



Voyages in Education and Public Outreach An Office of Space Science Newsletter

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Cosmic Questions Explored in New Traveling Museum Exhibition

Mary Dussault, Structure and Evolution of the Universe Forum

What is the universe like? Was there a beginning to time? How do we fit into the cosmos? Visitors to the new traveling exhibition *Cosmic Questions: Our Place in Space and Time* began exploring these questions on September 19, 2002, at the exhibit debut at Boston's Museum of Science. Led by educators and scientists at the Harvard-Smithsonian Center for Astrophysics (CfA), the development of this national exhibition and education project was supported by scientists and astronomy education and outreach programs from institutions nationwide. The Boston opening launches a three-year tour of *Cosmic Questions* to science centers nationwide, where it is expected to reach an audience of millions of public and school-based visitors.

Dr. Roy Gould and Mary Dussault of the Structure and Evolution of the Universe NASA Forum at CfA, directed the creation of *Cosmic Questions*. "This project involved the participation of dozens of scientists, Space Science E/PO programs, and astronomy research centers—from the CfA and Chandra, to the Marshall and Goddard NASA Centers, to observatories and research groups from Mauna Kea, Caltech, and MIT, among others," said Dussault. "Researchers contributed their time, knowledge, thoughtful advice, images and data throughout the development of the project—from early brainstorming meetings that shaped the conceptual framework of the exhibition, to last-minute proofreading and text review that helped to preserve the accuracy of the content." The Universe Forum will continue to facilitate and coordinate the participation of members of the space science community in lectures,

demonstrations and other live events as the exhibition tours.



A young visitor to Cosmic Questions gets a "feel" for the Milky Way's structure.

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Three years in the making, the 5,000 square foot *Cosmic Questions* exhibition is organized around four highly visual and interactive exhibit areas. In *Our Place in Space*, visitors are transported to the grand spectacle of our own Milky Way Galaxy and out to the billions of galaxies beyond. They can even launch from Earth and “fly” through the 3D structure of the universe using a joystick that controls a state-of-the-art visualization.

Observing the Universe gives visitors opportunities to “be the astronomer” as they take interactive virtual tours of the Mauna Kea observatories and the Chandra X-ray space telescope. Using tools such as an infrared camera, a spectroscope and special multiwavelength image viewers, visitors can investigate how astronomers piece together the story of the universe from clues provided by faint light from deep space.

In *Our Place in Time*, visitors encounter the idea that although human thoughts have only recently arrived in the cosmos, the very atoms in our bodies date billions of years back in time. A unique *Cosmic Kitchen* animated theater production explores Carl Sagan’s quote “to make an apple pie from scratch, first you must invent the universe” by taking visitors young and old on a 10-minute adventure from Big Bang to apple pie.



Museum visitors enjoy the theatrical “Cosmic Kitchen” production.

The *Cosmic Mysteries* section of the exhibit highlights some currently unanswered cosmic questions—about black holes, life elsewhere in the cosmos, and the basic ingredients of the universe—acknowledging that while we have

learned much about our place in space and time, there are deep mysteries yet to be understood.

A comprehensive set of *Cosmic Questions* education programs—created in partnership with the Museum of Science in Boston—extends and enhances the learning experience for school and public visitors to the exhibition, and helps host site museum staff to get the most out of their run of *Cosmic Questions*. Programs include: a two character play (*Girl Meets Boy: a Comedy about the Universe*); a live stage demonstration about the idea that looking out in space is looking back in time (*The “Real” Time Machine*); a set of activities, equipment, and background material for museum docents; an *Educators’ Guide* for teachers of grades 6-12; resources for professional development workshops for teachers; and resources for lecture series and additional programming. In addition, the planetarium show *Journey to the Edge of Space and Time* is available to host venues that have a planetarium.

Visitor feedback has been very positive and preliminary results suggest visitors are spending longer-than-average amounts of time in the exhibition and teachers are very positive about it.

From a 9 year old girl: “I learned that stars are going to explode some day, I thought they lived forever but they’re going to explode....The exhibit helped me know what the universe was like because I didn’t know it was so big, I didn’t know there were so many stars...it made me really think about it.”

From a teacher: “It means so much to me as a teacher to have meaty exhibits [like this one].”

Visitors are also very positive about the programs being offered in conjunction with the exhibit. Some comments on the play, “*Girl Meets Boy*”:

“We thought that it was very good. It gave you information without realizing it because it was in a script. We look forward to the exhibit.”

“Interesting! Poetry and science at the same time. I liked it a lot. You learn so much!”

