

KPNO Instruments for the Future

Richard Green

The Kitt Peak telescopes will continue to play a vital role with new instruments that emphasize red and near-infrared observations, wide-field data collection, time domain science, and development through partnerships.

Infrared Multi-Object Spectrograph (IRMOS)

John MacKenty of the Space Telescope Science Institute (STScI) is the principal investigator (PI) developing this multi-object spectrograph with a cold, programmable slit mask from a commercial digital micromirror array. The field of view will be approximately 160×120 arcsec on the Mayall 4-meter telescope, with custom shape slits formed from 0.25 arcsec units. The $f/15$ configuration is compatible with commissioning and subsequent use on the 2.1-meter as well. The detector is a $1K \times 1K$ HgCdTe Rockwell Hawaii 1 array. The instrument will offer spectral resolutions up to 4500, complementary to FLAMINGOS. The spectrograph contains two cold mechanisms: a 14-element grating wheel and a 12-position filter wheel.



IRMOS

The IRMOS team of the James Webb Space Telescope Project at Goddard Space Flight Center (GSFC), in collaboration with STScI, handled the optomechanical design and fabrication. That task was a challenge because the micromirrors act as a reflective slit and send the light back toward the telescope. The alignment and test of the two-plane optical layout has been going extremely well, as has the overall integration at GSFC. First-light commissioning is planned for November. Ultimately, IRMOS will be available for

KPNO proposers (probably first offered in 2004B), in exchange for which the PI and collaborators will get dedicated time for their investigations. Watch for a more detailed description of the instrument and the observing opportunity in upcoming issues of the *Newsletter*.

Exoplanet Tracker (ET)

As described in the last *Newsletter*, Jian Ge and his team from Penn State University are developing a high-throughput precision radial velocity spectrograph. They impose the moiré pattern from a Michelson interferometer on the widened spectrum produced by a moderate-dispersion VPH grating. Small shifts in absorption lines produce strong phase shifts in the nearly orthogonal moiré pattern, providing accuracies of about 3 meters per second. The bench-mounted spectrograph will be located in the lower Coudé area at the 2.1-meter, and can be fiber-fed from the Coudé Feed Telescope or the 2.1-meter. Commissioning of the redesigned instrument is planned for late this calendar year. You will be encouraged to propose for this shared-use instrument, and the Penn State team will support data reduction with their custom software. Semester 2004B is likely to see the first general use of the ET. As with IRMOS, Jian's team will get time for their investigations, the total amount of which will depend partly on the degree of success of proposals by other users.

NEWFIRM

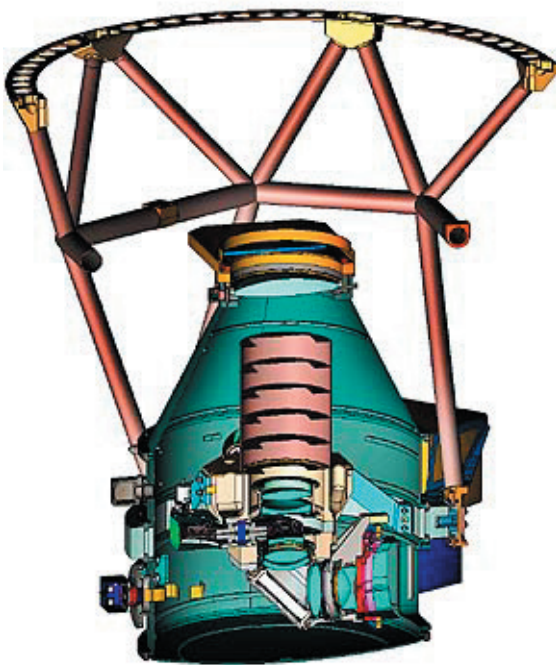
Ron Probst of NOAO is the PI on this wide-field, near-infrared imager for deep surveys to complement and support infrared-capable 8- to 10-meter telescopes. The detector package is a mosaic of four Raytheon InSb $2K \times 2K$ arrays, two-side butttable, currently under development in the Orion program as a partnership with the US Naval Observatory, NASA, and Raytheon. The field of view is 28 arcmin at the R-C focus of the 4-meter. NEWFIRM is capable of taking broad and narrowband filters in the J, H, and K_s bands. The project will utilize the new Monsoon data system under development at NOAO. The system will include a data pipeline that will deliver calibrated data to the NOAO archive. The instrument and its interfaces are being designed to be shared between the KPNO and CTIO 4-meter telescopes, with commissioning and first science currently planned for KPNO.

The completion of the NEWFIRM program depends on both internal and external partnerships. Within NOAO, the project involves the Major Instrumentation Program, the Data Products

continued

KPNO Instruments continued

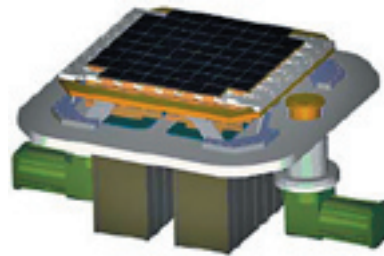
Program, and the KPNO and CTIO Engineering groups. Externally, NOAO and AURA have approved a partnership with the University of Maryland (UM), developed in response to our call for proposals. Initially, the UM Astronomy Department will provide substantial fiscal and human resources for NEWFIRM development in exchange for the right to allocate a share of the time on the KPNO 4-meter and other observing facilities. Preliminary design review is scheduled for June 4-5, and first-light commissioning is planned for fall 2005.



Conceptual rendering of NEWFIRM.

WIYN One-Degree Imager

WIYN Director George Jacoby is spearheading the effort to develop this very wide-field CCD imager with local, fast guiding through on-chip orthogonal transfer. This gigapixel camera with fast readout can serve as a Large Synoptic Survey Telescope (LSST) prototype. The CCD version of the Monsoon controller is being designed explicitly to be extensible to a gigapixel OTA mosaic. Prototype CCD development is now underway with WIYN acting in partnership with the University of Hawaii PanSTARRS consortium, including MIT Lincoln Labs, as well as Mike Lesser and Dick Bredthauer. The data flow offers the opportunity to test and develop concepts for the LSST pipeline and archiving. The WIYN Consortium is actively pursuing funding opportunities, which may include expanding the partnership to obtain sufficient resources and expertise. Currently, the array, controller, and filter technologies are under development. The ultimate goal is full science operations in 2007.



Conceptual rendering of the One-Degree Imager.

Clearly, there are ambitious plans for wide-field imaging and specialized spectroscopy at KPNO. Our goal is also to provide legacy instruments such as the R-C and echelle spectrographs as long as there is active proposal demand. As always, we welcome your thoughts on the long-term direction, particularly for optical spectroscopy, at the Mayall 4-meter and 2.1-meter telescopes.