



Education and Outreach from Deep in the Heart of Texas



This year at McDonald Observatory, we continued many of our successful education and public outreach programs, began some new ones, and planned for the future.

The newest star in our constellation of astronomy education programs is "Live from McDonald Observatory." This is a videoconference program that allows teachers and their students to "tour" the

observatory and interact with an astronomer. Texas is such a large state that many interested schools cannot make the long journey for a field trip to visit us. We've seen a lot of teacher interest in this videoconference program, and have done several dozen successful videoconferences already.

In mid-May, we held an Open House at McDonald Observatory that was geared toward nearby residents. On this day, all of our public programs were free of charge. The day included lots of special events as well, including public talks from our scientists, on-site fire-safety exhibits from the Texas Forest Service, and a free lunch.

We have also continued many of our popular education and outreach programs this year, like tours and star parties at our Frank N. Bash Visitors Center, teacher professional development workshops at McDonald, and our StarDate and Universo radio programs and *StarDate* magazine.

In 2007, the Frank N. Bash Visitors Center at McDonald Observatory welcomed around 55,000 visitors. We offer visitors guided tours of our research telescopes; live, safe solar viewing in our theater; thrice-weekly star parties under the darkest night skies of any professional observatory in the continental United States; a café and astronomy gift shop; and more.

The Visitors Center played host to 10 teacher professional development workshops in summer 2007. During these workshops, teachers generally stay for 3 days and 2 nights.

In addition to meeting astronomers and visiting professional telescopes, they perform activities to take back to their classrooms. Topics this summer ranged from Exploring the Solar System, to White Dwarfs and the Age of the Milky Way, to Light and Optics. The content of our workshops is aligned with the National Science Education Standards, as well as the Texas Essential Knowledge and Skills.

Some of our education and outreach programs are produced in Austin on the main University of Texas campus. This year, we continued our long-running EXES teacher program under the direction of Dr. Mary Kay Hemenway. University of Texas professor John Lacy is building EXES (the Echelon Cross Eschelle Spectrograph) for use on SOFIA. Since 1998, more than 50 EXES teacher meetings have been held, which usually include an update on EXES/SOFIA, an additional science talk, and beta-testing of a classroom activity for students. Some EXES teachers have traveled to Hawaii to participate in an observing run of TEXES, the EXES prototype instrument developed by Lacy.

Our two radio programs, StarDate and its Spanish-language counterpart, Universo, continue to thrive. StarDate is the longest-running nationally broadcast science program on the nation's airwaves. Heard by millions each day on 325 stations nationwide (including all of the major markets and the Armed Forces Radio Network), the program is a two-minute radio broadcast about what's up in the sky. Universo brings Spanish-language skywatching information to millions via 140 U.S. stations, and is also heard in Canada and several Central American countries. A German version, *Sternzeit*, airs throughout Germany daily.

We also continue to publish our popular-level astronomy magazine *StarDate*. It currently has about 9,000 subscribers. The magazine comes out six times per year. Each issue is full-color, and includes feature stories on astronomy research and history, the latest astronomy news, as well as detailed skywatching information and sky charts.

But that's not all! The future of education and public outreach from McDonald is looking bright. We've got several exciting new programs in development.

SPaRk

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About This Issue

Once again, the current issue of *Spark* underscores the impact of AAS members dedicated to improving and expanding astronomy education. Ten years ago, who knew that Sandy Preston's *StarDate* would not only endure but thrive, heard on the airwaves not only in English but in Spanish (as *Universo*)? And who would have foreseen astronomy education as an emerging, and growing, area within the broad area of astronomical research?



Yet, within this issue we read about McDonald Observatory's continuing and new education and outreach programs from "Deep In the Heart of Texas", whose success is due not only to the front-line people like Sandy, and Mary Kay Hemenway, but also to the astronomer colleagues in Texas, whom you may not have realized were, and are, quiet supporters of these efforts.

Kudos to nationally recognized astronomy educator and AAS Member, Andrew Fraknoi, who was named the 2007 California Professor of the Year. See the article on page 9 for the full story.

In these pages, Sydney Wolff announces the 11th (!) issue of *Astronomy Education Review*. The twelfth (yes, the twelfth) is now in preparation, and expanding to include a special section on astronomy demonstration articles edited by S. Pompea and J. Keller. This means that there are now many of you actively engaged in innovating and/or improving **and** testing classroom demonstrations. And that Dave Bruning can provide us a top ten list of articles to read (and by ten different first authors) just from *AER* is a testament to both the growth of *AER* but also to the growth of the scholarly field of astronomy education.

When we refer to under-representation in astronomy we often mean the under-representation of ethnic groups, however, a far broader meaning includes many unrecognized underserved populations. One of these is people with disabilities, and so I wish to call to your attention Doris Daou's article on the *Touch the Invisible Sky: A Multi-Wavelength Braille Book Featuring Tactile NASA Images*.

Both Sara Mitchell's "how to" article, **Getting It Out There: Astronomy Education in Every Venue**, and John Percy's review of the *Handbook of Research on Science Education*, Edited by Sandra K. Abell and Norman G. Lederman, 2007 serve to remind us that to be effective educators we should be open to learning from, and emulating, others successful experiences and research. After all, imitation (with due diligence on giving credit where due) is the sincerest form of flattery!

And finally, remember that your Society, its Committees, and its Divisions are quite active—as in the article by T. Slater and the reports from CAPP, SPD and HEAD attest.

Enjoy,
Susana E. Deustua,
Director of Education

Education and Outreach from Deep in the Heart of Texas continued

The Galaxies and Cosmos Explorer Tool (GCET) is being developed for high-school and college-age students by a team led by University of Texas astronomy professor Shardha Jogee. This on-line, web-based resource will allow students to access a wealth of multi-wavelength data from Hubble Space Telescope and other observatories on the evolution of galaxies and create a conceptual understanding of how our own galaxy in the present universe came to be.