Please contact Mary Dussault at mdussault@cfa.harvard.edu or visit <http://cosmicquestions.org> for more information on *Cosmic Questions* including the 2003 tour schedule which is being managed by the Association of Science Technology Centers. This project was made possible by support of the National Science Foundation and NASA’s Space Science Education and Public Outreach program.

Awards

Hammel Receives 2002 Carl Sagan medal

Heidi Hammel, a senior research scientist with the Space Science Institute in Boulder, Colorado has been awarded this year's prestigious Carl Sagan Medal by the Division for Planetary Sciences of the American Astronomical Society.

The Sagan Medal is awarded each year to a scientist whose efforts have significantly contributed to public understanding of, and enthusiasm for, planetary science.

"Hammel's dedication to communicating the excitement of planetary science is evident in the large number of lectures to children and the general public that have complemented her scientific career," said the AAS Newsletter, announcing the award. "She has a talent for understandable and enthusiastic descriptions of scientific results."



Hammel receives the 2002 Sagan Medal from Wes Huntress, Chair of the Division for Planetary Sciences of the American Astronomical Society.

Leon receives the NASA Exceptional Achievement Medal

Nancy Leon of JPL received the NASA Exceptional Achievement Medal this fall for her pioneering work in the creation of the *Space Place* (see *Voyages*, issue 1). The *Space Place* education and public outreach program includes a widely used website in both English and Spanish, regular contributions to newspapers and educator publications, museum displays, and collaborations with youth organizations. The *Space Place* effort is sponsored by the New Millennium Program, and is available to all NASA missions and programs who wish to participate.



Nancy Leon receives award from Dr. Ed Weiler (L), NASA OSS Associate Administrator and Dr. Charles Elachi (R), JPL Lab Director.

Updates

Braille Hubble Book Released

On November 21, 2002, *Touch the Universe – A NASA Braille Book of Astronomy* was released



Student Explores Jupiter in new Hubble Book.

during two events that were held simultaneously at the National Federation for the Blind in Baltimore, MD and DePaul University in Chicago, IL. The events featured blind and visually impaired students from across the country. *Touch the Universe* was developed under a Hubble Space Telescope E/PO grant by Braille book author Noreen Grice, Hubble scientist Bernhard Beck-Winchatz, and Colorado School for the Blind teacher Ben Wentworth (see *Voyages*, issue 3). The team views the publication as a first step toward fully including the blind and visually impaired in space science. "The book is a great example of how space scientists can make valuable contributions in E/PO by teaming up with experienced educators. Our next goal is to develop activities and observing programs that actively engage blind and visually impaired students from elementary grades through introductory college level in space science", says Beck-Winchatz, who

is a faculty member at DePaul University in Chicago. Information on obtaining *Touch the Universe* may be obtained at <http://books.nap.edu/catalog/10307.html>.

NEW MISSIONS

NASA recently selected a team to provide the Near Infrared Camera for the James Webb Space Telescope. The E/PO program associated with this instrument is detailed below.

NIRCam E/PO: "Linking Girls with the Sky" *Don McCarthy, The University of Arizona*

Astronomical images can inspire a new generation. The clarity of the James Webb Space Telescope, combined with the near-infrared camera's (NIRCam) ability to see farther back in time and through murky regions of space, may unveil the "First Light" from a newborn universe and the origins of planetary systems. However, the true legacy and impact of NIRCam images will depend on the educational foundation laid years earlier.

The NIRCam team, led by Dr. Marcia Rieke at The University of Arizona, unites scientists from across the US, Canada and Lockheed Martin with prominent science educators including Dr. L. Lebofsky, Dr. T. Slater, Dr. S. Pompea, and Dr. D. McCarthy. The E/PO program targets K-14 girls to combat misconceptions that women can't do or enjoy physical science. NIRCam has partnered with the Girl Scouts of the USA, to address such specific needs as (1) the review of existing badge programs for younger girls, (2) new, community-based activities and research experiences for older girls, (3) interaction experiences in person and on-line with inspiring mentors and role-models, and (4) leadership and training experiences for adult trainers.

The NIRCam E/PO activities will incorporate such topics as light pollution, image processing, and space science. The inquiry-based activities will be appropriate in both formal and informal settings and also used for training future teachers of science.

Girl Scouts and their adult leaders will be trained with these and other materials at the Astronomy Camp facilities on historic Mt. Lemmon using hands-on experiences with 60-inch telescopes, CCD and infrared cameras, and

image processing techniques. NIRCam scientists will also be involved in developing authentic research-based activities using NIRCam datasets for in-class use by middle and high school teachers.

