WIYN OBSERVATORY
WISCONSIN INDIANA YALE & NOAO

Newsletter

April 2009

Director's News

Keeping the Beat

Life at WIYN has been moving at a furious rhythm in the past few months! Progress has been made on many topics, and this *Newsletter* provides only a glimpse of our activities. There is a lot of good news to share. WHIRC has been accepted as a "general use" instrument and, if desired, can now be coupled with the WIYN Tip-Tilt Module for higher resolution imaging. The Bench Spectrograph Upgrade, a long endeavor in the history of WIYN, is essentially completed, after heroic efforts by a large team of people. Performance results are very encouraging and it's clear that the new optics and detector provide enhanced spectroscopic capabilities for WIYN. Hooray! Thanks to both teams for this excellent work.

ODI developments have also been moving at a high pace. Tremendous steps forward have been made on the mechanical components, software interfaces and data acquisition, filters, focal plane, shutter, optics, etc. Science opportunities offered by ODI are also being re-visited and will be the main program topic discussed at an upcoming workshop at the next June AAS meeting. I also invite everybody to have a look at the new ODI Web page!

In the coming months, very important decisions will also be made on the operational model adopted by WIYN during the next few years, including developments for queue observing and a scientific pipeline for ODI. Exciting times ahead, but these actions are needed to move WIYN forward…

On a personal level, it is hard to believe that six months have passed since I took over the directorship duties of WIYN! Every day brings its own set of challenges, all moving along under this fast rhythm. As a hobbyist drummer, keeping the beat is critical to let the music flow. As WIYN Director, keeping the beat is to me essential to make progress. But, no good music -or progress- comes without good players. I feel privileged to work with great band mates, all working in moving WIYN into the right direction. I enjoy the friendly humor, support, openness, mutual respect…let the beat go on!

~Pierre Martin

Bench Upgrade Nears Completion!

Patricia Knezek

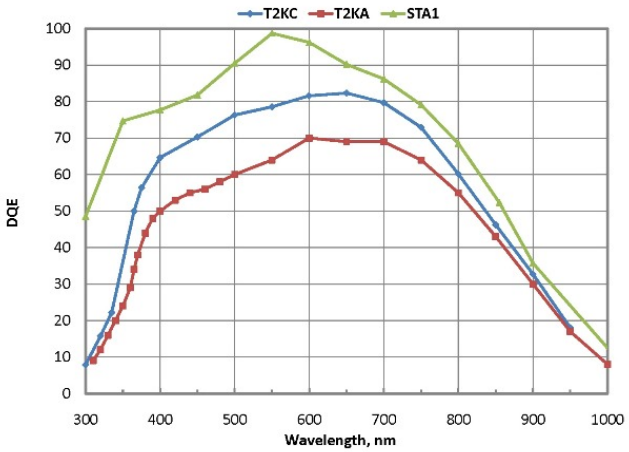

Figure 1: A comparison of the quantum efficiencies of the new Bench CCD, STA1, the original Bench CCD, T2KC, and T2KA, the CCD that replaced T2KC until the new CCD was ready.

The WIYN Bench Spectrograph is in the final stages of commissioning. The reader may consider this 'Part One' of the final report in which we will focus on some first results that will be of interest to users who plan to do science projects with the Bench. We continue to update the BSU Status Report Web site at http://www.wiyn.org/instrument/bench_upgrade.html and much of this material is also available there.

For those unfamiliar with the upgrade project, its overarching goal was to increase the average spectrograph throughput by ~60% while minimizing resolution loss (< 20%). In order to accomplish these goals, the project has had three major thrusts: (1) provide a new CCD; (2) allow for a suite of Volume Phase Holographic (VPH) gratings (two were provided as a part of the upgrade); and (3) design and fabricate a new collimator.

The new CCD:

The STA1 CCD has now been in use for over a year, as reported in earlier issues. This detector has very good quantum efficiency (see figure 1), low noise, and no bad columns. It is 2.6x4K, with 12 micron pixels. Its controller allows the user to bin in the spatial and (or) spectral direction. It also allows for a choice between three different gains. Thus, observers now have much more flexibility to set up the CCD to maximize for their science project. It does have some hot pixels, but these can be removed in the data reduction stage using darks. The hot pixels have

Bench Upgrade Nears Completion!