The tool contains images of over 8,000 galaxies covering two-thirds of the age of the visible universe, in a veritable zoo of sizes, brightnesses, colors, and shapes. A variety of exercises are being developed for high school and undergraduate instruction. The project is funded by grants from NASA, NSF, and The University of Texas.

A wheelchair-accessible telescope (WAT) is being developed for use at the Frank N. Bash Visitors Center at McDonald Observatory. The telescope's concrete pad and pier are already completed in the Visitors Center's public telescope park, and are awaiting installation of the telescope. This may come in mid-to-late 2008. We anticipate a dedication ceremony in 2009 to coincide with the International Year of Astronomy.

The MONET/North telescope located at McDonald Observatory atop Mt. Locke, is a unit of the Monitoring Network of Telescopes. MONET is a robotic telescope, with a twin at the South African Astronomical Observatory. One of the purposes of the MONET telescope at McDonald is to allow daytime remote observing for school children in Germany. The telescope is funded by the Alfried Krupp von Bohlen und Halbach Foundation. As site host for MONET, McDonald Observatory receives a percentage of observing time on both our unit, and MONET/South. In the near future, we will host teacher workshops and create classroom lessons for remote daytime observing from Texas schools using the African telescope and other remote telescopes.

In other news, McDonald Observatory has recently become a site for the Astronomical Society of the Pacific's Project ASTRO. This effort is headed up by McDonald research fellow Dan Lester.

As you can see, we've got plenty to keep us busy! We are blessed to work in astronomy and we look forward to continuing to do great education and outreach in this exciting field.

***Sandra Preston
McDonald Observatory***



Aerial view of McDonald Observatory. Front: Hobby-Eberly Telescope dome. Rear: Harlan J. Smith and Otto Struve telescopes. Photo by Marty Harris.



Students at Blackshear Elementary in Austin participate in a "Live ... from McDonald Observatory" videoconference. Photo by Susan Williamson.



Secondary teachers attending a professional development workshop at McDonald Observatory pause to have their photo taken on the catwalk of the Harlan J. Smith telescope. Photo by Kyle Fricke.

Top Ten Articles in *Astronomy Education Review* that Every Educator Should Read

<http://aer.noao.edu>



Every astronomy instructor should read the astronomy education literature. This isn't some vague statement like "Eat your yams—they're good for you." As professionals, we understand the role research has in developing new knowledge. To be good instructors, we need to read about education research to inform our teaching methods.

This isn't a plea to get you to perform education research. Not every astronomer does cosmological research, but we all read about inflation and dark energy to better prepare for our classes and to maintain our self-identity as scholars. So should we also read about education research to know how to help our students learn effectively.

With the risk of offending everyone in the astronomy education community, I list ten articles in the astronomy education research literature that I think everyone should read. I restricted my search to *Astronomy Education Review* (AER) because it is now the dominant journal for astronomy education research.

To make my "Top Ten," an article must broadly describe the educational process instead of addressing a single concept, such as Earth seasons. The articles I've included also principally address undergraduate education, but they should influence educators from a variety of settings. Several are not strictly research reports but are "meta" papers that provide a structure for understanding the important research. In inverse order (a la Letterman):

10) Bailey, J.M. and Slater, T.F. (2003).
"A Review of Astronomy Education Research," *Astronomy Education Review*, 2 (2), 20-45.
What better place to start your reading journey than with a comprehensive review of astronomy education research categorized by concept. Its suggestions for future research should give you a taste of what lies ahead.

9) Zeilik, M., and Morris-Dueer, V.J. (2005).
"What Are Essential Concepts In 'Astronomy 101'? A New Approach to Find Consensus from Two Different Samples of Instructors," *Astronomy Education Review*, 3 (2), 61-108.
Less is more—we need to cut back on topics so we can spend more time in class getting students to think. Instructors may not agree which 40 topics should populate a one-semester course but we do agree which are the 10 most important topics. This paper is a good place to start your internal debate as to what topics you can discard and which ones are key to your learning goals.

8) Partridge, B., and Greenstein, G. (2003).
"Goals for 'Astro 101': Report on Workshops for Department Leaders," *Astronomy Education Review*, 2 (2), 46-89.
Teaching isn't about topics. Our teaching goals should be to get students to embrace learning and to have them progress to the higher thinking stages. This report emphasizes student development over content and recognizes that skills, values, and attitudes are as important as topical content. It includes suggestions and strategies on how to meet these goals.

7) Fraknoi, A. (2002).
"Enrollments in Astronomy 101 Courses: An Update," *Astronomy Education Review*, 1 (1), 121-123.
Your students are not like you. Student populations change, sometimes quickly. You cannot approach teaching unless you know your audience and what their values and distractors are.

6) Miller, E. (2003).
"The Gender Gap in Cosmology: Results from a Small Case Study of Undergraduates," *Astronomy Education Review*, 1 (2), 35-45.
Male and female students bring different experiences and expectations to our classes. This is a starting place if you haven't thought about gender issues in your class before. Miller's study reveals that female students consistently underestimate the scale of the universe and have less confidence about their answers even when they are correct.

5 (tie) Deming, G. (2002).
"Results from the Astronomy Diagnostic Test National Project," *Astronomy Education Review*, 1 (1), 52-57.
Bardar, E., Prather, E., Brecher, K., and Slater, T. (2007).
"Development and Validation of the Light and Spectroscopy

Concept Inventory," *Astronomy Education Review*, 5 (2), 103-113. We need good assessment to determine whether our teaching methods are successful. Student evaluations can be worthless as discriminants of good teaching, but these two diagnostic tests may help you examine how successful your teaching methods are.