For information on the *James Webb Space Telescope*, please see

<http://ngst.gsfc.nasa.gov/>



The 61-inch Kuiper telescope (center) is one of several telescopes available in NIRCam training workshops for Girl Scout leaders nationwide with the Astronomy Camp facilities at Mt. Lemmon Observatory.

Future Venues for Space Science Exhibits

Cosmic Questions

<http://www.astc.org/exhibitions/cosmic/dc cosmic.htm>

February 1 - April 30, 2003 (tentative)

Midland Center for the Arts, Midland, MI

October 1 - December 31, 2003 (tentative)

Orlando Science Center, Orlando, FL

Hubble Space Telescope - New Views of the Universe

<http://www.sites.si.edu/exhibitions/>

Large Exhibit

June 14, 2003 - August 24, 2003

US Space and Rocket Center, Huntsville, AL

Small Exhibit

September 20, 2003 - January 6, 2004

Miami Museum of Science, Miami, FL

MarsQuest (<http://www.astc.org/exhibitions/mars/imars.htm>)

February 1 - April 30, 2003

Liberty Science Center, Jersey City, NJ

June 1 - August 31, 2003

Boonshoft Museum of Discovery, Dayton, OH

Information on exhibits and tour schedules may be obtained from the indicated links.

NASA OSS Support Network Profiles

This is the second in a series of articles which highlights contributions of the organizations of the NASA OSS E/PO Support Network (ESN). The 12 groups which make up the Support Network are involved in coordinating and integrating the OSS E/PO program. They provide a point of entry for individuals and organizations wishing to participate in the OSS E/PO program. A brochure describing the Support Network can be found at http://spacescience.nasa.gov/education/resources/ecosystem/brochure_low_res.pdf



ORIGINS
EDUCATION FORUM

The Origins Education Forum is one of the four national Education Forums established by NASA OSS to help organize the education and public outreach (E/PO) efforts of OSS missions and research programs. Led by the Space Telescope Science Institute, the Forum specializes in evaluation and computer technology, offering program evaluation support for Origins missions and playing a key role in the development of the NASA OSS Space Science Education Resource Directory, an on-line directory of educational resources produced by OSS missions and programs. (<http://teachspacescience.org> and see *Voyages*, issue 3).

The Forum provides Strategic leadership for Origins mission E/PO efforts and is an association of the EPO leads of the Origins missions, with a Secretariat based at the Space Telescope Science

Institute. Forum members work together to determine how the various mission E/PO efforts fit into the broader context of the Origins research which seeks answers to the fundamental questions: Where do we come from? Are we alone?

It seeks high-leverage opportunities to maximize the usefulness and effectiveness of E/PO materials and programs created by Origins missions. Forum members collaborate to enhance activities in formal education, informal education (e.g. exhibits), news, and online audiences in a manner to avoid duplication of effort and utilizes limited resources for maximum effectiveness. The Forum coordinates distributed activities and serves as an information resource for measuring the impact of E/PO efforts conducted by the Origins missions and research programs.

The activities of the Origins Education Forum currently are largely centered in the areas of sharing good ideas and developing recommended practices on such matters as product development and evaluation, with some time spent helping enhance the ESN infrastructure and services. Within these areas, the Origins Forum has specialized in evaluation, computer technology and Informal Science Education, drawing on the experience of the Hubble Space Telescope E/PO programs and staff.

As Origins and ESN E/PO efforts have matured and evolved, the Forum has been re-evaluating the needs of the communities it serves in anticipation of needs for new services. At a recent strategic planning retreat in Baltimore Maryland, forum members developed a new charter, mission vision and goals for the next five years. A new strategic plan resulting from these deliberations will be published in March 2003.

The observatories and programs comprising the Origins program include the Hubble Space Telescope, the Far-Ultraviolet Spectroscopic Explorer, the Space Infrared Telescope Facility, the Stratospheric Observatory for Infrared Astronomy, Kepler, the James Webb Space Telescope, the Navigator program, and the NASA Astrobiology Institute.

The Origins Web site is <http://origins.stsci.edu/>. For more information about the Origins Forum E/PO efforts, please contact Dr. Ian Griffin at griffin@stsci.edu.

