



# WIYN Observatory

Wisconsin Indiana Yale NOAO

## Newsletter

Volume 1, Issue 3, July 2006

### Director's News

*George Jacoby*

In the May Newsletter, I tried to make the point that we need to measure progress in life by looking back over timeframes of at least 6-12 months. While I stand by that general philosophy, these last 2 months have proven that exceptions happen. The latest report from the QUOTA/ODI front is a good example. As of May, the ODI engineering team, led by Dave Sawyer, was just getting the CCDs for QUOTA to work ... marginally. Thanks to Dave, Peter Moore (CTIO), and the CCD vendor (STA), progress since the last newsletter has been spectacular, as you will see in the QUOTA article. In this instance, I was delighted to be proven wrong about the long timeframes needed to perceive forward progress. In fact, all the instrument projects are moving along about as fast as we can handle, as you will see throughout this Newsletter.

Observers at Kitt Peak are experiencing one of the most prolific monsoon seasons in many years. The storms help to moderate fire danger and are truly impressive! Unfortunately, they reduce the number of available observing hours, and they are quite dangerous. The article on the 0.9-m facility offers an amazing picture, miraculously captured by the webcam on Kitt Peak and noted by George Will.

On the personnel front, the last key position in the ODI technical team has been filled by Dr. Andrey Yeatts who started on July 10 as the ODI Senior Software Engineer. WIYN is also hosting four students this summer – two REU students, an entering grad student at Yale, and a high school graduate from Sells. So WIYN is a very busy place right now! But a break in the action occurs in July as three WIYN personnel are getting married (though, not to each other!): Heidi Schweiker, Joe Keyes, and Daniel Harbeck – congratulations to them all!

*~George Jacoby*

### Lightning Strikes WIYN .9-m

*Heidi Schweiker & Andy Layden*



See a full-size image of the lightning strike at [http://www.noao.edu/kpno/kpcam/gallery/axis4m\\_060627\\_210607.jpg](http://www.noao.edu/kpno/kpcam/gallery/axis4m_060627_210607.jpg)

**WIYN 0.9-m.** Over the last few weeks, the PCI card that controls the shutter and filterwheel with S2KB has become increasingly erratic. In particular, when the system is restarted (e.g., after a power-down for lightning) the system does not recognize the card, leaving the observer unable to control the shutter or filter wheel. Since the monsoons began a few weeks ago, we have been having almost daily lightning shutdowns, and the card has responded only a few times. ACE (the service contractor) plans to upgrade to a different card during the T&E time in Aug/Sep, so the situation should be rectified before observing begins in the next semester.

On June 27 the telescope took a direct lightning hit that damaged the telescope motion control card. The card was replaced the next day with operations returning to normal 2 days after the strike. However, the telescope now makes "chattering" noises when it moves in declination. In the past, careful tuning of the dec drive motor speed by ACE has alleviated this problem, but they can not provide such tuning within the next several weeks. In Fall 2006, we will be installing new motors which will not suffer from this "chatter" problem.

Due to these technical problems combined with the monsoons and the fact that our service contractor is on another job out of the country, the last few observing runs in July have been cancelled. The 0.9-m is shut down now through late August with normal operations beginning again on September 12.

**PREST Award.** The PREST proposal for the Half Degree Imager (HDI) at the 0.9-m has now been officially awarded. Work begins on observatory upgrades as well as the new instrument in August. ~

## WIYN Operations

Charles Corson

*Figure 1: WNIR bearing is shown as it was removed from the telescope mount.*



The WIYN port rotator bearing was serviced during the June T&E in preparation for the installation of ODI (Figure 1). Testing earlier in the year indicated that there would be mechanical interference, given the expected weight and moment loading of ODI. The service was intended to be an inspection for a more serious and complete service in August, but the mechanics of the bearing and housing were in such good condition that a full service could be safely completed during the June T&E.



*Figure 2: The mechanical interference is shown as light circular streaks which are integral to the fork and pillow block assembly.*

The mechanical interference was found to be high spots on the fork and pillow block assembly (Figure 2). The rotator was coming into contact with the assembly. The interference was easily removed. Inspection showed the bearing was in good shape despite having been originally installed without lubrication.