3) Hudgins, D., Prather, E., Grayson, D., and Smits, D. (2007).

"Effectiveness of Collaborative Ranking Tasks on Student Understanding of Key Astronomy Concepts," *Astronomy Education Review*, 5 (1), 1-22.

Active learning needs carefully designed activities to get students to link ideas and confront misconceptions as they evolve from "regurgitators" to self-empowered learners. Ranking Tasks are a favorite activity in the physics community and now are being developed in astronomy.

2) Prather, E.E., Slater, T.F., Adams, J.P., Bailey, J.M., Jones, L.V., and Dostal, J.A. (2004).

"Research on a Lecture-Tutorial Approach to Teaching Introductory Astronomy for Nonscience Majors," *Astronomy Education Review*, 3 (2), 122-136.

In-class activities must evolve from converted lab activities and simple worksheets on the current topic. Successful learning by students requires a choreographed approach to enable students to use their pre-existing knowledge, avoid

improper use of primitive organizers (DiSessa's p-prims), confront misconceptions, and to construct a conceptual structure. Lecture-Tutorials are one way to assist students in their learning evolution.

1) Brissenden, G., Slater, T.F., Mathieu, R.D., and NISE College Level-One Team (2002).

"The Role of Assessment in the Development of the College Introductory Astronomy Course," *Astronomy Education Review*, 1 (1), 1-24.

If you get nothing else from the "Top Ten" article, it should be that assessment is key. Before you change anything in your classroom, you should carefully assess its current state. As you change each structure in your class, you should assess how it affects student learning. Quite simply: assess, assess, assess. These authors provide a practical how-to guide for assessment of student learning.

Undoubtedly your top ten list differs from mine. But that's okay as long as you use the literature to shape your teaching!

Dave Bruning
University of Wisconsin-Parkside

Snapshots from Education at the Hawaii Meeting



Chris Irwin shows us all how happy he is to take on the role of Managing Editor for *AstronomyCenter.org*, the Astro 101 archive of the National Science Digital Library cosponsored by the NSF, AAS, and AAPT.



José Francisco Salgado, Astronomer from the Adler Planetarium, talks about ways the Adler reaches out to the Spanish-speaking community in Chicago. The initiative called Adler en Español includes audio tours and programs in Spanish as well as *Nuestra Galaxia*, a 2-minute astronomy news segment on TV hosted by Salgado. Photo credit: Anaida Morales-Droz

Handbook of Research on Science Education



Edited by Sandra K. Abell and Norman G. Lederman, 2007
Lawrence Erlbaum Associates, Publishers; List Price: \$95.00 (softcover)
ISBN: 9780805847147

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John Percy
University of Toronto

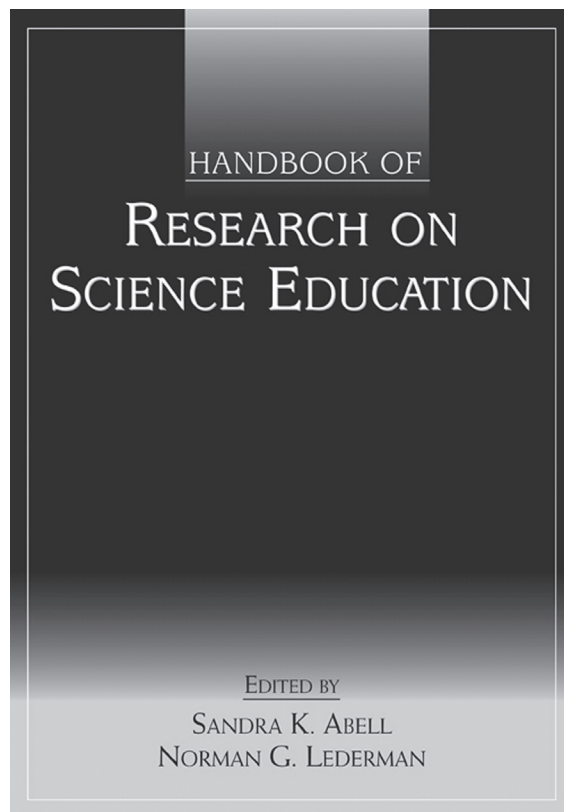
In September 2007, a small group of astronomy educators met at Tufts University to begin drafting an “astronomy education research (AER) charter”—a call-to-arms to improve the quantity, quality, variety, relevance, and impact of AER at the K-12, post-secondary, and public education levels. Every astronomy educator should obviously strive for effectiveness by using strategies based on education research and “best practices.” Millions of K-12 students in North America take astronomy courses or units each year, and 250,000 post-secondary students (mostly non-science students) take “Astro 101.” But few K-12 teachers have any background in astronomy content or pedagogy, and few post-secondary instructors have any background in pedagogy at all! How do we increase the quantity, quality, and variety of AER, disseminate it to the astronomy education community, and ensure that it is implemented? Among other things, we must make use of what is already known from science education research, in general.

Which brings us to the significance and timeliness of the *Handbook of Research on Science Education*. Its stated purpose is “to look backward in time in an attempt to capture where science education has been, and what we currently know... and to project into the future”. It contains 39 chapters, grouped into sections on: science learning; culture, gender, and society and science learning; science teaching (including separate chapters on teaching biology, chemistry, earth science, and physics—but not astronomy); curriculum and assessment in science; and science teacher education. It is international, comprehensive, peer-reviewed, densely-written, exhaustively referenced, and reasonably well indexed.

