

EDUCATIONAL OUTREACH

PUBLIC AFFAIRS AND EDUCATIONAL OUTREACH

2004 TLRBSE Summer Workshop Reaches New Heights

Steven Croft & Stephen Pompea

Twenty middle school and high school science teachers spent two weeks at NOAO in mid-June as part of their training in the Teacher Leaders in Research Based Science Education (TLRBSE) program, sponsored by the National Science Foundation. This is the third full year of this flagship Teacher Retention and Renewal program at NOAO, and both staff members and external evaluators agree this year's group was the best-prepared one yet. This advance preparation—aided by some especially good observing conditions on Kitt Peak during the intensive summer workshop—was reflected in the impressive quality of the initial research project results presented by the four teacher groups in the workshop's second week.

Designed to bolster secondary school science teaching across the nation, TLRBSE helps renew the enthusiasm and research pedagogical skills of experienced science teachers by giving them new techniques for instruction and immersing them in hands-on astronomical research. The program also helps retain science teachers by training these experienced attendees to serve as mentors to newer teachers in their area.

The experienced teachers (who must have completed more than five years in the science classroom) participate in the program as "Teacher Leaders." They are competitively selected, and come from all across the nation, from Alaska to Hawaii to Puerto Rico. They participate in a 15-week distance learning course in which they are given training in astronomy content, research pedagogy in the classroom, leadership, and effective mentoring techniques. They are also trained in one of four astronomical research projects. The projects supply them with a real research experience that they can share with their students. In order to make their research experience concrete, they come to Tucson and spend five days working with TLRBSE staff astronomers collecting data on three of Kitt Peak's major nighttime telescopes and the world's largest solar telescope.

During the summer workshop, the Teacher Leaders are provided with continued training in leadership and mentoring skills. After they leave the workshop, they are expected to take the



Figure 1. TLRBSE 2004 summer workshop participants and staff on Kitt Peak.

research techniques and astronomy research projects back to their classrooms. They are also expected to find at least three teacher "newbies" (less than five years in the classroom) in their home school or district and mentor them for at least two years to help them through the frequent rough spots encountered by those new to teaching—roughly half of all new teachers quit within the first five years.

The summer experience of this year's extremely well-qualified cadre was aided by five mostly clear days and nights on Kitt Peak that enabled them to collect significant new data for their research projects: searching for novae in the Andromeda Galaxy; recording and interpreting spectra of Active Galactic Nuclei; obtaining and interpreting spectra and light curves of giant and supergiant irregular variable stars to determine the basic nature of these stars; and, using Zeeman Splitting of infrared solar lines to investigate magnetic fields in sunspots.

Three successful alumni of the TLRBSE program returned to the workshop to provide this year's group of Teacher Leaders with the savor of real classroom experience in applying the objectives

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2004 TLRBSE Summer Workshop continued

of TLRBSE. Babs Sepulveda, a high school teacher from California (TLRBSE Cadre of 2002), Velvet Dowdy, a high school teacher from Kentucky (TLRBSE Cadre of 2002), and Andy Miller, a middle school teacher from Texas (TLRBSE Cadre of 2001), presented discussions of their experiences with using research in the classroom and in mentoring new teachers. The 2004 teachers agreed that these presentations were an invaluable part of the workshop.

In addition to mentoring less-experienced colleagues in their home areas, the community-building aspect of the 2004 cadre will be strengthened by assembling them and their "mentees" together at the April 2005 meeting of the National Science Teachers Association in Dallas. There they will share their experiences with the TLRBSE staff and each other.

The TLRBSE program makes the new 2004 data available to all past participants of the program, so that they may continue using the TLRBSE research projects in their classrooms. In addition, TLRBSE publishes a peer-reviewed journal with science results from student/teacher research groups.

TLRBSE will continue to expand with a new class of teachers in early 2005, for which recruiting will begin in September. See www.noao.edu/outreach/tlrbse for further information. We encourage you to find teachers in your area who might be interested in applying for the program.

We thank the many NOAO staff, and NSO staff members Frank Hill, Claude Plymate, and Carl Henney, who all contributed their time and expertise to the preparation and performance of the workshop.



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Some TLRBSE 2004 Teacher Comments

"A fantastic experience! The hands-on aspect of collecting data was the best part."

"It is a great validation for participants to feel as though their ideas are respected and their interests appreciated. It is also great validation to be expected to perform at a high level. Kitt Peak astronomers were tremendous at this!"

"We were treated like real astronomers. The accommodations were superb and the willingness of the staff to give up five days of their own observing opportunities is something that many of us appreciated."

"This was the experience of a lifetime. I feel privileged and fortunate to have had the opportunity. Everyone made us feel a part of the community. I really didn't want to leave."

"The night sky over Kitt Peak is magical—just an incredible experience."

"The opportunity to engage in observations at each telescope was invaluable in helping us to understand the data sets from each group. Coupled with the pre-Kitt Peak talks from each faculty member, I now have an understanding of the data limitations, etc."

"I can say that this ranks at the top of my experiences in education training. Thank you, thank you, thank you!"



First Hands-On Optics Kits Debut to Positive Reviews

Stephen Pompea & Douglas Isbell

The NOAO Hands-On Optics (HOO) team recently completed a number of milestones in the development and alpha testing of fun and instructional optical engineering activities for after-school science programs.

