



## Getting Ready for the Next 50 Years – Part 2

*Buell T. Jannuzi*

In the June 2007 *Newsletter*, we described how Kitt Peak National Observatory (KPNO) has begun a program of modernization projects in response to the recommendations of the NSF Senior Review. Since then, we have also benefited from the advice of the NOAO Users Committee. Our continuing efforts are part of the NOAO commitment to provide the community with outstanding research opportunities through the instruments and telescopes of Cerro Tololo Inter-American Observatory (CTIO) and KPNO. This article provides an update on the modernization activities planned for KPNO, as well as brief descriptions of the new capabilities coming to KPNO in the near future. Progress reports will appear in future editions of this *Newsletter* and on our Web site.

### New Capabilities

This semester, KPNO is welcoming two near-infrared imagers to our telescopes. The NEWFIRM wide-field infrared imager has begun shared-risk observations at the Mayall 4-meter telescope, and the WIYN High-Resolution Infrared Camera (WHIRC) is undergoing commissioning tests at the WIYN 3.5-meter. WHIRC will begin shared-risk observing during the 2008A semester and is anticipated to become a facility instrument by semester 2008B. NEWFIRM will be shared between the Mayall and Blanco telescopes, with the first move of the instrument to Chile currently scheduled for early 2010 (see [www.noao.edu/ets/newfirm/NEWFIRM\\_info.pdf](http://www.noao.edu/ets/newfirm/NEWFIRM_info.pdf)). The first NOAO Survey Program observing campaigns using NEWFIRM are anticipated to begin in semester 2008A.

The second half of 2010 will see the commissioning of the One-Degree-Imager (ODI) at WIYN. Following in the path of OPTIC and QUAD OTA (QUOTA), ODI will use similar orthogonal-transfer CCDs to deliver superb images, but over a much wider field of view. Both NEWFIRM and ODI will come complete with data-reduction pipelines that will deliver flat-fielded frames, together with astrometric and photometric information, to the NOAO Science Archive (NSA).

The evolution of the system of telescopes and instruments available to the US astronomical community via NOAO will be informed by the report of the Renewing Small Telescopes for Astronomical Research (ReSTAR) committee, due at year-end. This report will influence our plans for the future of instrumentation for the System of telescopes accessible through the NOAO observing-time allocation process, and for KPNO in particular.



Ron Probst, NOAO project manager for the NEWFIRM wide-field infrared imager (top photo), provides operational advice to Xiohui Fan (University of Arizona) and collaborators prior to the start of the first visitor program with the new instrument at the Mayall 4-meter telescope in early November.

We will also use the ReSTAR report and input from the community (including the Users Committee) to inform our consideration of restarting queue and/or service observing at one or more of the KPNO telescopes. Your thoughts regarding either new instruments or the utility of non-classical observing modes

to your science goals are welcome--send them to me at [bjannuzi@noao.edu](mailto:bjannuzi@noao.edu).

### KPNO Modernization

Several projects to modernize KPNO are underway. To aid in the installation and maintenance of large new instruments such as NEWFIRM and ODI, we have begun renewing our ability to support engineering activities on the mountain, including the purchase of new instrument-handling equipment and planning for the construction of a new instrument-handling facility. Equipped with a clean room suitable for all needed maintenance of the next generation of large instruments represented by NEWFIRM and ODI, the new facility will reduce the risk of damage to these valuable instruments and increase the amount of time the instruments can be used on the telescope.

New instruments are being deployed on Kitt Peak to help all the telescopes on the mountain keep better track of observing conditions and to aid in the long-term characterization of the site and archived data products. See the related article titled "The KPNO Site Monitoring Suite" for more details.

The telescopes are also receiving attention. We are restocking depleted stores of spare parts for all three of our main telescopes. New computers and networking hardware are being purchased for the Mayall and other telescopes to improve communications between subsystems and improve reliability. A preventative maintenance plan is being expanded and, coupled with inspections and testing of key sub-systems, will lead to the identification of additional modernization projects during the next three years.

Some of our existing instruments are being considered for upgrades and modernization, and we welcome your suggestions for improvements. Plans are being developed to replace aging detector controllers with new MONSOON systems, with the Mayall spectrographs and Mosaic-1 imager among the possible instruments to be upgraded. New guiders are also being considered in order

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to improve the performance of our existing instruments.

