrophysics Division meeting in San Francisco. The workshop, entitled "Beyond the Event Horizon: Education with Black Holes" was held at the Chabot Space and Science Center in Oakland, and was designed to accompany the planetarium show "Black Holes: The Other Side of Infinity." The planetarium show was developed with funding by the National Science Foundation and NASA's Gamma-ray Large Area Space Telescope (GLAST) mission. It was directed by Tom Lucas and was produced by the Denver Museum of Nature & Science in association with the PBS science series, NOVA. Tom Lucas also directed a one-hour NOVA episode about black holes, titled Monster of the Milky Way, which premiered on October 31, 2006. Both the planetarium and NOVA shows feature groundbreaking, scientifically accurate simulations of black holes which are visually stunning, transporting viewers to the edge of the event horizon and beyond. The black hole simulations used software developed by Professor Andrew Hamilton from the University of Colorado. On the search for black holes across deep space, viewers also encounter a range of spectacular cosmic wonders visualized by the National Center for Supercomputing Applications, including a depiction of the beginning of the Universe, the Big Bang, endless seas of dust and gas drawn together by gravity to form the first stars, the collision of two galaxies that cross paths in the vastness of space, and a virtual trip into the center of the Milky Way galaxy. The planetarium show is available through Spitz, Inc., and is now showing world-wide.

The SSU E/PO group has put together a resource website that includes complete presentation materials for the teachers' workshop, as well links to downloadable materials such as the black hole educator's guide which accompanies the planetarium show, a "Frequently Asked Questions" brochure about Black Holes (available in both English and Spanish) and links to the PBS NOVA website for the television program, other black hole classroom activities, cool black hole games, and more. For more information, see http://glast.sonoma.edu/teachers/blackholes/index.html.

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

Meet the Solar Physics Division Education & Public Outreach Committee!

Left to right: Emilie Drobnes, Zoe Frank, Pete Riley, Rich Wolfson, Jie Zhang

Emilie Drobnes (chair) is the EPO lead for the Solar Dynamics Observatory (SDO) at Goddard Space Flight Center (GSFC) and is changing people's perceptions of science, one project at a time. She is the mastermind and design diva behind the development of a multitude of NASA related formal and informal education and outreach efforts around the country, with a particular focus on Solar and Heliospheric Science. In her spare time, Emilie jumps from airplanes, sings karaoke, and rides mechanical bulls.

Zoe Frank spends most of her days helping to produce beautiful image of the Sun to stimulate the imagination of kids of all ages. Zoe works with the gurus of the Lockheed Martin Solar and Astrophysics Lab in Palo Alto, CA and rubs elbows with the great minds of Stanford University. She spends her off hours basking in the sunlight in her backyard.

During the day, **Pete Riley** masquerades as a Space Physicist at Science Applications International Corporation in San Diego studying the large-scale structure of the solar corona and inner heliosphere and the initiation and evolution of coronal mass ejections. He uses MHD codes running on supercomputers to verify that spacecraft measurements are correct. When not at work, he's the husband of the most tolerant woman in the world, father to 3 children, an IronMan, and ultra-distance runner.

Rich Wolfson is part solar physicist, part science educator. As a solar physicist, he focuses narrowly on the physics of the solar corona. As an educator he takes a broad look at all of physics. He's published both textbooks and books for general audiences, and has produced video courses with *The Teaching Company*. Solar physics manages to seep into all his educational activities, and the SPD Education/Public Outreach Committee offers an excellent opportunity for Rich to combine his interests in solar physics and education.

Jie Zhang is an assistant professor in Computational and Data Sciences Department (CDSD) at George Mason University (GMU). He is also serving as the director of Space Weather Lab at GMU. In addition to having fun teaching, he is interested in solving the long-standing mystery in our solar system: why the Sun intermittently produces huge eruptions that produce space storms and disrupt critical human technological systems in space. He likes to make use of the state-of-the-art computational technology, such as imaging processing, machine learning and data mining, to help scientific research. He also enjoys swimming and playing ping-pong.

Education and Related Sessions at 210 Meeting
May 27-31, 2007 - Honolulu, HI

Saturday, May 26, 2007

NASA CAE Workshop
9:00 am-5:00 pm
Hawaii Convention Center

Educator Reception for K-12 Science Teachers
Sponsored by Lockheed Martin Advanced Technology Center and the AAS
5:00pm-8:00pm
Ala Moana, Carnation

Sunday, May 27, 2007

NASA CAE Workshop
9:00 am-5:00 pm
Hawaii Convention Center

AstroZone: Hawaii
12:00-4:00 pm
Convention Center

Workshop 1:00 – 5:00 pm
Education and Public Outreach by NASA Researchers
Ala Moana

Undergraduate Orientation
6:00-7:00pm
Garden Rooftop

Opening Reception
7:00-9:00pm
Garden Rooftop

Monday, May 28, 2007

Special Session 31: 10:00 am – 11:30 am
Native Hawaiian Astronomy and Navigation
Room 314

Poster Session 5: 9:20 am – 7:00 pm
Citizen-Scientists and Public Astronomy
Exhibit Hall

Tuesday May 29

Explore Polynesian Voyaging in the StarLab Portable Planetarium
9:20 am, 12:45 pm , 3:30 pm, 5:00 pm
Exhibit Hall

Poster Session 5: 10:00 am – 7:00 pm
Citizen-Scientists and Public Astronomy
Exhibit Hall

Poster Session 5: 10:00 am – 7:00 pm
Citizen-Scientists and Public Astronomy
Exhibit Hall

Wednesday May 30

Explore Polynesian Voyaging in the StarLab Portable Planetarium
9:20 am, 12:45 pm. 3:30 pm, 5:00 pm
Exhibit Hall

Poster Session 73: 10:00 am – 6:30 pm
Career Issues

Poster Session 80: 10:00 am – 6:30 pm
Education in Practice – From K-12 to Undergraduate
Exhibit Hall

Thursday, May 31, 2007

Special Session 111: 10:00 am – 11:30 am
Women of Solar Physics: Status and Science
Room 318

Oral Session 116. 10:00 am – 11:00 am
Astronomy Education and Public Outreach
Room 323 C

Poster Session 73: 9:20 am – 2:00 pm
Career Issues

Poster Session 80: 9:20 am – 2:00 pm
Education in Practice – From K-12 to Undergraduate
Exhibit Hall

Astronomy Education Research Town Hall Meeting
12:45-1:45
Room 315

Committee on the Status of Women
12:45 – 1:45 pm
Room TBA