This handbook contains little of immediate *direct* interest to most readers of this newsletter. Although there is a 56-page chapter on “Learning Earth Sciences”, there is less than a page on “earth and space science”—mostly on teachers’ lack of knowledge in these areas. The references to the work

of Philip Sadler and Timothy Slater, two of the leaders in AER, are to their work in other areas. There are three pages on museums and science centers; planetariums are not mentioned. These pages are in a chapter on out-of-school science education, and deal mainly with formal research on these facilities. But, for the general reader, there is little to place these facilities in context. And the index does not include colleges and universities; the emphasis, in the handbook, is on K-12 science education.

Nevertheless, there are many chapters on topics of general interest and importance: diversity, gender, special-needs students; aboriginal students, inner-city and rural education, and international science education. And this handbook will be essential for anyone carrying out serious science education research, giving or taking a graduate course on the subject, or directing pre-service or in-service science teacher education. I particularly enjoyed the section on science teacher education: the papers were an excellent balance between philosophy, research, and practice. The chapter on Learning to Teach Science made effective use of narrative boxes and case studies. This is the stuff that those of us who are involved in teacher education in an “amateur” way should really know.



Building a Welcoming Environment for Undergraduates at Meetings



Does it seem like AAS meeting attendees are actually getting younger or is it just that we are getting older? Well, like many things in this world, it is actually a little of both. Discarding the fact that we are getting older ourselves, the number of undergraduates at the AAS meetings has increased dramatically. The past few AAS winter meetings have been the gathering place for more than 300 undergraduate

students. In fact, according to the American Physical Society (APS), the winter AAS meetings host the largest simultaneous assembly of undergraduate students majoring in physics in the entire country!

There are numerous reasons that this surprisingly and uniquely large gathering of undergraduates occurs at the AAS meeting. Foremost among these reasons is a long tradition of astronomy professors including undergraduates on their collaborative research teams. One of time-tested strategies to successfully attract and retain talented undergraduates interested in science, technology, engineering, and mathematics (STEM) disciplines is to engage them in authentic research experiences early in their higher education studies, and one way to get a reputation as being a great research mentor is to take students along to your professional meetings. The bottom line from research on why students pursue or leave STEM disciplines is not about ability or aptitude, but whether or not students feel a sense of belonging to a community.

A second important reason is that many physics majors try to complete multiple REU programs during their undergraduate years to try out different research fields. Often, they try to participate in at least one REU in astronomy. Bringing astronomy REU students to the AAS has become a common practice among most of the existing astronomy REU programs. Because one of the goals of REU programs is to enculturate undergraduate students into professional astronomy, national meeting participation is definitely an important responsibility of our profession.

The AAS Council, Astronomy Education Board, Education Office, and Executive Office, have responded to the growth

of undergraduates at AAS meetings with open arms. The Astronomy Education Board has endorsed a statement in the Draft AAS Education Strategic Plan that the AAS should actively support activities that, *"increase the pool of well-prepared, scientifically trained undergraduates by improving the attractiveness of astronomy, and science education in general, to meet the overall diverse needs of our society for technically trained individuals and to ensure the high quality of the next generation of astronomers."* In response, the Education and Executive Offices have arranged numerous activities for undergraduate meeting participants including an opening reception for undergraduates, a special poster session for undergraduates, speakers who give talks designed for undergraduates, and avenues for undergraduates to meet with representatives from recruiting graduate schools. These events are highly attended and enthusiastically appreciated by the attending undergraduates.

However, simply scheduling events for undergraduates only goes so far in welcoming undergraduate attendees into the AAS. What is most needed is for AAS members to go out of their way to make undergraduates feel like they are a part of our AAS community. This means that if you see an undergraduate standing nervously by their poster, it would be greatly appreciated if you would stop by and ask them to tell you about their poster. The best way to make an undergraduate feel like they are part of the meetings is to make them a part of the meeting where they get to talk to a "real astronomer." This works even if the poster is not about your area of expertise. The students desperately want to interact with other astronomers and to talk about what interests them.

Another way you can help make undergraduates feel welcome is to help judge for the various awards. This year, there will be hundreds of students competing for one of the Chambliss Awards which recognize exemplary research by undergraduate and graduate students. The Chambliss awards committee would like each student to talk to at least two different astronomers, which means the awards committee needs many, many volunteers to survey the different poster presentations. If you would like to help, contact the Education Office (education@aaas.org) to volunteer. Your assistance would be a great service toward advancing our goals of meaningfully engaging undergraduates and making them feel like they are an important part of the AAS community.

Tim Slater
AAS Education Officer
University of Arizona

Getting it Out There: Astronomy Education in Every Venue



In the face of concerns regarding both the quantity and quality of science reaching today's youth, it is valuable to explore venues for astronomy education that are innovative, resourceful, and even downright weird. When we step outside of traditional approaches and locations for education and outreach, we widen the range of possible audiences, activities, and outcomes.

With the right strategy, many unusual settings provide an opportunity to make a lasting impact on a science-starved audience.

The astronomy community has developed an impressive assortment of conventional materials and programs, including classroom resources, multimedia, teacher professional development, websites, afterschool programs, and more. As we develop more of these offerings, we struggle to fit into a crowded educational arena, competing fiercely against other projects for funding, interest, and implementation. We have the opportunity to set ourselves apart from the crowd – think outside the box and explore inventive ways to bring astronomy into the community.

Consider your target audience and find a way to fit astronomy into its members' everyday lives. Children spend plenty of time each day outside of the classroom, engaged in extracurricular activities, entertainment, family time, and other pursuits that are often exclusive of educational content. Connections with these activities can make astronomy enjoyable and comfortable for participants.