The bearing has now been cleaned, re-lubricated, and returned to service. Performance of the rotator is excellent, with some additional motor torque recovered now that the mechanical interference has been removed. Planning is now underway to gain access to the MNIR (MOS) rotator bearing for similar inspection and service.~

### July Wedding Bells!



Wedding bells rang out in July for WIYN personnel Joe Keys, Heidi Schweiker, and Daniel Harbeck. ~

## WIYN 3.5-m Telescope Report

Heidi Schweiker & Behzad Abareshi

Thanks to the efforts of Daryl Willmarth and Behzad Abareshi there is an updated version of the Hydra manual as well as updated Hydra tools packages (which include the Hydra simulator) available via anonymous ftp at <ftp.noao.edu/kpno/hydra>

Here you'll find two different Hydra tools packages for different Linux systems.

hydra\_tools.0.7.redhat.tgz

hydra\_tools.0.7.fedora.tgz

The only difference between the two is the type of Linux system they each run on. Our aim is to cover a more diverse mix of Linux flavors and kernel versions.

The original version, hydra\_tools.0.7.redhat.tgz, was built on Red Hat 7.3, and has been tested on Red Hat 6.0, 7.2, 7.3, and 9.0, plus an up-to-date Gentoo Linux (kernel 2.6.15).

The newer version, hydra\_tools.0.7.fedora.tgz, has been built and tested on Fedora Core 4; it has also been tested on CentOS 4 (Red Hat Enterprise clone).

Both versions have been successfully tested on Suse 9.2 (kernel 2.6.8), so there is an overlap. Since the binaries are all static (no library dependencies), we expect the software to run on many other Linux systems. If you have a more exotic system, you need to try both versions and see which one works for you.

NOTE: We are now only supporting this software under Linux; there is NOT a Sun/ Solaris version.~

## WIYN Personnel News

### NEW PERSONNEL:



ODI Senior Software Engineer Dr. Andrey Yeatts (at left) joined the WIYN ODI team in July. Welcome to the team, Andrey!



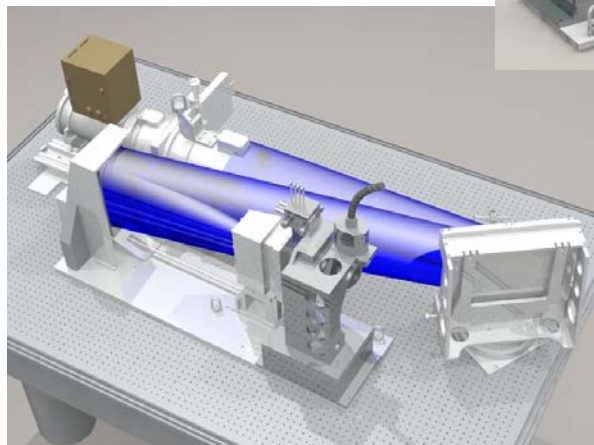
### VISITING REU SUMMER STUDENTS:

Pictured above are Lisa Ferrara (Yale) with mentor Steve Howell, and Daniel Harbeck with his two REU students Julie Skinner (U. of Oklahoma) and Robert Nowicki (Susquehanna University). Not pictured is summer student Jeff Pichotta, a high school student from Sells, AZ.

## Bench Upgrade Project

*Patricia Knezek, Project Manager & Matt Bershady (U. Wisconsin), Project Scientist*

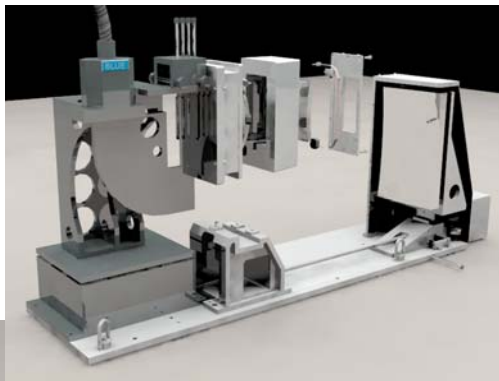
The Bench Upgrade Project continues to move forward. Current highlights include the successful external review of the optical design for the off-axis collimator (OAC), completion of the conceptual optomechanical design for the OAC, identification of excellent coating options for our new, high-density Volume Phase Holographic (VPH) grating, and progress towards a new CCD detector.