HOO is a collaborative program supported by the National Science Foundation's informal science education program that is designed to get underrepresented middle school students excited about science by actively engaging them in creative optics activities. NOAO is teamed with the Optical Society of America, SPIE, and MESA of California in the development, testing, and dissemination process of six inquiry-oriented optics modules aimed at the seventh grade level.

The first three modules under development deal with reflection and refraction of light. The NOAO Tucson HOO team consists of Stephen Pompea (Project Co-Principal Investigator, spompea@noao.edu), Connie Walker (professional development lead, cwalker@noao.edu), University of Arizona Optical Sciences Center graduate students Brian Kinder and Ken Cardell, and University of Arizona undergraduate astronomy major Carolyn Peruta.

Primary testing for the first three HOO modules has been held in Tucson at Wakefield Middle School and the Jewish Community Center. Further testing was conducted at a three-day workshop in mid-July led by Walker and Pompea at the University of Southern California (USC).

The USC workshop trained 28 MESA teachers and optics industry "resource agents" from California and Washington on prototype HOO activities, such as constructing a kaleidoscope, and hitting a target with a laser-pointer beam reflected off a progressively larger number of mirrors. Imbedded within these challenges are memorable lessons about magnification, how to determine the focal length of a lens, the unusual qualities of multiple mirror systems, the Law of Reflection, and the nature of common misconceptions about light.

"We use lasers because they are everywhere—in CD players, scanners, security systems, surgical devices, and military systems," explains Jason Briggs, education program manager at the Optical Society of America. "The physics and technology of lasers are ideas every student should be learning, but you've got to get the teachers on board with the ideas first."

"The sixth, seventh, and eighth grades are the perfect time to catch kids and teach them about science and technology," says NOAO's Walker, "because by high school, many of them have shied away from it, thinking it's not 'cool' enough."

The workshop was judged by the project's independent evaluator to be an outstanding success for both the teachers and volunteers. Informal comments from the teacher attendees support this positive early review.

"The kids are going to love this," said Darren Hayes, a science teacher at Willard Intermediate School in

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NOAO Senior Education Specialist Connie Walker helps Darren Hayes, a Compton teacher, left, and Richard Farnsworth, right, of Lawrence Livermore National Observatory, design a five-pointed laser star using mirrors and a single beam of light.



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First Hands-On Optics Kits Debut continued

Santa Ana, California, after learning how to build the HOO kaleidoscope kit.

Work at NOAO continues on producing and assembling extensive optics kits for the USC workshop teachers, and on the development of the second set of HOO modules. The project's advisory board will meet in October at the Optical Society of America meeting in Rochester to review the project's progress. Articles are being written about HOO for the Optical Society's *OPN* magazine and *Physics Today*, which should appear this winter.

Thanks to the USC Viterbi School of Engineering News for some of the material quoted in this article.

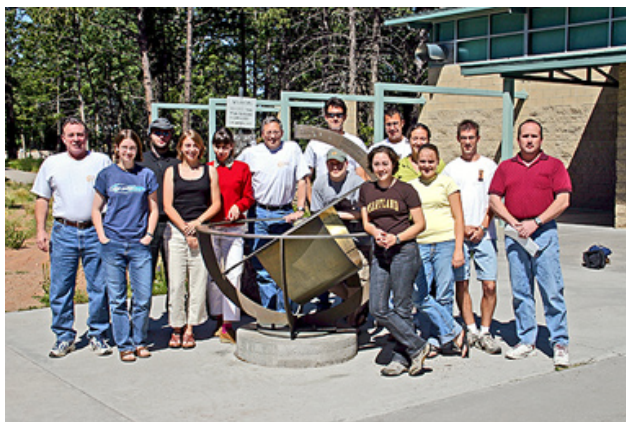


Michelle Hauer, a USC electrical engineering graduate student, aims laser beams at a mirror, being held by a teacher, to demonstrate the Law of Reflection.

KPNO and NSO 2004 REU Attendees



KPNO 2004 Research Experiences for Undergraduates (REU) participants. Left to right: Ian Roederer (Indiana Univ.), Lucas Laursen (Harvard Univ.), Elizabeth Schmidt (Carthage College), Laura Kushner (Univ. of Washington), Cassandra VanOutryve (Univ. of California at Berkeley), and Miranda Nordhaus (Rensselaer Polytechnic Institute).



NSO 2004 REU, Research Experiences for Teachers (RET), and Summer Research Assistantship (SRA) Program participants. From left: Creighton Wilson (RET, Lovelady High School), Michelle McMillan (REU, Northern Arizona Univ.), Drew Medlin (Grad SRA, New Mexico Tech), Leah Simon (Grad SRA, Macalester College), Maria Kazachenko (Undergrad SRA, St. Petersburg Univ., Russia), Michael Sinclair (RET, Kalamazoo Math and Science Center), Brian Robinson (ATST Fellow, Univ. of Alabama-Huntsville), Stuart Robbins (REU, Case Western Reserve Univ.), Brian Harker-Lundberg (Grad SRA, Utah State Univ.), Frances Edelman (REU, Yale), Stacia Luszcz (in front of Frances—REU, Cornell), Joel Lamb (REU, Univ. of Iowa), Mark Calhoun (RET, Sabino High School), Heidi Gerhardt (in front—Towson Univ.). Missing from photo are Matt Dawson (RET, Brockton High School), Cheryl-Annette Kincaid (Undergrad SRA, Univ. of North Texas), Kimberly Moody (Undergrad SRA, Univ. of Arizona), Anna Malanushenko (Undergrad SRA, St. Petersburg Univ., Russia).