Family activities provide the opportunity to build excitement and strengthen family communication about science. Parents and families have the greatest influence on children's attitudes towards education and career choices, and research has shown that family-oriented programs have a direct impact on student performance. You can bring your astronomy content to the families in your community with exciting hands-on activities and discussions that involve all members of the family. These events can be held in any environment, including community centers, museums, shelters, or other family-friendly facilities. It is essential to adapt the astronomy content to the family audience,

making it enjoyable, accessible, and likely to cause continued discussion at home.

Another idea is to bring activities into an unusual public location, such as a shopping mall, sporting arena, or local fair. This venue is very different from most traditional educational settings – you may only see your audience members briefly, for a few seconds to a few minutes. You'll want activities that are short but memorable, such as a quick make-and-take or experiments in which participants feel involved no matter how brief their visit. The value of these connections is often as an introduction, an opportunity to engage members of the public and provide a pathway to other activities that you offer. But this is not only advertising – even in those few moments, you have the opportunity to interest visitors in astronomy and make a positive impression.

Finally, explore novel community partnerships to bring astronomy into existing extracurricular activities. Many communities can boast a variety of sports opportunities for youth, but how many have connected physical fitness and kinesthetic astronomy? Or brought key concepts about astronomical size, scale, and modeling into afterschool arts and crafts? These unusual collaborations emphasize the connections between astronomy and everyday life, bringing the ideas down to Earth. You undoubtedly have activities and materials to utilize and adapt to new settings, and many partners are searching for interesting new ways to excite and educate children in community programs. These joint ventures can be unique, special, and lasting in the minds of participants.

When I am developing or adapting resources for any audience, I keep these three ideas in mind as key messages: science is practical (it's all around us), science is approachable (anyone can do it), and science is enjoyable (so have fun doing it). This trio of impressions can be more powerful than any specific content knowledge in affecting the attitudes and future choices of participants. When it comes to dreaming up new locations and partners for astronomy education, the sky's the limit – and sometimes the strangest approach will make the experience out of this world.

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Foothill College Astronomy Instructor is Named 2007 California Professor of the Year



Foothill College Astronomy Instructor Andrew Fraknoi, M.A., has been named the 2007 California Professor of the Year by the Carnegie Foundation for the Advancement of Teaching and the Council for Advancement & Support of Education (CASE). Fraknoi was selected from more than 300 top professors in the United States. The 40 national and state winners of the U.S. Professors of the Year Award were honored at a luncheon and

evening reception in Washington, D.C. Nov. 15.

The U.S. Professors of the Year Award Program salutes the most outstanding undergraduate instructors in the country—those who excel as teachers and influence the lives and careers of their students. It is recognized as one of the most prestigious awards honoring undergraduate teaching.

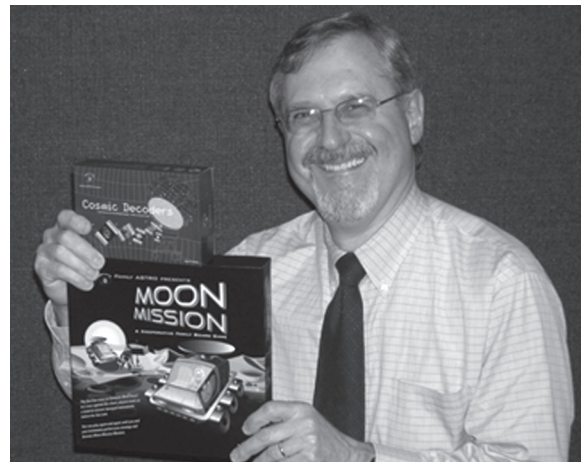
“So often what happens behind the doors of our nation’s college classrooms is left only to the public’s imagination,” Fraknoi said. “Yet, it is behind those doors that the crucial transformation of our students from kids to adults and from passive to active learners happens. My life’s missions have always been to share the excitement of astronomy with those who are not particularly science-oriented and foster in my students a lifelong interest in the wonders of the universe.”

A distinguished astronomy educator with a national reputation, Fraknoi is a longtime, community college instructor, textbook author, and prolific writer and speaker. During his career in education, he co-founded *Astronomy Education Review*, an online journal; founded the Cosmos in the Classroom Symposia for college faculty; and served as the executive director of the Astronomical Society of the Pacific (ASP) for 14 years. He has been a member of the Foothill College faculty and chairman of the college’s astronomy department since 1992.

A resident of San Francisco, Fraknoi is renowned for his ability to present and explain some of the most intriguing areas of modern astronomy and physics for students who are not majoring in the sciences. Students routinely applaud

him for his instructional approach, which emphasizes humor, analogies, demonstrations, and relating science to the humanities. He is not above choreographing a quick moon orbit dance for his students or doing his own pulsar dance to keep their interest.

Fraknoi was chosen for the prestigious award for his extraordinary dedication to undergraduate teaching; impact on and involvement with undergraduate students; scholarly approach to teaching and learning; and contributions to undergraduate education at Foothill College, in the community.



Foothill College Astronomy Instructor Andrew Fraknoi has been named the 2007 California Professor of the Year by the Carnegie Foundation for the Advancement of Teaching and the Council for Advancement & Support of Education (CASE). A resident of San Francisco, Fraknoi was selected from more than 300 top professors in the United States. Photo credit: Seth Shostak.

Touch the Invisible Sky: A Multi-Wavelength Braille Book Featuring Tactile NASA Images



The under-representation of people with disabilities in the space science field has been recognized and documented by respected studies and institutions. To help remedy this situation, special needs students have to be engaged with products that are dedicated to their needs. Special needs educators have the knowledge and expertise in instructional strategies for these students, but may not

have the particular special needs resources required for teaching space science. There is an overwhelming thirst for materials to help these teachers in their efforts to introduce space science to special needs students.