In addition to modernizing our instruments and telescopes, we also continue to renew our staff. New technical and engineering positions have been created, and you will be introduced to the new hires in future

*Newsletters.* The additional staff are essential not only for the successful completion of our modernization efforts, but will be needed to properly support complex instruments like ODI in the years ahead.

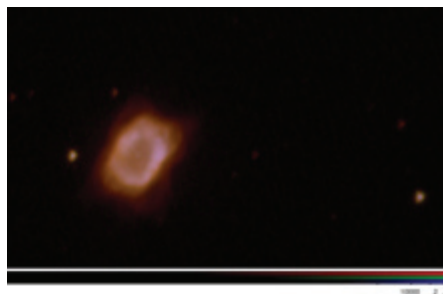
NOAO is committed to operating KPNO at the highest level of performance in partner-

ship with the Tohono O'odham Nation, on whose land we are fortunate to locate our observatory. We will continue to support the tenant observatories on the mountain as a critical parts of the US system of observing facilities, and we look forward to continuing to work closely with the community as we start another 50 years of operations. 

## WHIRC at Work on WIYN

*Dick Joyce & Margaret Meixner (STScI)*

The WIYN High-Resolution Infrared Camera (WHIRC), built by Margaret Meixner (Space Telescope Science Institute) and collaborators, has been delivered to Kitt Peak and has begun commissioning tests on the WIYN telescope. WHIRC employs a 2K x 2K Raytheon “Virgo” HgCdTe array to cover the 0.9–2.5 micron range with a pixel scale of 0.1 arcsec. The instrument is installed on the WIYN Tip/tilt Module (WTTM) port.



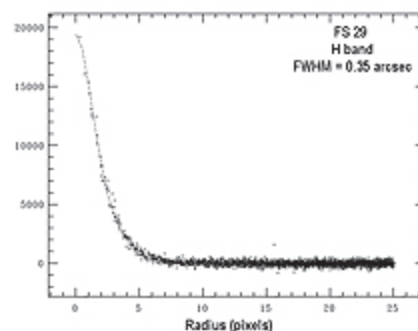
A JHK<sub>s</sub> image of the planetary nebula NGC 7027 taken with WHIRC.

When operating with WTTM correction under good seeing conditions, we anticipate image quality approaching 0.2–0.25 arcsec in the K<sub>s</sub> band. In addition to the standard J, H, and K<sub>s</sub> broadband filters, WHIRC contains 10 narrowband (typically 1 percent fractional bandwidth) filters covering a variety of atomic and molecular features. A description of the instrument can be found at [www.noao.edu/kpno/manuals/whirc/WHIRC\\_0708.htm](http://www.noao.edu/kpno/manuals/whirc/WHIRC_0708.htm).

WHIRC was delivered to WIYN in July 2007 and has undergone three short integration

and testing runs in July, August, and September, resulting in significant progress toward the commissioning of the instrument. Most of the software and computer integration with the telescope has been completed. The observing interface and observer's planning tool have been tested, and suggestions based on the commissioning tests are being incorporated.

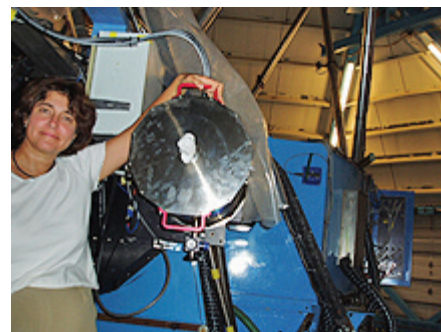
Science verification testing of WHIRC included observations of photometric standards and flat fields in all 13 filters to determine the optical throughput of the entire system, which was very close to the prediction during the design phase. Photometric and astrometric precision were tested by observation of well-studied clusters. Linearity, persistence and scattered moonlight tests all gave satisfactory results.



Plot of the radial profile of a star taken with the WTTM turned on yielding an image FWHM = 0.35 arcsec in the H band.

The WHIRC image quality is excellent. Tests with the pinhole array at the WTTM input

gave 0.17-arcsec images, demonstrating that the WHIRC /WTTM optics should not be a limiting factor to obtaining the best possible on-sky image quality. The commissioning runs so far have not included the testing of WTTM in active tip/tilt mode, although the combination was tested briefly in September, resulting in H-band images as good as 0.35 arcsec.



WHIRC Principal Investigator Margaret Meixner (STScI) and WHIRC in July during the testing and integration phase on the WIYN 3.5-meter telescope.