**Figure 1:** A solid-model rendering of the full Bench Upgrade system except the ATV) in the echelle configuration at an 11 deg camera-collimator angle. The absolute positioning of the elements on the Bench is for illustration, and does not represent the final layout. (J. Keyes)

**Optical design.** An independent review of the optical design was concluded on 30 June 2006. This review served essentially as a Preliminary Design Review for the optical design, and included a general assessment of the detailed design of the OAC and whether or not the design was specified sufficiently to allow proceeding to procure the optics once the optical tolerancing is completed and reviewed. The reviewer concluded that the design was sound and recommended proceeding forward with the tolerancing and stray light analysis. The optical design relies on the precise placement of a series of tilted lenses. Charles Harmer has completed an initial optical tolerancing - the results of which are encouraging. The Bench Upgrade project team is following the experience of recent ODI review-panel recommendations to err on the side of caution; we are having a consultant complete an independent tolerancing exercise prior to panel review. Plans for completion of the stray light analysis are being developed.

**Mechanical design.** With help of mechanical engineer Joe Keyes, we have developed a solid model of the current Bench spectrograph and a concept-level design for the OAC housing (see Figure 1). The opto-mechanical design is being specified for a f/4 beam, but with a stop that can be inserted into the light path to provide a f/5 beam for those who want to obtain the highest possible resolution. Modeling done by Matt Bershady has concluded that Charles Harmer's design is so good that there is minimal image



**Figure 2:** This view shows the sub-bench with the OAC housing lifted off its kinematic mount. The preload scheme and athermalization pads are exploded out of this housing. The OAP appears on the right of the picture. (J. Keyes)

degradation (<2% for the red Hydra fibers using the echelle) by opening up the

design to f/4. The opto-mechanical design consists of two housings for the four optical elements of the OAC, along with a housing for the off-axis parabola (OAP). These housings and the mount for the fiber foot will all be mounted on a sub-bench with an invar rod to preserve the precise separation between the optical elements. See Figure 2 for an exploded version of this sub-bench design.

**VPH testing.** Matt Bershady concluded a report on the 740 l/mm and 3300 l/mm VPH testing results, submitted to Centre Spatial de Liege (CSL) in advance of George Jacoby's trip this month to meet with key personnel to discuss the possibility of CSL fabricating other VPH gratings for WIYN in the future. These discussions are only in their infancy, and the WIYN scientific community will need to weigh in about what grating(s) they are interested in seeing on the 3.5 m. For example, a large-format H $\alpha$ /Li grating has been mentioned as one desirable option. Other examples include tilted-fringe gratings to gain echelle-like anamorphic factors in addition to high dispersion, and double-layer "notch" gratings for simultaneous observation of disparate wavelength regimes (e.g. H $\alpha$  and H $\beta$ ) at moderate dispersion. George and Matt have identified vendors that can provide suitable AR coatings for the 3300 l/mm VPH grating, which should improve the throughput ~10-20%. A formal bidding process will move forward soon. Matt has also confirmed that the LLNL Ag-Al dielectric coatings have been measured to have 95% reflectivity up to fold-angles of 45 deg for two mirrors used on SALT. We plan to upgrade the coating of the VPH fold-flat to enable larger fold angles (currently used at 22.5 deg) and improve overall throughput.

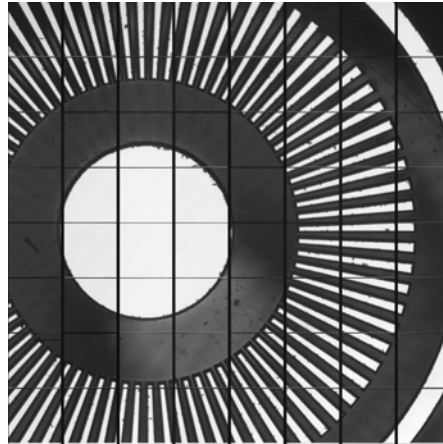
**New Detector/Controller/Dewar for the Bench Spectrograph.** There are 2 STA 1042 CCDs (2.6K x 4K CCDs from Lot #2 of the OTAs for QUOTA/ODI) currently being thinned and packaged, with an expected delivery date of about August 1. Initial testing of these CCDs looked very promising in terms of their low-noise characteristics. Once they are delivered to WIYN, the Bench Upgrade team will work with the ODI team to have the CCDs run with MONSOON in our downtown lab. Meanwhile, KPNO engineering staff is continuing its efforts towards a new CCD with MONSOON electronics for the Bench. (This is to replace the failed T2KC). The impending delivery of the STA CCDs will likely lead to a re-evaluation of the KPNO engineering effort.~

## QUOTA and ODI News

*George Jacoby & Daniel Harbeck*

QUOTA and ODI have seen a lot of progress over the last two months. The incoming hardware is the most obvious field of progress – assembly of the dewar that holds the CCD focal plane array will be in a few weeks when the corrector lenses have been AR coated.

