

Collaborations Improve Capabilities of KPNO and Our Partners

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With the encouragement and advice of the NSF, the AURA Board of Directors, and the Observatory Council, Kitt Peak National Observatory (KPNO) has been working to continue support of its operations and improve its capabilities by forming collaborations that further the scientific and educational missions of the National Optical Astronomy Observatory. We are happy to report the renewal of a successful partnership and the formation of a new collaboration, both of which further the ability of NOAO to provide first-class observing capabilities to the community and our partners. Several smaller instrumentation collaborations are also continuing into FY 2007.

Early in 2006, an external committee was impaneled to review proposals for the formation of collaborations in support of NOAO 4-meter telescope operations, and one proposal for the renewal of an existing partnership to develop instrumentation for KPNO. We thank the committee for their careful and thorough review of the proposals. Following the committee's recommendations, and past guidance from the Observatory Council, NOAO has finalized agreements with the University of Maryland and Clemson University.

Renewal of the KPNO-University of Maryland Collaborative Agreement

A partnership was established between KPNO and the Astronomy Department at the University of Maryland in 2003, following an Announcement of Opportunity in the March 2002 *NOAO/NSO Newsletter* and a series of reviews (see the August 2004 *Newsletter*). This partnership, judged to be beneficial to both parties, has served as an example for developing other new collaborations.

The initial focus of the KPNO-Maryland partnership has been the production of the NOAO Extremely Wide-Field Infrared Imager (NEWFIRM) as a complete scientific system. This instrument is scheduled to see first light in 2007. Maryland has provided financial and in-kind support to this project in exchange for guaranteed access to 20 percent of science nights on the Mayall 4-meter telescope (with possibility of trading for equivalent WIYN or 2.1-meter telescope time).

Maryland's resources have supported the purchase of large optics for the NEWFIRM camera and helped in the procurement of some key NEWFIRM components through competitive bidding to outside contractors. Maryland resources enabled the acquisition of a suite of narrow-band filters not otherwise in the baseline budget, which will be available for use by the astronomical community. Maryland personnel Rob Swaters, Brian Thomas, and Ping Huang are fully integrated into the NOAO pipeline and archive development teams, and their participation has been essential to meeting the delivery schedule for the NEWFIRM system.

The guaranteed access to the Kitt Peak telescopes provided to Maryland has had a strong positive impact on the scientific productivity of the university's department. The high level of interest in these facilities necessitated the formation of an internal review committee to prioritize the requests for telescope time. The Maryland users of the KPNO facilities cover a broad cross-section of the department: nine professorial faculty, seven postdocs and research scientists, and 11 graduate students have used these facilities since semester 2003B. Of the 11 students, nine are using the telescopes in support of their PhD research.

Science highlights include successful searches for and studies of comets and asteroids (e.g., the NASA Deep Impact Mission), detailed ground-based follow-ups of star-forming molecular

clouds in our Galaxy mapped by the Spitzer Space Telescope, and analyses of the mass distribution, star formation history, and impact of nuclear activity in nearby and distant galaxies. Science results have already appeared in more than a half-dozen publications, and several other papers are in preparation. The smaller KPNO telescopes have also served as excellent training tools for beginning students. A Kitt Peak summer school has been organized in 2004 (see photo) and 2005 to provide pre-thesis astronomy graduate students with some hands-on experience at the facilities of KPNO.

A proposal to extend the collaborative agreement for an additional three years was submitted by Maryland in late 2005. The extension proposal was reviewed as described above, and accepted in June 2006. The terms of this new agreement follow the recommendations of the Observatory Council. The commissioning of NEWFIRM on the Mayall telescope, the advent of the QUAD Orthogonal Transfer Array (QUOTA), followed by the One-Degree Imager (ODI) on WIYN, and the release of expanded versions of the NOAO Science Archive (NSA), represent major milestones planned for this renewal period. Maryland will contribute both financially and in-kind to these projects through its collaboration with KPNO.

The top software priority will be to finalize the Mosaic and NEWFIRM data reduction pipelines. Much of the effort will focus on streamlining the installation procedure for both pipelines, adding to the documentation, and fine-tuning the user interface to control the pipeline and monitor the data processing and data quality. The WIYN consortium has welcomed the participation of NOAO Data Products Program (DPP) staff in the development and implementation of the QUOTA and ODI data reduction pipeline, so another important component of the collaborative effort will be to adapt the highly flexible and scalable framework of the Mosaic/NEWFIRM pipelines to the higher demands of QUOTA, and eventually ODI, with Maryland playing a role in this effort.

Finally, Maryland will continue to contribute to the development of the NSA. The most exciting areas of potential development include the construction of pipelines to create higher-level data products from NSA holdings of Mosaic and NEWFIRM images, continuation of work on generic catalog query capability to enable queries across multiple heterogeneous catalogs in the NSA holdings, and construction of new Web services for analysis of images and catalogs.

A New KPNO-Clemson Partnership

The new partnership for KPNO recommended by our review panel (beyond those pending with CTIO) is with Clemson University. With a growing astrophysics presence in the university's Department of Physics and Astronomy, the new three-year agreement provides Clemson researchers and students with guaranteed access to 10 percent of Mayall telescope observing time each year, while providing KPNO with needed operating funds. Signed in June, the agreement also allows Clemson astronomers to exchange half of their KPNO 4-meter time for nights on other optical telescopes in the US national system.

This partnership was made possible by an extremely generous \$100,000 grant from the Seneca-based Charles Curry Foundation. The agreement demonstrates Clemson's commitment to world-class basic inquiry, graduate education and training, and frontier research resources. Clemson greatly appreciates the continuing generous support of the Curry Foundation in strengthening graduate astrophysics research opportunities at the university.

Clemson astronomers will use their guaranteed telescope access to investigate the origin of hyper-energetic gamma-ray bursts, track the evolution of supernovae explosions, determine the composition of high-redshift gas in the intergalactic medium, search for the formation of

planets in circumstellar disks around other stars, and probe the physics of the atmospheres and interiors of stars in the Milky Way. For more information on astrophysics at Clemson, see www.astro.clemson.edu.

Instrumentation Collaborations with the University of Florida, STScI, and Goddard Continue

KPNO continues to form smaller but vitally important collaborations to further the development of new instrumentation technology. These agreements bring new capabilities to the community and provide instrument developers with opportunities to test new ideas and technology.

Through these kinds of agreements, we are currently providing observing time with the Exoplanet Tracker (ET, Jian Ge and the University of Florida, see www.noao.edu/noaoprop/help/etmemo.html and www.astroufl.edu/et/) on the KPNO 2.1-meter telescope; FLAMINGOS (Steve Eikenberry and the University of Florida, see www.noao.edu/manuals/flmn and flamingos.astro.ufl.edu/); and, the Infrared Multi-Object Spectrograph (IRMOS, John MacKenty of the Space Telescope Science Institute (STScI), with the instrument being a collaboration between NASA's Goddard Space Flight Center, STScI, and KPNO; see www.noao.edu/manuals/irmos_perf.pdf).

We are open to forming additional collaborations with teams interested in bringing their instruments to KPNO telescopes. Please contact Buell Jannuzi (bjannuzi@noao.edu) with expressions of interest.