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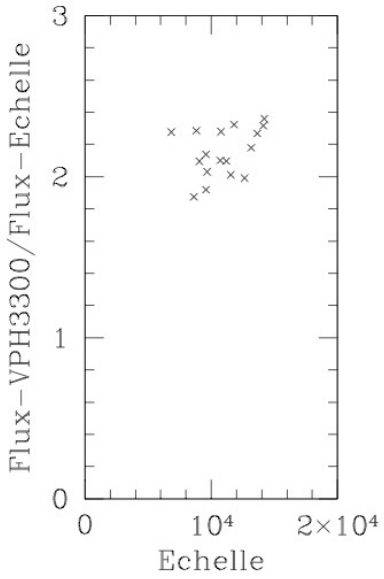

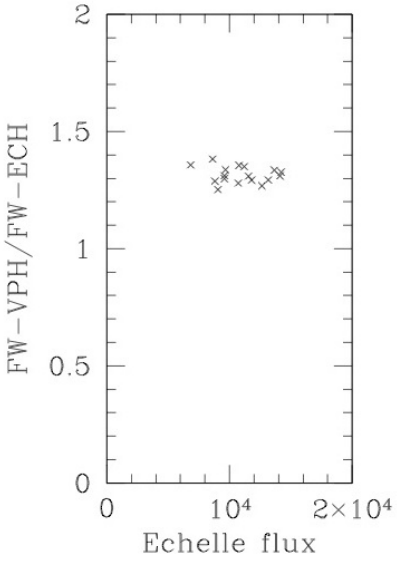

Figure 2: The image on the left shows the measured flux ratios of 316@63 echelle and the 3300 l/mm VPH at 5130 Å (α=57.8 degrees). The image on the right shows the measured ratios of line widths in the direction of dispersion for several lines. The measured Δλ/λ for the VPH from this configuration was 16,700. (Credit for both images: J. Glaspey)

been checked and seem to behave as linearly as the other pixels over signal levels corresponding to the range 4700 electrons to 74000 electrons. The dark current appears to be stable over time, and so we are currently building a library of darks for the different binning options. The CCD does fringe at wavelengths longer than ~7500 angstroms, so observers should be aware that that will need to be removed in the data reduction stage, and take several flatfield images.

Finally, when using the Simmons camera, because STA1 only has 2.6K 12 micron pixels in the spatial direction, 15 red Hydra fibers are not imaged onto the CCD. Adding to that the broken fibers, that means that only 66 fibers are available to use with the Simmons camera. The number should be similar for the blue Hydra fibers, but we have not yet had a chance to obtain data to confirm that.

The new VPH gratings:

The BSU project provided two new VPH gratings. The first grating, a coated 740 l/mm VPH grating, has been in use since 2006. Information on this grating was published in the October 2006 WIYN Newsletter. Please refer to that Newsletter (available off of the WIYN Observatory web site) or the Bench Upgrade status web page mentioned at the beginning of this article. (Note that all information reported on this grating is with T2KA and the old collimator – we should see improved throughput with STA1+new collimator, but this grating has not been tested with the new system yet.)

A first cut at a comparison of the second (currently uncoated) 3300 l/mm VPH grating to the echelle using STA1 and the new collimator indicates that the VPH is ~2x as efficient as the echelle, with the expected ~30% degradation in image quality (see figure 2). Thus, for astronomers whose science is photon-driven, and for whom resolution is not critical, this will open up a whole new regime of possible science. Furthermore, at the expense of a little more resolution, they could opt for the new f/4 mask and increase the throughput even more.