The cultivation of diversity is a core value of the NASA education effort. NASA strives to ensure that underrepresented and underserved students participate in NASA education and research programs and to encourage these students to pursue STEM careers. NASA therefore encourages education and public outreach efforts that reach traditionally underrepresented and underserved populations.

According to the National Federation of the Blind and the American Foundation for the Blind there are approximately 10 million people who are blind or visually impaired in the United States, with approximately 1.3 million legally blind persons of which 93,600 are of school age. Yet there is a distinct lack of hands-on materials, particularly at the high school level, that would make the world of astronomy more accessible to them.

Because astronomy is often visually based, many people assume that it cannot be made accessible to the blind. However tactile graphics are evolving as an education tool and a new book, *“Touch the Invisible Sky”* makes the world of NASA and astronomy accessible to a portion of the public and students that have been traditionally underserved.

The study of the universe in multiple wavelengths has revolutionized our understanding and appreciation of the cosmos. Hubble, Chandra, and Spitzer are examples of powerful, NASA telescopes that complement each other in their observations spanning the electromagnetic spectrum. Our understanding of how the universe works has come

quite far with the plethora of imagery from these NASA “Great Observatories”.

Interestingly, most of the electromagnetic spectrum is invisible to all of us; astronomers have merely translated data into a visible medium. We have, at this juncture, a unique opportunity to take a bold step forward in relaying scientific information -- to combine multi-wavelength data, imagery and tactile graphics to communicate the beauty and science of the universe to people regardless of their own visual ability.

“Touch the Invisible Sky” combines Braille, large type print, and colorful tactile images so the readers can “see” the images of astronomical objects observed in several different wavelengths with their eyes or their fingertips. Readers will perceive the universe from an entirely new perspective as this multi-wavelength Braille book presents objects and features in the Universe that are hidden to our eyes.

The featured objects were chosen to give a flavor of the diverse nature of the universe, from our own Sun to distant galaxies and the extreme universe of supernovae and pulsars. The features revealed by the different wavelength observations show how multi-wavelength observations can be synthesized to attain a deep understanding of the structure of astronomical objects and mechanisms that shape them.

We hope this book will help students learn about the concept of electromagnetic spectrum, the wavelengths and the difference between the information learned from each. This book will also be a great tool to introduce space science in the classrooms and the idea of the many different astronomical objects in space.

The project team began by analyzing imagery and developing a story line that unlocks the secrets of the universe. The authors carefully selected each image so that the essential message can be interpreted from the electromagnetic spectrum into a tactile form. The book displays tactile images of previously unseen celestial objects and presents them as a set of four multi-wavelength views so the reader can directly compare and explore distinctive features.

The book is authored by Simon Steel (Harvard-Smithsonian Center for Astrophysics), Noreen Grice (You Can Do Astronomy LLC), and Doris Daou (NASA Headquarters, on leave from the Spitzer Science Center and the Infrared Processing and Analysis Center). Noreen Grice designed

the tactile images. The text and prototype tactile images underwent rigorous editorial and educational review by Ben Wentworth with his students at the Colorado School for the Blind. The tactile images are in color with Techno Braille (acrylic) overlay.

The book also includes a foreword by professional mountain climber Erik Weihenmayer, who describes his sense of discovery as the world's first blind person to climb Mt. Everest. Erik's frontiers widens as he climbs to new heights just as our understanding of the universe widens through previously unseen views.

The prototype of this book was funded by a peer-reviewed Cycle 5 education and public outreach grant from the

Chandra X-ray Center to Dr. Mark Lacy and E/PO Lead Doris Daou of the Spitzer Science Center.

Funds for publication were contributed by the Space Telescope Science Institute, the Chandra X-ray Center, the Spitzer Science Center, and NASA's Origins and Universe Forums.

Doris Daou

NASA Headquarters, Science Mission Directorate.

(On leave from the Spitzer Science Center/Infrared Processing and Analysis Center/Jet Propulsion Laboratory)

The 11th issue of the Astronomy Education Review

Astronomy Education Review (AER) has recently announced the completion of its 11th issue and has started the 12th issue (<http://aer.noao.edu>).

The papers in the just completed 11th issue are listed below. We especially want to call attention to the second paper, by Robert O'Connell, which is in essence a handbook for new instructors and TA's, and summarizes the experience and practical advice of the teaching faculty in a major department.

We also want to announce a new project at AER. Steve Pompea and John Keller are serving as editors of a special section (or even perhaps a special issue) that will contain short papers and research relating to astronomy demonstrations. Colleagues are invited to write up innovative or improved demos for classroom and informal science education use. Full information on how to submit your favorite demo can be found in an announcement in the new 12th issue (Volume 6, no. 2) that we have just opened.

The featured papers and articles in the just completed 11th issue include:

- Regulations and Ethical Considerations for Astronomy Education Research by Erik Brogt, (University of Arizona), et al.
- Facts of Life for New Teachers in the Astronomy Non-majors Curriculum by Robert W. O'Connell (University of Virginia)
- Bachelor of Science in Astronomy Technology: A Model by Jesus Rodrigo F. Torres (Rizal Technological University, Philippines)

- Survey of Introductory Astrophysics Textbooks by David Bruning (University of Wisconsin-Parkside)
- A Theoretical Background on a Successful Implementation of Lecture-Tutorials by Erik Brogt (University of Arizona)
- Using Literacy Techniques to Teach Astronomy to Non-Science Majors by C. A. Garland, (Castleton State College) and D. L. Ratay (Cortana Corporation)
- Science and Nonscience Students' Ideas about Basic Astronomy Concepts in Preservice Training for Elementary School Teachers by Huseyin Kalkan & Kasim Kiroglu (Ondokuz Mayıs University, Turkey)
- Arecibo Observatory for All by P. Bartus (University of Puerto Rico), et al.
- Estimating the Solar Apex Using Stellar Radial Velocities: A Spreadsheet and Graphical Exercise for College-Level Astronomy Classes by Russell Sampson (Eastern Connecticut State University)
- Analysis of the Astronomy Diagnostic Test by Erik Brogt (University of Arizona), et al.
- Good Reading from Other Sources on Astronomy Education and Outreach by Andrew Fraknoi (Foothill College)
- New Media Technologies: Proposing An Integrated Approach by Aaron Price (AAVSO)

You can find the full 11th issue by clicking on "back issues" and then on "vol. 6, no. 1."

