

EDUCATIONAL OUTREACH

PUBLIC AFFAIRS AND EDUCATIONAL OUTREACH

Educational Outreach Update

Dr. Steven Croft joined the PAEO staff in early July as a Senior Science Education Specialist, with primary responsibilities in the Teacher Leaders in Research Based Science Education (TLRBSE) Program. He worked in the NASA planetary program for over 15 years as a planetary geologist/geophysicist and worked on the Voyager 2 Imaging Team for the Uranus and Neptune encounters. While working at the University of Arizona Lunar and Planetary Lab, he helped found the Image Processing for Teaching Project and the Center for Image Processing in Education. Dr. Croft came to NOAO from the NASA Classroom of the Future in West Virginia, where he worked as a senior scientist developing inquiry and problem-based science education materials and led teacher professional development workshops. Dr. Croft has a master's degree in astronomy and master's and doctorate degrees in geophysics and space science from UCLA. He has also received many awards for outstanding teaching. We are delighted to have him in the department.



Stephen Pompea and Connie Walker represented NOAO at several recent education and public outreach conferences. In mid-June, NASA's Office of Space Science Education and Public Outreach held a specialized conference in Chicago to bring together scientists and educators with an interest in space science education and outreach. Three posters were presented on Project ASTRO, TLRBSE, and Teaching about Spectroscopy in a Children's Museum setting. In addition to this and other education/public outreach conferences, PAEO staff displayed the NOAO exhibit at the 200th Meeting of the American Astronomical Society, hosted by the University of New Mexico in Albuquerque on June 2-6.



On May 29, Stephen Pompea, Connie Walker, and John Keller (Steward Observatory) gave two three-hour workshops on spectroscopy and the nature of light and color to 50 TUSD teachers at the Inquiry Institute. The Inquiry Institute is a three-day institute held at the University of Arizona each year with the purpose of deepening understanding of inquiry-based instruction among K-12 teachers. At the spectroscopy workshop, teachers learned by guided inquiry how a spectrometer works by building it and then using it to explore the color of room lights to determine the elements present in these lights, using their characteristic optical "fingerprints."



Doug Isbell and Stephen Pompea attended a National Virtual Observatory Outreach workshop at Johns Hopkins on July 11 and 12, presenting a talk on "Lessons Learned from Data-Rich Science Education Projects." Planning efforts are underway to identify the tools of greatest educational utility for use with large data sets.



Efforts to jumpstart a Project ASTRO-like program in Chile are progressing well. Toward the end of May, NOAO Educational Outreach Staff, NOAO Spanish-speaking astronomers, and local Spanish-speaking teachers conducted a successful teleconference with their

counterparts at CTIO. Several copies of the Spanish version of an astronomy activity and resource book, the Astronomical Society of the Pacific's *Universe at Your Fingertips (UYAF)*, as well as Learning Technologies spectrometers were sent to CTIO for Chilean teachers. Efforts have begun in Chile to provide feedback on the Spanish translation of *UYAF*.

At the end of June, NOAO Tucson was selected as a Family ASTRO site for 2002-2004. Family ASTRO is a new program (supported by the National Science Foundation) to bring hands-on astronomy activities and astronomy events to families of all backgrounds. There are three diverse communities in the Tucson area that will be participating in the Family ASTRO program: the families of students in the Indian Oasis/Baboquivari Unified School District of the Tohono O'odham Indian Nation, the Hispanic community associated with the Sunnyside Unified School District, and families affiliated with the Sahuaro Girl Scout Council. The program will start at the end of October with training for Site Leader Connie Walker and Site Coordinator Robert Wilson.



In May, the TLRBSE program successfully wrapped up its first on-line distance learning course on astronomy content, pedagogy, and leadership skills for teachers. This was a 15-week course with intensive instructor-participant

interaction. The on-line course was preparation for a two-week research experience in July. The 19 TLRBSE teacher leaders converged on Tucson from all over the US, bringing with them

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a variety of backgrounds and impressive credentials. At the workshop, they received specialized training on mentoring and leadership, as well as science education content and pedagogy in order to work more effectively with their learning colleagues.

The teachers were divided into two groups. One group conducted research at Kitt Peak National Observatory and the other at the National Solar Observatory's Sacramento Peak facility. Both groups received instruction on leadership, instrumentation, data analysis, and image processing. Each teacher was part of a research team pursuing an authentic research topic using observational data. The task before them now is to bring the research, and their renewed excitement for it, into the classroom. In addition each of the teacher leaders are to mentor three teachers new to the field, in an effort to retain them in the teaching ranks.

The workshop and distance learning course were very successful experiences, thanks to the efforts of the in-house NOAO TLRBSE team, as well as Jeff Lockwood (TERC), Don McCarthy (Steward), Steve Howell (Planetary Science Institute), Travis Rector (NRAO), Randy Accetta (Magellan University), Kathy Stiles (WestEd), and Jean Young (M.J. Young & Associates). Particular thanks goes to three NSO scientists who worked extensively with the TLRBSE Team to develop the solar research experience and who served as

mentors for the teachers during their stay at Sac Peak: K.S. Balasubramaniam, Han Uitenbroek, and Alexie Pevtsov. Their outstanding work with the teachers and many months of labor leading to the workshop contributed greatly to its ultimate success.