New Educational Products

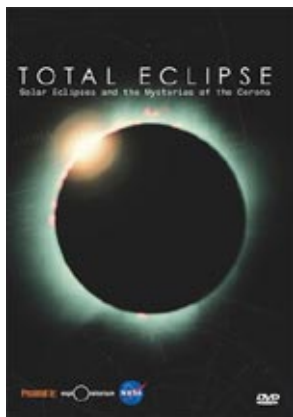
Total Eclipse: Solar Eclipses and the Mysteries of the Corona - A New Video

Exploratorium and NASA's Sun-Earth Connection Education Forum

Perhaps the most spectacular natural phenomenon visible from Earth, total solar eclipses have captivated humankind with their dramatic beauty for thousands of years. *Total Eclipse: Solar Eclipses and the Mysteries of the Corona*, a new video in VHS and DVD formats, explores the science behind eclipses and how these events can provide insight into the dynamic nature of the Sun and its effects on Earth and society. The video, produced by the Exploratorium and NASA's Sun-Earth Connection Education Forum, features the best footage of recent total solar eclipses from the Caribbean, Turkey, and Africa. The modular thirty-minute program covers the following areas:

- The mechanics of eclipses.
- A historical perspective tracing human interest in this awe-inspiring natural event.
- The role of eclipses for studying the solar corona, and the importance of NASA Sun-Earth Connection research on our modern understanding of the Sun.
- Modern eclipse expeditions shared with thousands of remote viewers via webcast.

Rich imagery, a fascinating storyline, as well as clear explanations and analogies offered by Sun-Earth Connection scientists contribute to making this video an engaging new product. The scientists featured in the video include Janet Luhmann, Nahide Craig, and Gibor Basri of UC Berkeley, David Alexander of Lockheed-Martin, Todd Hoeksema and Madhulika Guhathakurta of NASA Headquarters, and Fred Espenak of NASA/Goddard Space Flight Center.

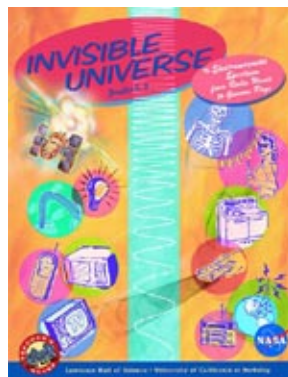


The video will be shown on NASA Television in connection with upcoming solar eclipses. The video was produced to help the informal education community share the wonder of total solar eclipses with their audiences. Use of this video as background material can help bring the "totality experience" to life as part of a planetarium eclipse demonstration, or a multimedia museum program. The video can help informal educators in their task of providing the public with a clearer understanding of our nearest star and its effects on Earth and society. The video will also be useful to formal educators, particularly at the middle school level, where eclipses are covered as part of the curriculum. The video is available at no cost, and has been distributed to more than one hundred informal science educators who requested a copy at the 2002 International Planetarium Society (IPS) and Association of Science and Technology Centers (ASTC) conferences. Additional copies can be requested by contacting personnel from the Sun-Earth Connection Education Forum. Please send email to outreach@sunearth.gsfc.nasa.gov.

New GEMS and TOPS Guides

Lynn Cominsky and Philip Plait, Sonoma State University

NASA OSS announces the release of two broad classroom activity guides based on the Swift and Gamma-Ray Large Area Space Telescope (GLAST) missions in the Structure & Evolution of the Universe (SEU) theme area.



Invisible Universe: The Electromagnetic Spectrum from Radio Waves to Gamma Rays is a set of classroom activities created by the Lawrence Hall of Science Great Explorations in Math and Science (GEMS) program in conjunction with the Swift E/PO group at Sonoma State University (SSU). The Guide contains five thoroughly-tested activities that use the mystery of gamma-ray bursts as a "hook" to teach students about the electromagnetic spectrum, the different ways astronomical objects emit energy across the spectrum, and how astronomers detect these objects. The supplies

needed to perform the lessons are inexpensive, and are readily available in most schools or can be found easily in hardware stores.

Far Out Math! is a series of activities created by TOPS Learning Systems Inc. and the GLAST E/PO group at SSU. Using ordinary classroom supplies, the students create a series of slide rules (remember them?) to learn how to manipulate logarithms, exponents, powers of two and orders of magnitude. The activities are well-tested in the classroom environment and are fun to do. Along the way, the students will learn about NASA science, high-energy astronomy, and the GLAST mission, using logarithms and exponents to solve problems involving GLAST.

