KPNO/KITTPEAK
NATIONAL OBSERVATORY

# A Year of Ambitious Plans for WIYN Projects

*Richard Green*

Invigorated by the crisp fall weather in Madison, WI, the WIYN Board met in early October and encouraged vigorous progress on four major WIYN instrumentation initiatives.

As the external five-year review pointed out in 2001, WIYN delivers the best images over a wide field of view of any continental US facility. That compliment is validated by the reported modal seeing over the last year and a half of 0.58 arcsec. To further capitalize on this ability, the consortium is focusing on investments in wide-field spectroscopy and in rapid guiding for sharpened imaging.

The first project slated for completion is the Hydra positioner upgrade. The current x-y stages require critical alignment and are obsolete in terms of direct replacement parts for lead screws, motors and controllers. Building on the Hydra/CTIO heritage, Gary Muller and an NOAO-based technical team have designed a replacement system that is maintainable and more tolerant to alignment errors, and which may shorten the reconfiguration time considerably. The design passed critical design review in September, and is already well along in fabrication. Behzad Abareshi is porting the code to Linux, and a substantial lab testing period is planned before installation during next summer's shutdown. Commissioning is likely to extend into early fall of 2004, in order to validate astrometric solutions during stable weather conditions. The result will be a system that promises reliable performance for the remainder of the decade.

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The original design of the bench spectrograph concentrated on spectral purity and assumed only modest focal ratio degradation from the fiber outputs. The consequence for the as-built system was a modest throughput and noticeable light losses for end fibers. Matt Bershady (University of Wisconsin) and Charles and Di Harmer have led an effort to modify the optomechanical design of the bench to increase throughput with only minimal degradation in spectral resolution. They have also investigated an off-axis collimator and novel field lens group that can lead to up to three times greater throughput. The Board approved the design project to proceed to Preliminary Design Review next spring. Meanwhile, the KPNO technical group is fabricating a mount for a new 740 lines per millimeter VPH grating. Such gratings typically deliver additional improvements in throughput (up to a factor of two).

This new grating affords approximately 400 angstroms of coverage between half power points with R ~ 2000 in first order, with a central wavelength range between 8000 angstroms and 1 micron. In second order, it has an almost equally high throughput (greater than 90 percent). The grating will be tested on the telescope this fall, thanks to the Harmers' development of a working configuration, which includes a flat that will accommodate the transmission optic on the existing bench.

The WIYN tip-tilt module (WTTM) is expected to have its most marked effect in the near infrared. Its general performance in the optical range was validated in October by cross-comparison with John Tonry's University of Hawaii OPTIC camera containing orthogonal transfer (OT) CCDs. In both cases, the fast guiding improved the 0.4-arcsec delivered images to approximately 0.3 arcsec FWHM, as expected. Pat Knezek obtained a narrowband [O III] image in a half-hour exposure ending at two airmasses, with a FWHM of 0.6 arcsec with the OPTIC camera. To capitalize on the excellent imaging potential of WTTM, Margaret

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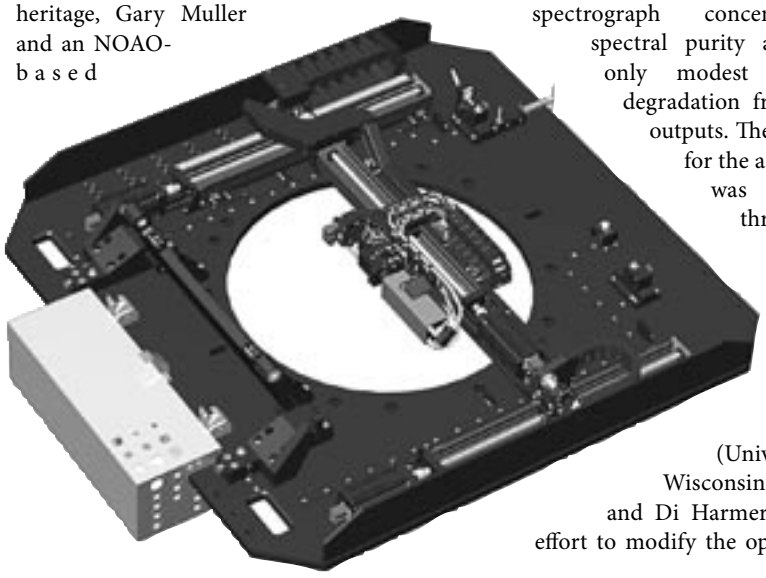

*NOAO engineer Gary Muller's model image of the Hydra positioner stage.*

## *Ambitious Plans for WIYN continued*

Meixner at Space Telescope Science Institute has received internal funding to start construction of WHIRC, the WIYN High-Resolution IR Camera. It will be designed to produce two pixel scales, 0.06 arcsec and 0.12 arcsec, on a 2K×2K HgCdTe detector. The initial implementation would be with a 1K×1K detector provided by NOAO. With additional resources provided by WIYN, the preliminary design should be completed early next calendar year.

Finally, the prospects of image improvement through local fast guiding have motivated the development of the One-Degree Imager. This gigapixel camera will be based on orthogonal transfer arrays (OTAs) of OT CCDs. The project has made tremendous progress, with the successful initiation of the first foundry run of OTAs.

George Jacoby (Project Scientist) has engaged the design and production talents of Dick Bredthauer (Semiconductor Technology Associates) to produce the masks to run through the Dalsa foundry. Mike Lesser (ITL) will perform the thinning and packaging. The design is the result of a highly productive collaboration between Jacoby, Bredthauer, and Lesser with Barry Burke of MIT Lincoln Labs and John Tonry and Gerry Luppino of the University of Hawaii through interaction between WIYN and the PanSTARRS project. NOAO is simultaneously developing a version of its new Monsoon data acquisition system to operate OTAs. The confluence is expected next March or April, with a working OTA and controller in the lab for the beginning of testing. The WIYN Board authorized George and the development phase manager, Pat Knezek, to proceed with mechanical design to bring the entire system up to Conceptual Design Review level. The goal is for science operations to begin in 2007.

*Kafka and Honeycutt's composite B and Z image of M3 taken with WTTM.*

Add to these considerable instrumentation efforts the planned aluminization of the primary mirror next summer and the near-term replacement of the azimuth precision bearings, and you can get an idea of the extremely busy year ahead for WIYN, as well as the amount of contributions KPNO and NOAO/Tucson are making for these impressive improvements.