

Sonoma State University
Department of Physics and Astronomy
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This report, the Department's twenty-sixth, covers the period September 2002 through August 2004. See <http://phys-astro.sonoma.edu> for more information.

1 Personnel

In September, 2002 the faculty consisted of professors Lynn R. Cominsky, John R. Dunning, Saeid Rahimi (Dean), Gordon G. Spear (Observatory Director), Bryant Hichwa, Brock Weiss, Enrique Izaguirre and Joseph S. Tenn. Tenn served as department chair through this reporting period. Dr. Reza Khosravani joined the department in the Fall of 2003. Dr. Philip Plait continues on as staff, working full-time on NASA-sponsored Education and Public Outreach (E/PO) with Cominsky. Assistant professor Brock L. Weiss resigned in the Fall of 2003.

2 Instruction

A total of 593 students took Descriptive Astronomy, Introductory Observational Astronomy, Extraterrestrial Intelligence and Interstellar Travel, Frontiers in Astronomy, Cosmology, and Advanced Observational Astronomy in 2002-03, while 718 took Descriptive Astronomy, Introductory Observational Astronomy, Extraterrestrial Intelligence and Interstellar Travel, Frontiers in Astronomy, Astrophysics: Stars, Cosmology and Special Studies in the following academic year.

The Department awarded 1 B.A. degree and 7 B.S. degrees in 2002-03 and 3 B.A. degrees and 9 B.S. degrees in 2003-04. All degrees are in Physics. There were 58 physics majors in Spring 2003 and 63 in Spring 2004.

3 Equipment

SSU operates two observatories. The on-campus observatory has two optical telescopes, a 0.36 meter Schmidt-Cassegrain and a 0.25-m $f/5$ Newtonian, mounted in a sliding-roof facility. Auxiliary instrumentation for the 0.36-m telescope includes an ST-4 CCD camera, wide field cameras, and a grating spectrograph.

The Epoch Instruments 0.25 meter telescope is computer controlled. The system points reliably to within 1-2 arcminutes on the sky. When used with the current ST-7 CCD camera, the resulting images have a 20 arcminute field of view and a 2 arcsecond/pixel image scale. Unguided exposures as long as 2 minutes produce untrailed images. Reliable photometry is feasible for objects as faint as 16th magnitude.

In fall 2003 our 1970s vintage Celestron-14 (0.36 meter Schmidt-Cassegrain) was dismantled. We temporarily mounted the new C-14 on a Paramount ME for engineering evaluation and check-out before being moved to the new off-campus facility. This new system (now

known as GORT, or the Gamma-ray Optical Robotic Telescope) was moved to the off-campus facility in spring 2004. At that time a Mathis Instruments MI-500F fork mount was ordered for the old Celestron-14. This new mount will enable computer controlled operations and reliable tracking for this historic telescope.

The off-campus facility is located on the grounds of the California Academy of Sciences' Hume Observatory in the Pepperwood Reserve, approximately 27 kilometers northeast of SSU. The telescope, a 0.36 meter Schmidt-Cassegrain, is housed in a small dome ten meters east of the main observatory. The facility was built as the flagship of the Global Telescope Network (GTN), sponsored by the Gamma-ray Large Area Space Telescope (GLAST) mission, as part of the education and public outreach effort (see Research and Science Education section below). The telescope sits on a Bisque Paramount ME robotic mount and is equipped with an Apogee AP-47 CCD with a set of standard Bessell filters. First light was achieved in July 2004. Currently, the telescope is operational remotely from a warm room located in the main Hume observatory. Work is being done to make the telescope operate fully robotically, with a pre-programmed list of targets, while automatically archiving the acquired data.

4 Research and Science Education

Cominsky continued as director of the NASA Education and Public Outreach (E/PO) Group at SSU, which is the lead institution for the E/PO of the GLAST and Swift missions. SSU became the lead institution for the joint NASA/ESA XMM-Newton mission in 2003. Swift is due for launch in November 2004, GLAST in 2007, and XMM-Newton has been flying since 1999.

During the period of this report, the group worked on and completed a number of educational products. For GLAST, a series of activities were created for the Active Galaxies Educators Guide, which uses active galaxies to engage students and teach them standards-based lessons in math and science. An accompanying poster was also created, drawn by E/PO group Science Illustrator Aurore Simonnet, with textual content written by Plait. The first of three GLAST-sponsored modules created with the TOPS Research Systems group was printed and workshops were given that use this module, featuring simple paper slide rules to teach logarithms.

