

EDUCATIONAL OUTREACH

PUBLIC AFFAIRS AND EDUCATIONAL OUTREACH

Clear Skies and Challenging Observing Projects: The 2003 TLRBSE Summer Workshop

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Eighteen competitively selected science teachers spent two weeks in early July at Kitt Peak National Observatory, as the culmination of an intensive teacher enhancement and retention program designed to bring active astronomical research into the classroom.

The second full year of NOAO's Teacher Leaders in Research Based Science Education (TLRBSE) program featured two new observing projects, which were aided by five clear nights of observing time on three of Kitt Peak's major nighttime telescopes, plus two days at the world's largest solar telescope

The teachers, who had to complete a challenging on-line Distance Learning course before even making it to Arizona, also received training on how to be an effective mentor to novice teachers. Each of the TLRBSE participants, who hailed from all across the country from Alaska to Puerto Rico, will be expected to mentor three teachers in their area to help retain them in the field during their challenging early years in the profession.

The four astronomical research projects covered these topics:

- Searching for novae in the massive nearby spiral Andromeda galaxy (M31), using the WIYN 0.9-meter telescope on Kitt Peak. Participants took images of sections of the Andromeda galaxy that can be compared with earlier photos of the same regions to identify the transitory signal of these bright stellar outbursts. These outbursts occur when mass is transferred between two stars in a binary system, causing the surface layers of one star to ignite explosively from the fusion of hydrogen nuclei. The research objective of this TLRBSE project is to characterize the different types of novae, the rate of novae outbursts in galaxies of various sizes and shapes, and the distribution of binary and white dwarf stars in M31.
- Searching for Active Galactic Nuclei. Participants used the historic 2.1-meter telescope on Kitt Peak to obtain spectra of these deep space beacons, which include radio galaxies and oddballs like BL Lacertae objects. The research objective of this TLRBSE project is to characterize the environment of the early universe.



Figure 1. 2003 TLRBSE summer workshop participants and NOAO staff at Kitt Peak.

WORKSHOP ATTENDEES

Sherry Brown (Edmonds Woodway High School, Edmonds, WA)
Harlan Devore (Cape Fear High School, Fayetteville, NC)
Velvet Dowdy (Graves County High School, Mayfield, KY)
Steve Harness (Kingsburg Joint Union High School, Kingsburg, CA)
Joan Kadaras (Westford Academy, Westford, MA)
Tim Lundt (Burchell High School, Wasilla, AK)
Kathy Malone (Shady Side Academy, Pittsburgh, PA)
Ivy Merriot (Abaetern Academy, Bozeman, MT)
Thomas Morin (Belmont High School, Belmont, NH)
James Myers (Warren Central High School, Bowling Green, KY)
Brian Rogan (New Jewish High School, Waltham, MA)
Gary Sampson (Wauwatosa East High School, Wauwatosa, WI)
Elba Sepulveda (CROEM, Mayaguez, PR)
Marty Stuart (Bozeman High School, Bozeman, MT)
Dwight Taylor (Goldenview Middle School, Anchorage, AK)
Karin van Klaveren (Golden West Middle School, Fairfield, CA)
Thomas Vinng (Desert Mountain High School, Scottsdale, AZ)
Diedre Young (Cornerstone Community Christian School, Kelso, WA)

continued



TLRBSE Summer Workshop continued

- A new TLRBSE project designed to characterize a common but poorly understood group of variable stars whose basic composition is similar to the Sun. Participants used the coudé feed telescope on Kitt Peak to obtain spectra of a class of irregular variable stars known as RV Tauri stars. These variables, which vary in their output on a measurable timescale, are thought to be in the process of changing from giant stars to white dwarfs by ejecting shells of material. Although many of these stars have been well-studied photometrically, their spectroscopic (compositional) features are not well known. The research objective of this TLRBSE project is to obtain a spectroscopic record that can be used to unravel the details of change in these rapidly evolving objects.
- A new TLRBSE project on multiwavelength solar imagery and spectroscopy. Participants used the gigantic McMath-Pierce Solar Telescope on Kitt Peak to obtain infrared spectra across sunspot groups to observe Zeeman splitting. The spectra were used to create magnetic field profiles across the sunspot groups, which were then combined with images of the Sun at wavelengths ranging from infrared to X-ray to help unravel the evolution of these groups and how they vary from one to another.

Although the participants spent most of their time on their own projects, most teachers had an observing experience on all four telescopes.

With all the clear nights, the TLRBSE participants were also able to make a number of additional observations. For example, the teachers used the 0.9-meter telescope to take multicolor images of several objects of educational interest, including planetary and diffuse nebulae and nearby galaxies. These images will allow students to construct their own enhanced color images of these familiar objects.

"It was a joy to work with such a dedicated, talented, and hard working group of science teachers," said Stephen Pompea, program director for TLRBSE at NOAO Tucson. "They encountered all of the challenges of astronomical research in their work at Kitt Peak National Observatory, and they performed admirably. It was a pleasure to have them as research colleagues."

The 2003 TLRBSE participants will attend the April 2004 meeting of the National Science Teachers Association in Atlanta as part of their continuing commitment to the program.

Now in its second full year following an earlier incarnation known as RBSE, TLRBSE is an inquiry-based Teacher Enhancement Program for middle school and high school teachers funded by the National Science Foundation (NSF).

The TLRBSE program also publishes an ongoing peer-reviewed journal with science results from its student-teacher research groups, who will continue to receive data from Kitt Peak throughout the year. TLRBSE will continue to expand with a new class of teachers in early 2004, for which recruiting will begin in September. See www.noao.edu/outreach/tlrbse for further information.

continued

Quotes from 2003 TLRBSE Teachers

"I felt from start to finish that I was a valued professional."