Both GEMS and TOPS are highly-respected educational programs with long and successful histories of classroom activity development. The GEMS guide was created with close involvement of the Swift Education Committee (SwEC), a group of scientists and educators familiar with the science and E/PO goals of the Swift mission. The SwEC gave input at every step of the development of the guide, ensuring the highest-level quality of both the science and the pedagogy of the guide. In addition, members of the Swift science team did a final, thorough review. Scientists of the GLAST Science Working Group were active in overseeing development of *Far Out Math!* and greatly enhanced the math activities' tie-in with the science of GLAST and the objects it studies. Activities in both guides were also tested by the GLAST, Swift and SEU Educator Ambassadors, a group of top-quality educators selected to help develop and disseminate SEU materials. The Ambassadors provided very useful feedback on the guides that were used to further improve them.

Both guides are standards-based. For more information or to obtain a copy of the activities, go to <http://swift.sonoma.edu/education/index.html> and <http://www-glast.sonoma.edu/teachers/teachers.html> respectively.

Shimmering New Auroras Book for Children

Sun Earth Connection Education Forum (SECEF)

Have you seen the auroras, those mysterious, colored curtains of light, high in the night sky? For more gorgeous visions, check out our new book called *Auroras: Mysterious Lights in the Sky*, appearing in both on-line (using Flash animation)



Northern aurora

and print versions. *Auroras* is directed at primary school children, as well as their parents and teachers (it includes a special section of Science Facts at the end of the book).

The striking aurora images are real – in the on-line version they are from NASA spacecraft, and in the print version the images are photographs taken by Jan Curtis. A collaboration between SECEF and Ideum, it was made in support of the next Sun-Earth Day (see article, page 12) on March 18, 2003 (<http://sunearth.gsfc.nasa.gov/sunearthday>), whose theme is “Live from the Aurora.” The print version of *Auroras: Mysterious Lights in the Sky* will be released shortly. The on-line version can be found at <http://ds9.ssl.berkeley.edu/auroras/>

New Educational Products from Deep Impact

Dr. Lucy McFadden, University of Maryland

The Deep Impact E/PO team has released several educational products on its web page <http://deepimpact.jpl.nasa.gov/educ> and its mirror site <http://deepimpact.umd.edu/educ>

These products are the result of planning and interactions with educators over the past two years since the project began in January, 2000. They have been designed for use in a wide range of grades from grade 2-12.



Make a Comet Model and Eat It was designed for younger students, beginning with grade 2 to develop knowledge of the basics of comets and to experience the process of observations and

keeping records. It can be adapted for use in high school chemistry classes if desired. The materials contain directions for the activity, discussion of the National Science Education Standards related to the activity and a worksheet for students to record their actions and observations.

Deep Impact Comet On a Stick emphasizes the process of modeling used in the planning, design and execution of a NASA mission. In this unit, the students will have to build a model using their limited knowledge of comets and materials they might find at home.

Exploring Comets and Modelling for Mission Success is a combination of the above two modules and includes supplementary and background material.

In *Collaborative Decision Making* middle school and high school students form groups to solve a problem that the Deep Impact science team is currently working on – determining the best time of day to impact the comet in July, 2005. The mission team needs to have good coverage by NASA's Deep Space Network ground stations, but also want the best telescope observing sites around the world to witness and record the impact and its aftermath. Students have to understand the issues for impacting at different times of day and night, and are asked to come to a solution which they may pass on to the Principal Investigator. Educators at McCREL, Aurora, Colorado wrote this unit with help from Mike A'Hearn (University of Maryland), Karen Meech (University of Hawaii), Brian Muirhead (NSA JPL) and Lucy McFadden (University of Maryland).

Excavating Cratering is a student inquiry into the question "How do you make a 70 foot deep, football field sized crater in a comet?" The lessons are designed to provide students with experience in conducting scientific inquiries, gain a greater understanding of scientific modeling and get the students involved with the excitement of a NASA mission in development. Students design experiments and test materials that the impactor will hit, as well as evaluate the composition of the impactor. Students conduct their experiments, plot their results, and write a report that they can send to the Deep Impact project management. The Deep Impact team will answer any reports they get. Gretchen Walker (University of Maryland) developed and tested this module and received cratering expertise from Pete Schultz at Brown University and Jay Melosh at University Arizona.

Serving the Universe – One Plate at a Time

Chuck Bueter

Astronomy enthusiasts have long used moveable paper instruments to understand the motion of the sun, moon, stars and planets. With the assistance of the NASA OSS Broker / Facilitator at DePaul University, *Paper Plate Education* continues that tradition with its collection of hands-on activities that are made from simple paper plates.

The Paper Plate Education website at <http://analyzer.depaul.edu/paperplate> reduces complex notions to simple explanations, all with the aid of the humble paper plate. Planetarians, teachers, astronomers and students alike have designed many lesson-supporting paper plate activities that range from tactile star charts to satellite tracking bowls.