The new collimator:

The final major component of the upgrade project has been to design, fabricate, install, and commission a new all-refractive 800mm focal length collimator. The collimator has been installed and is in shared-risk use during 2009A while we complete its commissioning. When the collimator was installed, we also replaced the toes of both Hydra fiber feet and SparsePak. The combination of the new collimator and the new toes not only improves overall throughput, but the vignetting of the end fibers of all the toes has been essentially eliminated, so that the illumination of the end fibers is comparable to that of the central fibers (see figure 3). We are also gaining in the spectral direction, collecting more photons both on the red and blue end of the spectrum (see figure 4).

Overall, the image quality looks very good as well. For example, we set up the 600@10 single ruled grating (SRG) with λ_c ~5600 Å, using the Hydra red fibers, BSC, and achieved an FWHM of ~2.2 pixels (binned 2x2, so each pixel is 24 um). Variation in FWHM from the blue end to red end of the spectrum was only ~0.1 pixels, for a >2700 Å coverage. This is directly comparable to the situation with the old setup. As another example, we set up the 316@63 echelle grating with λ_c ~5180 Å , using the Hydra red fibers, BSC, and achieved an FWHM ~3.4 pixels in the dispersion direction (1x1 binning). For an [approximate] dispersion of 0.054 Å/pixel the FWHM is then 0.184 Å, providing a resolution $\lambda/\Delta\lambda$ = 28,000 for that particular configuration. *This implies that the echelle resolution with the red fibers has increased by ~50% with new CCD.*

Finally, preliminary results indicate that the overall throughput gains will be close to what was expected. A first cut at determining the relative increase in throughput

BENCH Upgrade Nears Completion!

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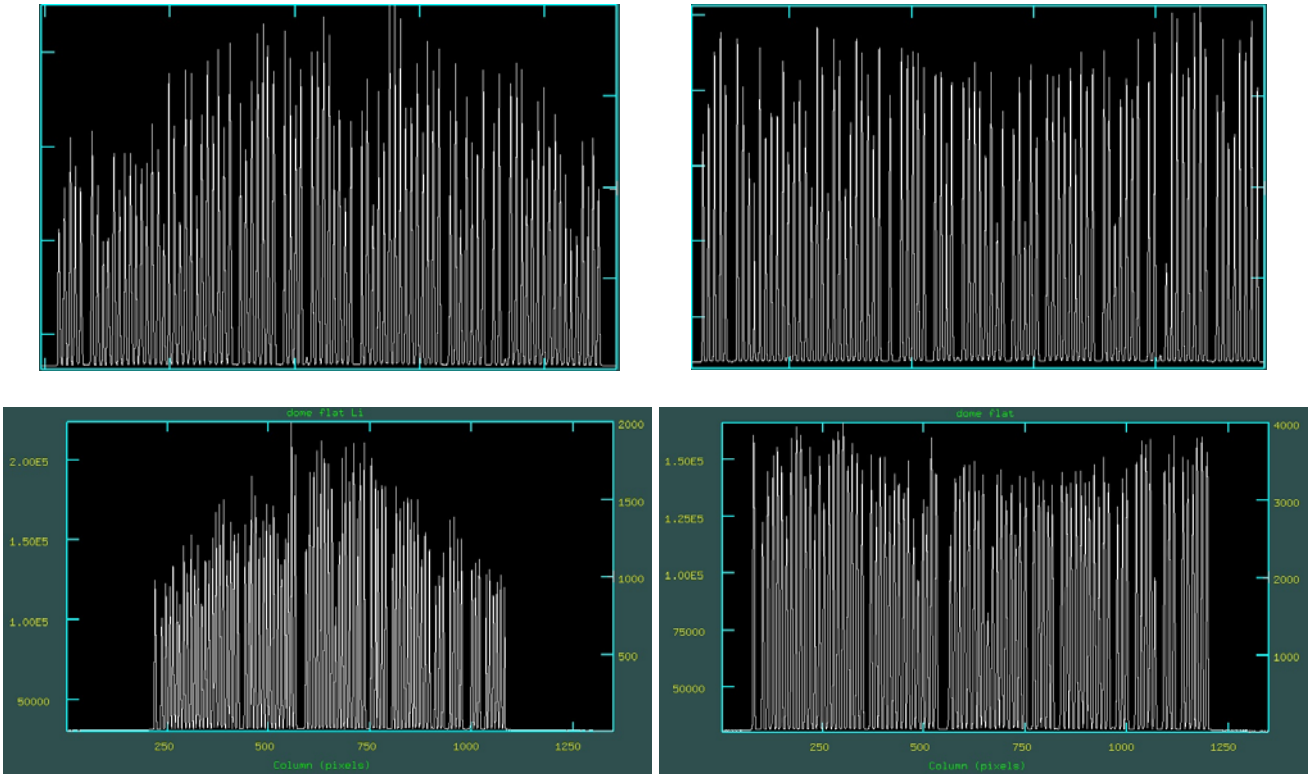