GLAST also sponsored the construction of the GLAST Optical Robotic Telescope (GORT) on the grounds of the Hume observatory (see Equipment, above) as part of the GTN. The science goal of the observatory is to aid the GLAST mission by observing high-energy targets such as blazars and gamma-ray bursts in visible

wavelengths. GORT will contribute to leadup and followup observations of blazar activity as well as multi-wavelength observations during the GLAST mission. There is an educational goal as well: students from around the country will be able to observe targets, receive the data, and analyze them in the classroom. The NASA E/PO group has partnered with the American Association of Variable Star Observers (AAVSO) and the Berkeley Hands On Universe Group to make this possible. The AAVSO has created finder charts with photometric sequences for the GTN targets, and enlisted their international team of observers to monitor these targets. The Hands On Universe group has pre-existing lesson plans for using astronomical data in the classroom. The Elk Creek Observatory in Kansas and the Bell Observatory of Western Kentucky University are also GTN partners.

GLAST also participated in the development and later sponsored a “short course” workshop for teachers called “Modeling the Universe”. The workshop uses Structure and Evolution of the Universe mission science and E/PO products to demonstrate the age, size, and scale of the Universe. This workshop has been given at various national and regional science and education meetings.

The GLAST E/PO website <http://glast.sonoma.edu> has been completely revamped and features classroom materials along with information about GLAST science.

Swift E/PO during the reporting period includes a partnership with the Lawrence Hall of Science to create a new lesson plan in their immensely popular Great Explorations in Math and Science series. The new guide, “Invisible Universe: from Radio Waves to Gamma Rays”, features lessons on the electromagnetic spectrum and gamma-ray bursts. Many educator workshops have used these materials during the past two years.

The E/PO team for Swift also created the Gamma-Ray Burst (GRB) Educators Guide and poster, which uses GRBs to teach students lessons in math, science, technology, and science history. Swift sponsored several segments of “What’s in the News” (WITN), a television program for middle school students, produced by the Pennsylvania State University (PSU). Each of these episodes reached an estimated five million students across the country. The WITN segments consisted of three short five-minute spots and a longer 15 minute feature that showcased Swift. Due to budget reasons, Penn State cancelled the WITN program in 2004. The Swift website <http://swift.sonoma.edu> was completely revised and integrated with the mission web site in preparation for launch in November 2004.

Several XMM-Newton E/PO products are being developed, including a supernova educators guide, similar to the GLAST and Swift educators guides, a StarLab portable planetarium show about the X-ray universe, and a Contemporary Laboratory Exercises in Astronomy activity where a user can examine and model an X-ray spectrum of a supernova and use it to examine

the nebula’s elemental abundances. The XMM-Newton E/PO website <http://xmm.sonoma.edu> was completely revised and is mirrored at NASA GSFC.

During the reporting period, the E/PO group (including the Educator Ambassadors) presented posters and workshops at venues all across the country, including the AAS, HEAD, AAPT, NCTM, and NSTA meetings. Presentations were also given at schools, colleges, astronomy clubs, museums, and on television. In total, 65,766 people were direct participants in these presentations, including 13,091 teachers. Of special note, the E/PO group was part of the organizing committee for the 2004 national AAPT meeting held in Sacramento, California, and also participated in the “Expanding Your Horizons” conferences (to nurture girls’ interest in math and science) held at the Santa Rosa Junior College in March 2003 and at Sonoma State University in March 2004.

The E/PO group held a training session for the NASA Structure and Evolution of the Universe (SEU) Educator Ambassadors (EAs) at SSU in mid-July, 2004. The EAs are master teachers and curriculum designers, selected in national competitions organized by SSU. In 2003, 14 new EAs were added to the original cadre of 10, and now represent the GLAST, Swift, XMM-Newton, LISA, GALEX, and Astro-E2 missions, as well as the GSFC HEASARC. The Educator Ambassadors help develop, test and disseminate educational materials for NASA. The 2004 training session, organized and implemented by Project Manager Sarah Silva, was an intensive 10-day immersion in the products developed by the E/PO group and other SEU E/PO professionals.

Spear is continuing to monitor a number of gamma-loud active galaxies (AGNs) in the V and I bands as part of the SSUO contribution to the GTN. These objects were selected from the GTN observing program object list that was established by Spear. SSUO will continue to monitor these objects as part of the SSU contribution to the GTN. Students Tiffany Borders, Jen Price, Gray Slater, and Ryan McDaniel (as well as Spear himself and Tim Graves) contributed to obtaining observations of the GTN blazars 3C66a, BL Lac, Mrk501, Mrk421, and PKS07016. For more information about goals and details of this observing program, or to learn how to participate in the GTN see <http://gtn.sonoma.edu>.