Sidney Wolff and Andrew Fraknoi
AER Editors

Education Updates from AAS Divisions & Committees

The chairs and education representatives of all AAS Divisions and Committees are invited and encouraged to submit updates on their education, outreach, and related efforts to the editors for inclusion in every issue of Spark.

Committee on Astronomy and Public Policy (CAPP)

Putting on Our Thinking CAPP when it comes to Education

Recently, members of the AAS Committee on Astronomy Public Policy (CAPP) met in Washington, D.C. to develop a set of goals to be approved by the AAS Council. Among these goals are to track issues related to federal research and education policy, share that information with the AAS membership, help advocate on behalf of the society, and EDUCATE the AAS membership regarding how public policy is made and implemented at the federal level. Examples of issues considered by the CAPP related to education policy might include:

- 1) federal funding of science education;
- 2) the regulation of student VISAs for colleagues who wish to study in the United States;
- 3) providing input on the STEM education report recently released by the NSF (see AIP FYI #105); and
- 4) assessment-based measures of educational effectiveness (such as called for in the No child Left Behind Act - NCLB).

CAPP plans to increase the effectiveness of our own educational efforts through improved communication with the AAS membership via email alerts, additional public policy sessions held at winter and summer meetings, as well as an expanded WWW site to serve important updates and background documents (see www.aas.org for updates as they become available).

Educational assessment is not just a K-12 issue. Although the debate continues regarding NCLB (see AIP FYI #94), and the nature of its reauthorization this coming year, there is a growing realization that institutions need to assess the outcomes of higher education experiences as well (e.g. Spellings Commission Report "A Test of Leadership: Charting the Future of U.S. Higher Education"). The fraction of high school students in the U.S. that enroll in various forms of higher ed is at an all-time high (68.6% in 2005), yet of the 1995-1996 freshman class, only 58% had earned a degree within six years (U.S. Department of Education, Digest of Education Statistics, 2006). Education research tells us that

assessment should attempt to track expected outcomes - that we should test those things we want students to learn most. Yet it is not obvious what the basic requirements of a post-secondary educational experience should be: different educational institutions have different goals and serve different purposes. Assessment tools for higher education can be more sophisticated than simple multiple-choice exams, and should attempt to measure things such as critical thinking, analytic reasoning, written communication, and problem solving (e.g. the Collegiate Learning Assessment). Particularly as the astronomical community begins to undertake the next decadal survey of astronomy and astrophysics, the membership of the AAS should cultivate a deeper understanding of public policy issues related to the educational missions of their institutions. The CAPP plans to assist the AAS membership in this endeavor through periodic updates on our new WWW site. We welcome your comments, questions, and suggestions, as we move forward in this area.

Solar Physics Division (SPD)

The SPD E/PO Committee Progresses

At the 210 joint AAS/SPD meeting held in Hawaii last May, The SPD Education and Public Outreach (EPO) Committee officially appointed two new members: Spiros Patsourakos of the Naval Research Lab and Dave Dooling of the National Solar Observatory.

The SPD EPO committee has recently completed the drafting of its strategic plan which is currently under review by the SPD Officers and Committee. The plan adopted the five AAS AEB strategic plan overarching goals with SPD specific objectives. This important task completed, our efforts have now shifted to focus on the development and implementation of our future education and outreach efforts. The SPD EPO committee has identified four areas for consideration and implementation by the joint AGU/SPD meeting next May in Ft. Lauderdale, FL. These include: (1) Bringing the Sun to IYA by promoting and enabling the SPD community to strongly participate in the 2009 IYA education and outreach efforts, (2) enabling deeper and more meaningful undergraduate and

graduate student involvement in meetings by following and expanding on the examples set by the AAS and the AGU, (3) implementing a coordinated SPD booth and display area tailored to maximize impact at each of the three different types of meetings: joint AAS/SPD, joint AGU/SPD and stand alone meetings, and (4) building SPD Education and Outreach website content to provide a more robust resource for the community.

Visit the SPD website (http://spd.aas.org/navbar_edout.html) for more information and updates on our progress.

High Energy Astrophysics Division (HEAD)

High School Outreach Efforts A Success

Sixty high school students from Roseland University Prep (RUP) in Santa Rosa, California fully engaged with college life this summer through the efforts of Dr. Lynn Cominsky and the NASA E/PO at Sonoma State University (SSU). The “Summer Experience” at SSU proved a positive educational highlight for everyone involved, including event organizers.

“This is the make-or-break year, where we finally get to measure the success of this innovative and exciting program” said Dr. Lynn Cominsky, director of the NASA E/PO and one of 60 advisory board members for RUP. The students are entering their fourth year of this charter school program and are now applying to colleges – so far over 35 students have been admitted to SSU and other four-year universities. The “Summer Experience” gave them a taste of the opportunities ahead of them.