A collage of paper plate activities.

A key to the success of Paper Plate Education is that its activities are simple, low cost, and non-intimidating. "They're definitely helpful, even something as simple as this," said one visually-impaired college student as he touched the Big Dipper on a tactile "Platisphere". "It makes life a lot easier when you can actually get a picture of it."

Paper Plate Education became accessible to a larger audience when DePaul University provided use of its web server to Chuck Bueter, a member of the Great Lakes Planetarium Association who manages the Paper Plate Education website. After being featured by *Yahoo!* and *USA Today*, the website saw its daily traffic jump to over 600 distinct visitors who are accessing over 20,000 files every day. Another DePaul

initiative - a PLATO grant - supported production of a 70 minute videotape by the Great Lakes Planetarium Association to detail the construction and use of nine paper plate astronomy activities.

"This has really energized me," said high school astronomy teacher Gary Norcia. "It stimulates you to come up with other ways to present things, and that's terrific."

Educational Programs

Invisible Universe Online: A Distance-learning Course for Science Teachers on Astronomical Origins

John Keller, University of Arizona

To expand the number of teachers that NASA Space Science E/PO programs impact, a new online, distance-learning course, *Invisible Universe Online*, was designed and implemented this past year in a partnership with the SIRTf (<http://sirtf.caltech.edu>) and SOFIA (<http://sofia.arc.nasa.gov>) E/PO Programs, Montana State University, and the University of Arizona. The *Invisible Universe Online* traces the long chain of events from the birth of the universe in the Big Bang, through the formation of galaxies, stars, and planets by focusing on the scientific questions, technological challenges, and space missions pursuing the search for origins. The 15 week, Internet-delivered, graduate course for secondary school science teachers highlights the use of multiwavelength astronomy to address issues central to the NASA Origins Program. The course is intended to emphasize how astronomers use data from multiple wavelengths of the electromagnetic spectrum to advance our understanding of "astronomical origins" as outlined by the NASA Origins Program. Course topics are divided into three categories. The first five weeks of the course focuses on the NASA Origins Science Roadmap (<http://origins.jpl.nasa.gov>) and developed an understanding of light and the electromagnetic spectrum. The next six weeks cover the formation and evolution of stellar and planetary systems.

The final weeks focus on cosmology and galactic evolution. The course syllabus and weekly assignments can also be accessed at the National Teacher Enhancement Network website: <http://btc.montana.edu/ceres/origins/>. The course was first offered during the Spring 2002 semester and will be repeated through the next several semesters as part of the Montana State University Master of Science in Science Education program (<http://btc.montana.edu/distributed/>) and the NSTA Professional Development Institute (http://ecommerce.nsta.org/institute/courses_web.asp). Forty-four science educators have completed the course thus far; enrollment for the Spring 2003 semester should double this number. Participants have been spread geographically throughout the country and abroad.

During the Spring 2002 semester, the course was extensively evaluated. Participant survey responses repeatedly and consistently attested to the overall effectiveness and success of the use of an on-line distance-learning course for enhancing astronomy content knowledge and pedagogical reflection among secondary school science teachers. The results of both formative and summative evaluations provide the basis for continued development and revisions of the course. Through this venture, we hope to learn more about effectively using the Internet to reach out to science educators. Furthermore, the course serves as a test-bed for developing and testing various approaches to distance-learning that will inform the extent to which a flexible SOFIA flight-training workshops can be delivered via the Internet for secondary teachers selected to fly on SOFIA missions.

The course has been developed and taught by University of Arizona Professor Tim Slater and astronomy education graduate students John Keller and Adrienne Gauthier, and University of Colorado Fiske Planetarium astronomy educator Sanlyn Buxner. A detailed course description and evaluation summary will soon appear in the Astronomy Education Review (<http://aer.noao.edu/>). Course development, formative and summative evaluation, and funding for the Spring and Fall 2002 participating teachers was provided by the SOFIA and SIRTf E/PO Programs. For further information, please contact John Keller at jkeller@lpl.arizona.edu.