Spear has begun development of software and procedures to allow the GTN to evaluate past and current blazar activity using data submitted to the AAVSO international database. New AAVSO data is available within minutes after it has been submitted by observers so that GTN observers will be able to determine current activity levels for the GTN program objects at the start of each night’s observations.

Spear is continuing a program to observe and analyze interacting binary systems that exhibit apsidal motion. The goal is to provide information about stellar structure and relativistic apsidal motion. Systems observed include DI Her, IU Aur, RW Tau, and Z Dra.

Student Jen Price has been observing various minor planets to evaluate the attainable astrometric precision

for the Epoch telescope system. Student Ryan McDaniel has been observing selected minor planets to determine light curves.

5 Miscellaneous

SSUO was used 21 times for Public Viewing Nights, 42 nights for class visits, 84 nights for research, and 12 nights for engineering and maintenance. There were over 500 visitors to the observatory during the time period covered by this report.

The Department presented its *What Physicists Do* public lecture series, under Tenn's direction, for the 64th through 67th semesters. Visiting speakers on astronomical topics were Joe Jordan (NASA Ames and SETI Institute), Geoffrey Bower and Eugene Chiang (UC Berkeley), Jean Brodie and Claire Max (UC Santa Cruz and Lick Observatory), Claudia Alexander and Robert Hogg (JPL), Greg Madejski (SLAC), Chad Trujillo, Luisa Rebull, and Peter Shawhan (Caltech), Mark Halpern (UBC), Geoffrey Briggs (NASA Ames), Daniel Reichart (UNC), Stephanie Snedden ('83, NMSU), and Roy Gal (UC Davis).

Cominsky, substituting for Steve Maran, was acting Press Officer for the American Astronomical Society at the Winter Meeting in Seattle, WA. She moderated six press briefings and provided many interviews regarding the "speed of gravity." For the summer 2003 meeting in Nashville, TN, Cominsky, in her usual capacity as Deputy Press Officer, moderated 3 press briefings. She also provided a radio interview with NPR's Science Friday on the highlights of the meeting. Hear it at: http://www.sciencefriday.com/pages/2003/May/hour2_053003.html. She also moderated six press briefings at the summer meeting in Denver, CO in June 2004.

Cominsky also did other media interviews, including a SciFi Overdrive radio program on Gamma-ray Bursts, GLAST and Swift in September, 2003, BBC radio and LA Times interviews on NASA's Beyond Einstein program, in May, 2004, and a NPR Connections show on Stephen Hawking's new black hole theories in July, 2004. Hear it at: http://www.theconnection.org/shows/2004/07/20040722_b_main.asp.

Cominsky delivered an invited focus lecture at the California Science Teacher's Association Meeting in October 2003 entitled "Things My Mother Never Told me About the Universe." In January 2004, she gave the inaugural lecture in the Mission and Technology Lecture Series at Spectrum Astro, Inc., entitled "Einstein's Universe and Beyond."

Spear presented a GTN Update in fall 2002 at the GLAST Large Area Telescope Collaboration meeting. He also presented talks about the GTN and about observing blazars with small telescopes at the Balloon Fests in 2003 and 2004. These events focused on scientific ballooning for high school students and their teachers and are sponsored by the Santa Cruz Institute for Particle Physics.

Spear presented a poster paper about the GTN-AAVSO blazar program at the 201st meeting of the AAS

in Seattle in January 2003 and a talk about observing blazar variability at the special PRO-AM Collaboration session at the 204th meeting of the AAS in Denver in June 2004.

Spear also presented the inaugural talk at the dedication and first-light ceremony for GORT in July 2004. This talk summarized the history of the development of this facility and described how GORT would contribute to the GTN and to the GLAST mission.

Tenn continues to maintain the Bruce Medalists website: <http://phys-astro.sonoma.edu/brucemedalists>. He submitted four articles to the Biographical Encyclopedia of Astronomers, scheduled for publication by Springer in 2005. During the two-year report period he served as President-elect and President of the Northern California/Nevada Section of the American Association of Physics Teachers.

Plait has been very active with his Bad Astronomy public outreach efforts. He still maintains the Bad Astronomy website (<http://www.badastronomy.com>), and has written several articles for Night Sky and Sky and Telescope magazines. His book, *Bad Astronomy: Misconceptions and Misuses Revealed from Astrology to the Moon Landing "Hoax"*, now in its fifth printing, is still enjoying brisk sales. He has given numerous invited lectures, including the Hayden Planetarium in New York City, the Space Telescope Science Institute in Baltimore, MD, and Dryden Flight Research Center in California. He has also given talks at dozens of other venues including schools, teacher conferences, museums, and special-interest conferences. In addition, he continues to do numerous radio and television interviews about both bad astronomy and about work done by the E/PO group.

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