Roseland University Prep is a public charter high school that focuses on giving economically impoverished, predominantly Latino youth the needed skill set to enter into and succeed at four-year universities. SSU hosted the August event complete with a welcome from President Ruben Arminana at a dinner with both students and parents, campus tours, application and financial counseling, recreational activities and many mini-classes taught by university instructors.

“The astronomical highlights of the Experience were the night at the SSU Observatory and viewing of the Monster of the Milky Way PBS NOVA show” said Cominsky who obtained a \$10,000 grant from SSU and a \$5,000 donation from the Federated Indians of the Graton Rancheria to make this experience possible. Support and organization of the entire event were coordinated by the SSU E/PO group, which

has been running an after-school astronomy club with the RUP students during the past several years. RUP students have also taken a field-trip to the group’s robotic telescope GORT, which is located in a dark area of Santa Rosa, about 30 minutes (and an entire world) away from Roseland.

“It was one of the most rewarding things I have done in 20 plus years at SSU,” said Cominsky. “We are trying to put the funding and schedule together to do this again next summer.”

Cominsky is positive about the program’s direction and its continued mission of bringing students into the world of higher education.

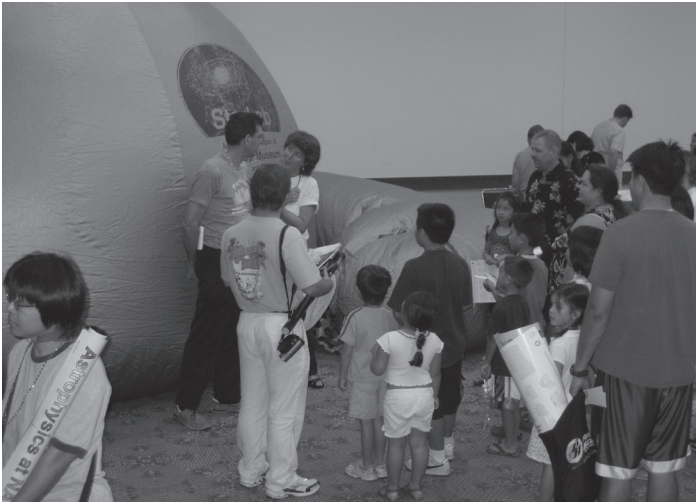
“I am thrilled at the progress that the students are making and that so many have already been accepted to SSU and other colleges, even though application season is just beginning,” she said. “We are trying to raise money for the RUP Scholarship fund to make sure that everyone who gets accepted into the college of their choice can afford to attend for all four years.”

Contributions to *Spark*

We encourage all members of the community to contribute articles to *Spark*, which is published twice a year to coincide with the AAS national meetings. If you are interested in making a contribution, we recommend sending us a brief description of your proposed contribution in advance so that we can discuss your idea and suggest a suitable article length (generally around either 400 or 800 words). Our editorial meetings are held in February and September of each year, so suggestions received before those months are easiest for us to incorporate. Article deadlines are April 1 for the issue released at the summer meeting, and November 1 for the winter meeting issue.

We look forward to discussing your ideas for contributions, and to reading your articles! Email the editors: Jake Noel-Storr and Gina Brissenden at spark@aaas.org.

AstroZone: Hawaii Photos



AstroZone families eagerly await their turn in the Starlab immersive dome. Inside the dome, Gemini Observatory staff took families on an exciting tour of the Stars that combined modern day astronomy with Hawai'ian folklore and traditions.



Two scoops or one? Kids at AstroZone try a sample of everyone's favorite Astronaut ice cream while listening to Astronaut Robert "Bobby" Satcher talk about how he became an Astronaut.



Have you ever met an Astronaut? For AstroZone families the answer is yes and they even have the signed photo to prove it! Visitors take a moment to speak with Astronaut Robert "Bobby" Satcher and learn all about living and working in space.



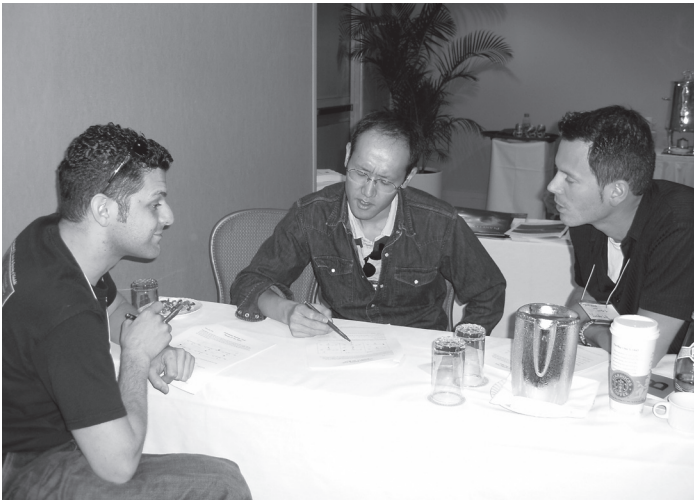
Edna DeVore of the SETI institute shares the excitement of searching for life in the universe with AstroZone families through an online interactive and information about the SOFIA and Kepler missions.

AstroZone takes place before every AAS Meeting. To get involved contact the organizers: Jake Noel-Storr (jake@cis.rit.edu) and Emilie Drobnes (emilie.drobnes@nasa.gov)

CAE Workshop Photos



Presenters Edward Prather and Gina Brissenden (Univ. of Arizona) interact with participants of the NASA Center for Astronomy Education (CAE) Teaching Excellence Workshop for instructors teaching Astro 101.



Workshop participants practice being “really good Astro 101 students” while in a learner-centered environment to learn ways to improve their Astro 101 instruction.

AAS provides many education offerings for members and the public starting the two days prior to the beginning of science sessions at each of its meetings.

SPaRk

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