One major remaining issue is the identification and mitigation of excess detector readout noise. NOAO engineer Maureen Ellis is leading the effort to resolve this remaining noise issue. Commissioning tests of WHIRC with WTTM are planned for the late 2007A and early 2008A semesters, with the anticipation that WHIRC will meet its final acceptance criteria during the 2008A semester. WHIRC is being offered for shared-risk observing, but without WTTM in active tip/tilt mode, during the 2008A semester.

# The KPNO Site Monitoring Suite

*Bob Blum*

**K**itt Peak National Observatory (KPNO) has embarked on a project to deploy a modern site-monitoring suite to aid observers in real-time site characterization and to provide long-term site quality data.

The initial system will deploy a differential image motion monitor (DIMM) with a multi-aperture scintillation sensor (MASS) upgrade path, similar to the system in place at Cerro Tololo Inter-American Observatory (CTIO). The DIMM uses two independent images of the same star formed through separate pupil-plane apertures to track image motion. The relative image motion between the two images is used to estimate the variance in image motion due to the atmosphere, which is related through theory to the “seeing” or image FWHM. The DIMM will be deployed on a 3-meter tower south of the KPNO 2.1-meter telescope and will operate in robotic mode. Site work has begun, and contracts have been let or bids sought for all the major components. First light is expected in early 2008.

The MASS is a low-resolution turbulence profiler used to indicate where the turbulent layers are located at any given time. The MASS

is sensitive to turbulence in six logarithmically spaced layers from 0.5 kilometers to 16 kilometers in altitude, and can be used in concert with the DIMM (a MASS-DIMM) to determine the strength of the ground-layer turbulence. The MASS was developed via a collaboration between the University of Moscow’s Sternberg Institute and CTIO.

KPNO is also deploying an all-sky camera, known as KASCA, which will provide images every 30 seconds of the entire night sky over Kitt Peak in red and blue filters, as well as a sodium filter to aid in the tracking of light pollution near the horizon. The KASCA has been built at CTIO and is used to observe thin clouds and OH air glow by generating movies throughout the night. Clouds are seen in silhouette by their motion across star fields or the OH airglow itself. The KASCA is completed and will soon be deployed on the roof of the Kitt Peak mountain administration building.

The data from both the DIMM and KASCA will be available in real time to all KPNO and tenant observatory observers, as well as after the fact through nightly summary plots and a public database.

# Elizabeth Alvarez del Castillo and John Glaspey Rejoin NOAO

*Buell T. Jannuzi*

**E**lizabeth Alvarez del Castillo has joined the KPNO management team as assistant to the KPNO Director. Many of us know Elizabeth from her previous term with NOAO as part of our planetary sciences group with Michael Belton. During her subsequent service as associate director of the International Dark-Sky Association, she collaborated extensively with our observatories in the US and Chile, and our NOAO outreach programs.

Most recently, she worked with the director’s office at the University of Arizona’s astronomy department (Steward Observatory) and with the Large Binocular Telescope (LBT) project. She has been involved in many aspects of the astronomy community on local, national and international levels, and has worked on a diverse set of projects. Elizabeth is already contributing to several key issues important to KPNO, including the active protection of the quality of the site (outdoor lighting issues), relations with tenant observatories, and general operations. We are fortunate to have Elizabeth join our team.

John Glaspey has accepted a Visiting Scientist position with KPNO and the NOAO Public Affairs and Educational Outreach (PAEO)

office. We are pleased that John will be helping with important aspects of our programs for FY08. Known to many at NOAO from his years as supervisor of mountain scientific support, John brings to us his numerous skills, infectious enthusiasm, and years of experience in the operation of observatories, including L’Observatoire astronomique du mont Megantic, the Canada-France-Hawaii Telescope, the Hobby-Eberly Telescope, KPNO, and the MMT.

John will be assisting with various aspects of improvements to the WIYN Bench Spectrograph (including the deployment of a new detector/controller/Dewar), and he will be working to solve some long-standing pointing issues with the Mayall 4-meter telescope. John will be helping KPNO and the PAEO group with outreach to the Tohono O’odham Nation, including a new partnership between NOAO and the Indian Oasis-Baboquivari Unified School District called “Reach for the Stars” (see related article in the PAEO section of this *Newsletter*). John has also been integrated into the ongoing Hands-On Optics informal science education activities conducted by PAEO with the Boys & Girls Clubs on the Nation in Sells and elsewhere, led by Connie Walker.