***Figure 3:** We are gaining in the spatial direction, collecting additional photons on the end fibers, which were vignetted in the old system. The new collimator puts the pupil at the entrance of the camera and the new fiber toe baffles were opened up, thus the illumination of the CCD is generally more uniform. This is clearly seen in these images. The top image shows line plots of dome flats using the red fiber cable with the old collimator (left) and with the new collimator (right) with the 600@10 grating. The bottom image shows line plots of dome flats using the red fiber cable with the old collimator (left) and with the new collimator (right) with the 316@63 echelle grating. The difference is particularly dramatic for the echelle. (Credit for both images: J. Glaspey)*

by G. Jacoby using SparsePak data taken with the 600@10 SRG grating by Marsha Wolf in January 2009, and compared in the overlap wavelength region with data on the same stars taken with the old system in February 2008 indicates a ~70% increase for Feige 34, and ~50% increase for G191B2B (two spectrophotometric standard stars).

These numbers are estimated to be good to perhaps 20% due to a number of unknowns, including: the accuracy of the centration of the star in the central fiber of SparsePak; the sky conditions on the two nights; the gain of T2KA. The oft-quoted goal of the project was to increase the throughput by ~60% while losing <20% in image quality.

*Note: The combination of SparsePak + 600@10 grating + central fiber is expected to be one of the **most modest** examples of improvement due to the large fiber size of SparsePak, the high efficiency of the 600@10 grating, and the fact that the throughput peaks in the central fiber. Thus, end fibers and other setups (especially with the echelle) could see significantly larger gains.*

Stay tuned for more information in Part Two! And keep checking the update Web site – we're posting updates there as fast as we can.

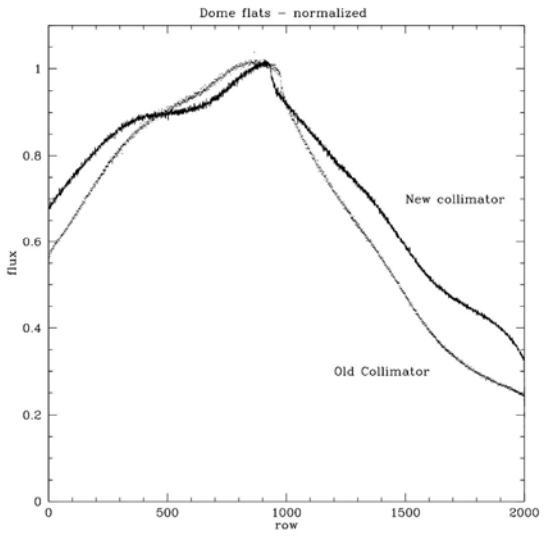
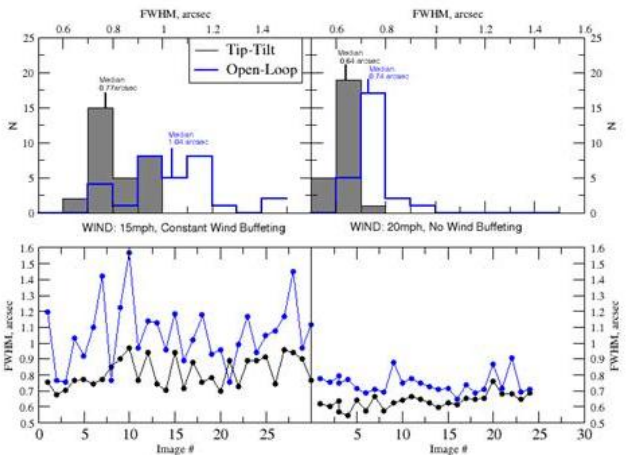