"[The astronomers] were especially trusting in letting us operate the telescopes and assisting in observatory operations—I felt a real sense of acceptance from them."

"This program has all the components needed to meet their objectives of training mentors and doing actual research. One of the best I have ever been involved in."

"There were some logistical flaws but the staff corrected [them] quickly. This was hands down the best workshop I have attended."

"Content-wise, the Distance Learning course was good preparation. It hit the right areas."

"I felt like I was a graduate student—cranking data, taking down and setting up the telescope. I can't believe [the astronomer] trusted us [to do all these things] but that was true of all the staff."

"This is an excellent program. It was a great experience being around astronomers and learning to use scientific instruments. Also, sharing information about astronomy and education issues with other teachers is very helpful."

"I had the experience of being an astronomer, and being able to tell my students about that is invaluable."

"I've attended almost every workshop there is for science teachers and TLRBSE is, by far, the very best one I've been to."



TLRBSE Summer Workshop continued

We strongly encourage you to find teachers in your area who might be interested in applying for the program.

We would also like to thank NOAO and NSO staff members Patricia Knezek, Frank Hill, Christoph Keller, Carl Henney, and Claude Plymate, among many others, who contributed their time and expertise to the preparation and performance of the workshop.

Figure 2: NSO staff scientist Christoph Keller observes TLRBSE teacher Ivy Merriot as she takes flat fields for her group's observations with Keller's infrared spectrometer at the McMath-Pierce Telescope Facility during the summer workshop.



NSO and KPNO 2003 REU Attendees



NSO 2003 Research Experiences for Undergraduates (REU), Research Experiences for Teachers (RET), and Summer Research Assistantship (SRA) Program participants. Back, from left: Thomas Haxton (REU, University of Chicago), Ludovico Cesario (Grad SRA, Universita La Sapienza, Italy), Francisco Virgili (REU, Michigan State), K.S. Balasubramaniam (NSO REU/RET Site Director), Mark Janoff (REU, Swarthmore College), Charles Baldner (Undergrad SRA, Macalester College), Sebastien Deroche (Grad SRA, EESO-France), Jesse Miner (Undergrad SRA, State University of New York at Stony Brook), Matt Dawson (RET, Brockton High School), and Linda Stefaniak (RET, Allentown High School). Front, from left: Sarah Jaeggli (REU, University of Arizona), Anna Malanushenko (Undergrad SRA, St. Petersburg University, Russia), Cheryl-Annette Kincaid (Undergrad SRA, University of North Texas), Victoria Astley (REU, Florida Institute of Technology), and Laura Allaire (Grad SRA, University of Rochester). Missing from photo are Steven Olmschenk (REU, University of Chicago) and Travis Stagg (RET, West Valley High School-Fairbanks).



KPNO 2003 Research Experiences for Undergraduates (REU) participants. Left to right: Meredith Hughes (Yale University), Kevin Schlaufman (Penn State University), Amy Bender (University of Illinois at Urbana), Jennifer Connelly (Dickinson College), Mia Bovill (University of Maryland), and Tuan Do (University of California at Berkeley).



The REU/PIA Programs at CTIO

Alan Whiting & Nicole van der Blik

In a control room high in the Chilean Andes, three astronomers are guiding the motions of a large telescope and the actions of a sophisticated electronic detector attached to it. They have just finished collecting light from a supernova, whose careful measurement may help to determine the motion of the whole universe, and in a moment, after observing certain standard stars to establish the night's calibration, they will look at the bubble of tenuous gas blown by a dying star. This is not an unusual night at Cerro Tololo Inter-American Observatory (CTIO), but these are unusual astronomers. They are undergraduate students from schools in the United States and Chile. One of them is now making the decision about which standard will give the best data for the fate of the Universe.

This is a scene from the recently concluded 2003 CTIO Research Experiences for Undergraduates (REU) and Prácticas de Investigación en Astronomía (PIA) activities. For ten weeks La Serena was host to five US and two Chilean undergraduates, teaching them about astronomical research by having them perform it at an international institution boasting cutting-edge instrumentation and science.

The programs are a living example of the international character of our science. US students, English-speaking and a long way from home, lived and worked together with Chileans (who were in a foreign environment in a different way). Coping with differences of language and culture was every bit as important a learning experience as mastering the intricacies of observational astronomy.



Lara Pierpoint (UCLA) starts an exposure on the CTIO 0.9-meter while Abner Zapata (Universidad de Concepcion) watches carefully.



Image of the barred spiral galaxy NGC 1097 constructed from data taken by Rebecca Wilcox (University of Washington), Lara Pierpoint (UCLA) and Abner Zapata (Universidad de Concepcion). Supernova 2003B is the star just to the left of the smaller elliptical galaxy at upper right.

Though the students are no longer at CTIO, their part in the program is not finished. At the January 2004 AAS meeting in Atlanta, GA, they will meet again to present their work as poster papers (and take their place in the more general astronomical community).

The preparations for next year's program are already underway and we are soliciting applications for 2004. The application deadline is 1 October 2003. The program is open to US citizens or permanent residents who will be enrolled as full-time undergraduate students through January 2004. Please check the CTIO REU Web page (www.ctio.noao.edu/REU/reu.html) for application materials and the latest news about our 2004 program, as well as for more information about the CTIO REU program, projects, and participants from previous years.

Please direct inquiries to ctioreu@noao.edu.