Mary Bishop, a high school science teacher from New York, carefully sketches all sunspots visible on a projected solar image during the July 2002 TLRBSE workshop. Such sketches are done each sunny day in the Hilltop Dome at Sacramento Peak Observatory as part of the dawn "Flare Patrol." Mary and her fellow teachers made solar sketches using the patrol telescope as part of their research experience in Sunspot, NM.

The REU Experience

Allison Heinrichs (Ohio State University)

As my plane glided into the Tucson International Airport, I craned my neck toward the tiny window to try to see the twinkling lights of the sprawling city below. Having never been to the West before, I didn't know what to expect, but I pictured a sandy desert littered with cow skulls and crawling with snakes and scorpions. The sudden thud of the plane making contact with the runway jolted me from my thoughts, and the excited butterflies in the pit of my stomach returned. I could hardly wait to start my summer Research Experiences for Undergraduates (REU) program with Kitt Peak National Observatory.

It's been several weeks now since I arrived in Tucson and, although my impression of the desert has been refined, my excitement has not waned. The research done here is fascinating, and the REU program provides me with many opportunities to learn about it.

Weekly colloquia, casual discussions with various research scientists, and even just wandering the halls has given me an

incredible appreciation for the vast amount of research done in astronomy. The best part is that the astronomers here have a contagious enthusiasm for their research, and all it takes is an expression of interest to launch any one of them into discussions covering everything from the detection of distant quasars and the formation of planets around other stars, to the workings of CCD cameras and seismic vibrations on the Sun.

Over the 4th of July holiday, I went on the annual REU group trip to Sunspot, NM. After a day filled with games, food, and fun in this small community, and a beautiful clear night spent gazing up at the Milky Way, we were treated to an in-depth tour of the National Solar Observatory high atop Sacramento Peak. Our day started with a lecture on solar astronomy, the different methods used to observe the Sun, and the future of solar observing, from both the ground and space. We were then given a tour of the solar telescopes and watched as the solar astronomers took afternoon observations. We ended

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REU Experience continued

the tour at the Hilltop Dome, where we were personally able to observe the Sun and see some sunspots and solar flares.



KPNO REU students (from left to right): Jeffrey Fogel (Harvard University), Kwayera Davis (College of Charleston), Allison Heinrichs (Ohio State University), Bryan Henderson (University of Washington), Ely Duenas (Hunter College), and Gisela Telis (Columbia University). Ely Duenas was part of NASA's URPA program.

On our way back to Tucson, we made a side trip to Socorro, NM, to see the Very Large Array (VLA). Upon our arrival we donned hard hats and, much to my delight, were allowed to walk around inside the dish of radio telescope #27 (which had been taken out of the formation for service). The adventurous few who climbed to the edge of the dish received a breathtaking view of the remaining bright white telescopes gazing up into an electric-blue desert sky. After exiting the dish, we wandered through various control rooms, heard the whirl of machines processing data, and watched as the telescope operators kept a wary eye on the status of each dish. As we left the VLA for the long trek back to Tucson, everyone in the van watched as the massive telescopes became tiny dots strewn across the horizon.

True to the word "Experiences" in its name, the REU program does not merely involve a series of lectures and fascinating field trips; it also includes hands-on research in various areas of astronomy. The applications of potential REU students are reviewed and selected by their future advisors based on the students' stated fields of interest. We are then given the opportunity to make a contribution to these topics by designing programs, reducing data, and going on observing runs.

Since reading a captivating article about the eventual collision of comet Shoemaker-Levy 9 with Jupiter a year before it occurred, I've found comets to be incredibly interesting. Moreover, the act of collecting article upon article regarding the collision sparked a love for science writing in me as well. These interests play directly into the focus of my REU responsibilities. My research project involves data reduction on a periodic comet, Neujmin 1, in order to determine and

confirm characteristic properties, such as the comet's period of rotation and diameter. This information, though only a small drop in the bucket of knowledge, will contribute to our understanding of some of the most pristine bodies in our solar system.

My REU advisors, Beatrice Mueller and Nalin Samarasinha, are just as enthusiastic about their research as the rest of the scientists at NOAO, and they are more than willing to take time out of their day to indulge my questions and hypotheses regarding everything from the composition of asteroids to the best way to do photometry using IRAF. Beatrice and Nalin are also very supportive of my interest in science writing, and have provided me with several opportunities to gain more experience in this pursuit.



NSO REU students (from left to right): Marjorie Frankel (Wellesley College), Erika Roesler (Northern Arizona University), Adam Kraus (University of Kansas), Joy Chavez (University of Houston), William Plick (Connecticut College), Mary Melton (Texas A&M University), and Carol Thornton (Virginia Polytechnic Institute). Missing from photo is Adria Updike (Smith College).

Perhaps even more valuable than learning about the research currently being done in astronomy has been meeting the other REU students, the people who may someday take the lead in this research, and help shape and refine the world's understanding of our mysterious universe.