After a frustrating and intense period of learning to master operation of the orthogonal transfer array CCDs (OTAs), we are now confident that the OTAs of Lot 2 are performing well enough to be commissioned on QUOTA. The Lot 2 devices are cosmetically very clean and they read out with a noise level of  $10 e^-$  (or less) and thus meet the specifications for ODI. First measurements indicate a full-well capacity of order of  $95,000 e^-$ . We measured a reasonable charge transfer efficiency that is high enough to allow fast guiding. However, the charge transfer efficiency during the read-out critically depends upon the correct setting of the voltages of clocks and biases. The Lot 2 devices consume more power than anticipated ( $\sim 1$  Watt per chip), and we are not yet sure if the cooling system can accommodate this load. The only significant remaining issue is the presence of a small non-linearity in the CCDs that we will address after we give the go ahead to Mike Lesser to thin four chips for QUOTA. Now that we demonstrated that the OTAs and Monsoon work together we are confident that we have a viable detector and controller concept for ODI. We anticipate

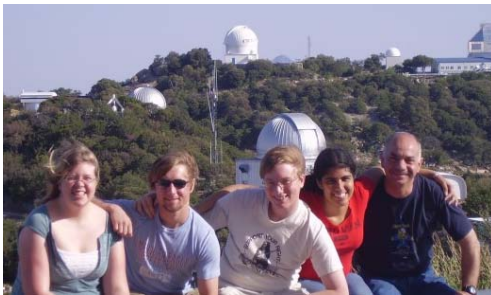


*Image of a test target taken with a Lot 2 OTA chip in the WIYN CCD lab. Note the prominent cell structure of the OTA CCD detector. The image with a resolution of 4kx4k pixels shows a lot of detail of the test target as well as of the dust on the chip.*

that QUOTA will see first light during the WIYN T&E time in the second week of October.

Infinite Optics delivered the near-final Sloan  $r'$  band filter for QUOTA in June. This is a 5.75 inch filter that serves as an R&D project for the large (45 cm) filters required in ODI. We were able to test this filter in the lab and on sky at the telescope. There are two remarkable improvements compared to the first engineering sample we received earlier this year: the new filter is flat to 1.5 waves over a 4 inch aperture (compared to 18 waves of the earlier version). And the bandpass of the filter has a much flatter shape than the precursor. The new  $r'$  filter was tested at the 4m telescope on June 19<sup>th</sup>. A standard field was measured to make a comparison between our filter and the Sloan photometric system. A small color term exists - about 0.1 mag per ( $r'-i'$ ), which is consistent with small differences in the red cut-on of the Infinite Optics filter and the Mosaic equivalent. Minor ghosting occurs around bright stars and we are evaluating possible causes within the filter and the 4-m corrector with the vendor.

In other news, WIYN will be holding the ODI System Preliminary Design Review (PDR) and Optics Critical Design Review (CDR) on August 2<sup>nd</sup> and 3<sup>rd</sup> in Tucson.~



### Indiana REU Students Observe at 0.9-m

*Kevin Croxall (Indiana University)*

Six students from across the country assembled this summer to participate in Indiana University's NSF-sponsored REU program. They are, from left to right, Jennifer Lozier, Alex Shvonski, Jesse Lord, Amandeep Gill, Walter Trentadue, and (not pictured) Steve Battazzo. In June, the REU participants were given first hand observing experience at the WIYN 0.9-m telescope located at Kitt Peak Na-

tional Observatory. While at Kitt Peak, the students observed open clusters with S2KB and Mosaic, and the data gathered will be used for future REU projects. By the end of their tenure, they were proficient at the use of the instruments, determining sky conditions, recording logs, and other aspects of observing. "Our trip to Kitt Peak National Observatory was both informative and fulfilling," said Walter Trentadue, a student at Northeastern Illinois University. "It was extremely rewarding learning how to do this on our own." All had an incredibly rewarding experience.

The students are participating in various research projects: Jesse Lord (Whitman College) – radiative hydrodynamic simulations of protoplanetary disks; Jennifer Lozier (Mt. Union College) – hydrodynamic simulations of binary star formation; Alex Shvonski (Wheaton College) – a search for debris disks using the Spitzer Space Telescope; Steve Battazzo (University of Oregon) – LED calibrations for the ring of fire on SNAP; Amandeep Gill (Brown University) and Walter Trentadue (Northeastern Illinois University) – Li abundances in the old open cluster NGC 188.