***Figure 4:** The image shows extracted dome flats for the same Hydra fiber, demonstrating the improved throughput in the spectral direction due to the pupil being closer to the camera entrance aperture. (Data from C. Deliyannis runs using 2 identical setups, before and after the collimator change. Credit: John Glaspey)*

WHIRC Update

Dick Joyce (NOAO) & Heidi Schweiker (WIYN)

WHIRC has been used for several observing runs this semester, including the first visitor use with WTTM. WHIRC is available for use with WTTM on a shared-risk basis, being contingent on the availability of WIYN support personnel for operating WTTM. In addition, maintenance on any problems which occur during the night may be deferred until the following day. Our experience to date suggests that WTTM can produce improvements in seeing-limited image quality similar to those seen at visible wavelengths (0.1 – 0.15 arcsec in FWHM), but can be especially effective in removing the effects of wind shake, as shown in the figure. We strongly suggest that prospective WHIRC/WTTM observers become familiar with the limitations on guide star brightness and guide field published on the WHIRC website and User's Manual to determine in advance of their run whether their science fields will be amenable to WTTM operation.



Results of two tests to measure the FWHM improvements from turning on WTTM correction, using 10 s exposures in the H band. The results are consistent with the predicted improvements of 0.1 – 0.15 arcsec and even more significant when wind buffeting is a factor. (Credit: C. Corson and H. Schweiker)

The Data Reduction Manual has been revised to include several new tasks. 1.) An IRAF script "prepares" the raw data for reduction by renormalization for multiple Fowler samples, linearity correction, recalculation of the WCS coefficients for instrument rotator offset angle, and stripping off the reference rows and columns. 2.) A pupil ghost template, used with the Mosaic reduction task 'rmpupil' appears to do a good job of eliminating this artifact, although we have not yet verified this photometrically. 3.) Fringes seen in the Paschen-beta (and occasionally H) filters can be removed using the Mosaic reduction task 'rmfringe'. 4.) The Zemax optical distortion model has been incorporated into a database file which can be used with the task 'geotran' to correct for the small distortion if one is making large image mosaics.

The dual-instrument capability of the IAS port lends itself to the use of WHIRC in combination with an optical imager (MiniMo or OPTIC) mounted at the CCD port. Obvious applications include combined optical/IR observations of science targets or nights split between optical and IR observers. This can be done in principle, requiring only moving the WTTM Pickoff Mirror in the IAS out of the beam and switching computer operation over from WHIRC to the optical imager (or vice versa). This process, however, involves powering down one instrument and powering up the other, as well as switching computer interfaces. There are potential stability issues for both instruments shortly after being powered up, and the risk of lost observing time, which will be difficult to quantify until we gain some experience in this process. If science and weather considerations permit, we suggest that observers planning to use both WHIRC and MiniMo/OPTIC try to accomplish their program by successive, rather than split night, use of the imagers.

Observer support is also a potential problem. The WHIRC/MiniMo/OPTIC instrument scientists and the Operations Coordinator have therefore established the following policy:

Current policy requires anyone wishing to use both WHIRC and either optical imager during a run to be fully proficient with at least one of the instruments and therefore require no instrument start-up support. In this sense, a proficient observer is one who has used the instrument at least once in the past year and has had a full start-up by qualified WIYN personnel within the past three years. Furthermore, observers are required to fully discuss their plans for each instrument use in the comment section of the ORPF and to contact the appropriate WIYN staff 6 weeks prior to their run to discuss the details of their observations. These discussions will include the potential risks in degraded performance and observing inefficiency, and it will be assumed that observers carrying out a dual-instrument program will understand and accept these risks.