Two days after I landed in Tucson, my roommate and I threw a small party for the other REU students on our patio, and their different personalities began to emerge. Some have definitely established themselves as the comedians of the group, while others are a bit more reserved and reflective. The one trait that seems to be common among all the students, however, is a bright optimism regarding their futures.

I'm sure that I will leave Tucson with lasting memories, not just of beautiful mountains and breathtaking night skies, but of valuable friendships and a wealth of knowledge.



Report on the First REU Site Directors' Meeting

Alan B. Whiting

Site directors of the Research Experiences for Undergraduates (REU) programs in Astronomy met at the University of Indiana on July 10–11 to review their progress and discuss improvements. NOAO was represented by Ken Mighell from Tucson and I represented CTIO.

REU programs generally take place over the summer (the southern summer in CTIO's case), with the general goal of allowing undergraduate students a chance to learn about and take part in astronomical research. This year there are 125 students at 14 sites funded by the National Science Foundation (NSF). Three more sites are to be added next year. Small colleges and consortia, large universities, and national observatories are all represented. The variety of situations makes for a wide variation in the details of how the programs are conducted,

a fact made evident from the short presentation each site director gave at the opening of the meeting. However, all programs have students conducting astronomical research under the direction of professional astronomers.

The directors quickly agreed on measures to coordinate things like offer and reply dates, and to work for rough equality of student stipends. Many details of how to run an REU program were brought out and exchanged. Some sites, for example, have all students apply on a Web-based form; and the software to handle this has been made available to all.

An important issue is more effective recruitment of students, especially of minorities who have been historically underrepresented in astronomy. Based on a tour he made to several Historically Black Colleges

and Universities (HBCU), Ken Mighell emphasized that personal relationships with professors are vital. The NSF REU office is investigating ways of developing such relationships, including the coordination of visits by several site directors on behalf of all the REU programs.

Perhaps most important was the exchange of ideas among the directors. Each program seemed to have some insight or method of doing something that another program picked up as a good approach to try.

Overall it was a very worthwhile meeting. There is enough follow-up work for everyone to do that no one has mentioned another meeting as of yet, but certainly the REU site directors will get together again.

Undergraduates Wanted for the 2003 CTIO REU Program!

Nicole van der Bliek, Alan Whiting & Chris Smith

The year 2002 saw another successful NSF-funded Research Experiences for Undergraduates (REU) program at CTIO. Four students participated in our REU program and all four will attend the January 2003 AAS meeting in Washington D.C. to present a poster on their work. We are looking forward to another outstanding program for 2003, when we anticipate offering five undergraduate Research Assistant positions for a ten-week program starting in January.

CTIO hosts the only NSF-funded REU program that takes place during the US academic year, which is the Chilean summer (January through March). This schedule provides an alternative for students who can take advantage of a quarter or semester away from their home campuses, and who are interested in participating in an "overseas" program. The CTIO REU program offers students the unique opportunity to gain observational experience studying objects in the rich Southern Hemisphere sky (e.g., the Magellanic Clouds and the Galactic Center), while also providing them with a chance to work alongside Chilean astronomy and engineering students who come to CTIO to participate in the "Prácticas de Investigación en Astronomía" (PIA) program of summer engineering internships.

The application deadline for the 2003 CTIO REU program is 1 October 2002. The program is open to US citizens or permanent residents who will be enrolled as full-time undergraduate students through January 2003. Please check the CTIO REU Web page (www.ctio.noao.edu/REU/reu.html) for application materials and the latest news about our 2003 program, as well as for more information about the CTIO REU program, projects, and participants from previous years.



In Brief

A spectacular **wide-field color image of the Eagle Nebula (M16)**, taken by Travis Rector at the WIYN 0.9-meter telescope, was promoted to the media at the June AAS meeting. Its subsequent release by the Reuters news service and related coverage on Yahoo.com led to widespread international popularity, with inquiries for media publication or public use spanning the globe from Scotland to South Korea.

A typical comment from the public: "It is by far the most beautiful creation I have seen in my 63 years!"



A **new color poster of the Eagle Nebula image** was prepared simultaneously for release by NOAO Public Outreach, along with new posters of M33 and AE Aurigae, "The Flaming Star." We were therefore able to refer dozens of queries by interested members of the public to the Kitt Peak Visitor Center for a phone order purchase of the poster-sized image. The new poster of M33 is unique in its combination of data from Kitt Peak and several radio telescopes, including NRAO facilities.



New lighting for the **Kitt Peak Visitor Center** was contracted and installed in June (see photo), lending a much more relaxed "atmosphere" to the interior, and giving greater flexibility to the placement of exhibits. A new spectroscopy exhibit purchased from the Exploratorium has been delivered and put on display. A solar-powered audio kiosk describing the tile mural on the exterior wall of the Kitt Peak Visitor Center has been installed on the outdoor patio.



Snow Day Down South



This striking photograph shows the SOAR telescope dome on snow-covered Cerro Pachón in late July, only a month after the cover photo of this Newsletter.

(Photo Credit: Sergio Franco)