Minority University Education and Research Partnership Initiative

This is the fourth in a series of articles which highlights the programs of the institutions participating in NASA's Minority University Education and Research Partnership Initiative in Space Science (described in Voyages, issue 2)

Partnerships in Astronomy and Astrophysics Education and Research at Southern University

J. Gregory Stacy, Southern University

Under the auspices of NASA's Minority University Education and Research Partnership Initiative in Space Science, Southern University, the largest Historically Black College and University (HBCU) system in the country, is pursuing two collaborative research and education projects involving undergraduate students in the areas of experimental high-energy and solar astrophysics. With the Space Science and Particle Astrophysics research group at neighboring Louisiana State University (LSU, Lead Co-I M. Cherry) in Baton Rouge, Southern is collaborating in an experimental detector-development effort related to gamma-ray astronomy. Student participants in the MARGIE (Minute-of-Arc Resolution Gamma Ray Imaging Experiment) project receive broad-based multidisciplinary instruction and hands-on training in state-of-the-art experimental techniques in newly refurbished laboratories.

Southern is also collaborating with space scientists at the Smithsonian Astrophysical Observatory (SAO, Lead Co-I L. Strachan) associated with the Ultraviolet Coronagraph Spectrometer (UVCS) aboard the Solar and Heliospheric Observatory (SOHO) spacecraft. Southern students are being mentored, instructed, and trained in the research skills required to actively participate in ongoing UVCS calibration, data-analysis and scientific studies related to the Sun's corona and the solar wind.

Among the key accomplishments of the past year has been the inauguration of a space-science

lecture series on the Southern campus featuring invited talks by visiting SAO, NASA, and LSU scientists to introduce students to current areas of space research. These visits have already afforded two Southern undergraduates the opportunity to participate in summer research internships, one (G. Simms) at SAO with the SOHO/UVCS group (research mentor: L. Strachan) in Cambridge, Massachusetts, and the other (M. Mbonye) in the Laboratory for High Energy Astrophysics at NASA's Goddard Space Flight Center (research mentor: K. Gendreau).



Telescope captures attention of Southern students for solar observing.

These new partnerships have contributed significantly to a major revitalization of the curriculum in astronomy and astrophysics at Southern which had lain dormant for many years. Student interest continues to rise as these and other initiatives have allowed a continued expansion and enhancement of laboratory facilities and equipment. Southern students are also becoming increasingly involved in public-education and outreach efforts at the local level, especially those associated with the Highland Road Park Observatory, a newly established public facility in Baton Rouge. Finally, students and faculty are particularly excited about a recent invitation from their SAO colleagues to become a formal partner in the proposed Advanced Coronagraphic and Spectroscopic Explorer (PI J. Kohl), one of four mission concepts under consideration by NASA for a MIDEX launch in 2007 or 2008, in which extensive student involvement is anticipated.

Profiles of Scientists in Education and Public Outreach

This profile is based on excerpts of an October 2002 interview with Dr. Heidi Hammel about her involvement in Education and Public Outreach (E/PO). Contributed by Dr. Cherilynn Morrow, Christy Edwards and Preston Dyches, Space Science Institute.

Current professional position:

I'm a Senior Research Scientist with the Space Science Institute (SSI) in Boulder, CO. I live in Ridgefield CT, and I telecommute to Boulder. My work is studying the outer planets in our solar system. My background is in Earth and planetary science, and I consider myself a planetary astronomer.

Why Heidi contributes to Education and Public Outreach (E/PO):

When I do E/PO and I'm working in the classroom, or in front of cameras or giving public lectures, I have a great time. It is a lot of fun to do! I also believe that it's important to make a positive impact on kids. I have had many opportunities to be a role model, and to me that's really important — to be demonstrating for students what scientists really look like and who they are. There are far too many misconceptions in the media about what a scientist is and what scientists do. We can really set some good examples, showing that scientists are not people with white lab coats and thick glasses who can't speak in languages that most people understand. We're really down-to-earth people, and I think that's a great message to communicate. I try to reach out to kids, especially girls, who may not have realized that science and engineering are careers they might pursue.

How Heidi balances research and E/PO:

It's always a tough game balancing research and E/PO because I'm a "soft-money" researcher.

I'm only paid to do research; I'm not paid to do anything else. You really have to want to put in a few extra hours. It's part of our responsibility as scientists – to give back to people, to kids, and to the public. Through their tax dollars they support this work, so I make the time and create the balance. I also try not to let the E/PO get out of hand. I'm first and foremost a scientific researcher and this E/PO work is completely voluntary. I do it when I can, and I try to do as much as possible. At the same time, I find if I'm not careful, I can be completely overwhelmed. I'm very selective about what I do, and I try to find E/PO activities that have leverage. I look for things that are big ticket, because you reach a lot more people that way.

The biggest challenges to her E/PO involvement:

The biggest hurdle is that it's not often perceived well in the research community. If you do a lot of this kind of work, people will think you're not taking your research seriously – you're more interested in doing Education and Public Outreach, and you're not a "serious" scientist. That can be a problem when you've put in proposals for grants, and they say, well, how much is she going to do on this research, and how much is she going to go off talking to TV cameras and school kids. It is fortunate, however, that professional organizations like NASA and NSF are placing more importance on E/PO. There is a need for more scientist participation in education and public outreach, and I'm not fully sure that these ideas have percolated down into the rank and file yet - there's still a lot of education that needs to go on.

Heidi's words of wisdom to other scientists:

Not everybody has to do exactly what I do. That's an important point to understand. Not everybody likes to be in front of a camera, or talking to kids, or giving public lectures. I happen to like doing those things, but there are a lot of other roles that are just as important.

Don't be limited in your thinking of what E/PO is by just a few examples. E/PO programs have many different facets and there is a whole spectrum of things that you can be involved in. A big part of doing successful E/PO is just to get out there and find the things you like to do, and do them well. Getting science out of the ivory tower and into the public realm is one of the most important and exciting things a scientist can do, but not everybody has to do it the same way.



Dr. Heidi Hammel

On the Horizon

Sun-Earth Day 2003- "Live From the Aurora"

Elaine Lewis, Sun-Earth Connection Education Forum

Students and educators are invited to participate in several exciting opportunities leading to Sun-Earth Day on March 18th. There are opportunities for museums, planetariums and science centers to participate in a live web cast on February 22-23 and again on March 1-2. These events will offer the audience a chance to see a sounding rocket launch and view an auroral event. Museums participating in 'Sleep over' events will be supported with activities, scientist interviews and astronaut reactions to the light shows provided by our Sun. On March 18th, Passport to Knowledge will bring a live Webcast called, "Live From the Aurora", to classrooms and NASA centers through NASA TV and local PBS stations. Students will be able to visit with scientists and other students to learn more about the aurora and local cultures in Alaska. In April, a new NASA Connect program, "Dancing in the Night Sky" will be featured. Scientist researchers working with the IMAGE and POLAR spacecrafts will join the program in Norway to share their growing knowledge about the Aurora.

This year Sun-Earth Day will introduce the *Student Observation Network* - a new way for students to work with real NASA data. S.O.N. was developed to provide educators with unique teaching tools that are compelling and help interest students in pursuing careers in science, technology, mathematics and engineering. Students will have the opportunity to conduct investigations, use NASA data, make predictions and collaborate with other students across the nation. They will also have the ability to collect and analyze data from several sources including on-line observatory telescopes and satellite imagery.

An Educator's Resource Packet is also available. This packet includes specific materials related to learning more about the aurora and a new teacher's guide complete with activities supporting involvement in the Student Observation Network. The Educator's Resource Packet can be ordered through NASA CORE or by registering on the Sun-Earth Day website (<http://sunearth.gsfc.nasa.gov/sunearthday>) through the *Student Observation Network*.

New GEMS Guide

Israel Hawkins, Sun-Earth Connection Education Forum

The "Living with a Star" teacher's guide will be released in early 2003 as part of the award-winning Great Explorations in Math and Science (GEMS) series. This middle school guide, produced by NASA's Sun-Earth Connection Education Forum and the UC Berkeley Lawrence Hall of Science, examines the Earth's relationship to the dynamic Sun. The guide provides a series of engaging activities for students to help them understand aspects of the Sun-Earth system that affect life and society. A key goal of the guide is to make students aware of the risks of living with our nearest star, the Sun, and how 'space weather' impacts astronaut safety, satellite operations, power grids, and communications. The guide will include a complementary CD-ROM and website that will provide access to NASA space weather information, satellite imagery, movies, scientist interviews, and other multimedia resources. The guide will be distributed nationally through an existing network of more than 50 GEMS sites that offer professional development and training on how to use the guides to teachers in their region.

E/PO Workshop for Scientists, Engineers & Education Mangers

The Space Science Institute announces its 9th annual K-14 Education Workshop for Scientists, Engineers & Education Mangers, currently scheduled for April 27-30, 2003 in Boulder, CO. The four-day workshop will offer participants valuable information and experience necessary to both contribute meaningfully to education, and to design and implement effective education and public outreach programs in association with scientific research programs. For more information, visit <http://www.spacescience.org> or contact Christy Edwards at edwardcl@colorado.edu or 303-735-4880

If you would like to receive an electronic copy of future newsletters, contribute an article or just have questions about getting involved with the NASA OSS E/PO Program, contact Larry Cooper, Editor, at lcooper1@hq.nasa.gov. Prior issues of *Voyages* are online at <http://spacescience.nasa.gov/education/news>.