Finally, the WHIRC Web-site at http://www.noao.edu/kpno/manuals/whirc/WHIRC.htm has been updated. One can obtain the latest versions of the manuals and reduction files from this site. Your comments are welcome.

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The *WIYN Newsletter*, contacts list, and miscellaneous information about WIYN Observatory may be viewed on our Website at *www.noao.edu/wiyn/*.

ODI News: Hardware Checks & Dewar CDR

Daniel Harbeck

As reported in the Personnel News column in this *Newsletter*, Rick McCloskey was hired as of April 1st as the ODI Systems Engineer. Rick will be part of the Kitt Peak engineering group, but will be assigned 100 percent to ODI for the next two years. In February, John Ivens joined us as the ODI Software Engineer. Since his arrival, John has focused on building a conceptual science user interface for ODI. We welcome both Rick and John to the ODI team!

Figure 1: The ODI Instrument support package is fully assembled for the first time.

Significant progress was made toward building the instrument support package (ISP). We have fully assembled all major parts of the ISP, including the dewar entrance window holder and all shrouds (see figure 1). For the very first time, a stepper motor successfully drove one of the filter swing arms. After years of design work, it was amazing to see parts actually moving (figure 2).

Figure 2: One filter swing arm is fully motorized. A filter change takes ~30 seconds.

Figure 3: Operation manual picture of the ODI shutter: The instrumentation group in Bonn has a tradition of taking a theme picture for each of their shutters.

After an initial fit check and functional evaluation, we disassembled the ISP and sent the parts out for anodizing; this will take a couple of weeks.

The ODI shutter arrived just in time for this article (see figure 3). Properly exposing the focal plane (which is 40cm x 40cm) is challenging. The Bonn shutter will allow linear and homogeneous exposures, from tenths of a second to hours, thanks to its dual-blade design.

A big step forward was achieved with the delivery of the first lens of the ODI corrector: Lens number 2, which is also the dewar window, arrived in Tucson at the end of February, and has been sent out to Infinite Optics in California for anti-reflection coating. We also recently received two of the four prisms for the atmospheric dispersion compensator – evaluation and acceptance testing are currently under way. Fabrication of the optics should be finished by June of this year.

The procurement of ODI filters moved forward: Three filters (SDSS g', r', and i') were ordered from Barr. The glass substrates for these filters undergo extensive testing, and the actual production will start in a few weeks. The first filter should arrive in June. The next filters to order are the u'-band and z'-band filters.

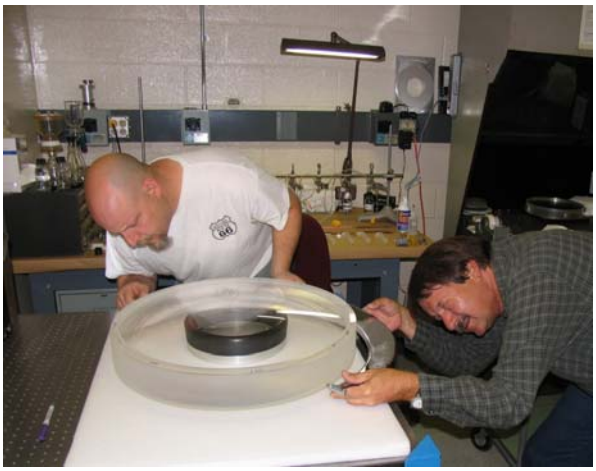


Figure 4: Inspection of the ODI Dewar window.

ODI News: Hardware Checks & Dewar CDR

Continued

Last but not least, we have mounted the Silicon Carbide (SiC) focal base plate into the dewar shell (see figure 5). SiC is a very brittle material, and we had to glue more than 260 stainless steel inserts into the base plate. As a next step, precise locating holes will be drilled into these steel inserts – this would be extremely risky to do directly into the SiC material that behaves like glass. Once this processing step is finished, we will hand over the focal plate to Imaging Technology Lab here in Tucson to mount the 64 OTA detectors. However, to reach this major milestone we will have to be patient until autumn of this year when the detectors are scheduled to be available.~

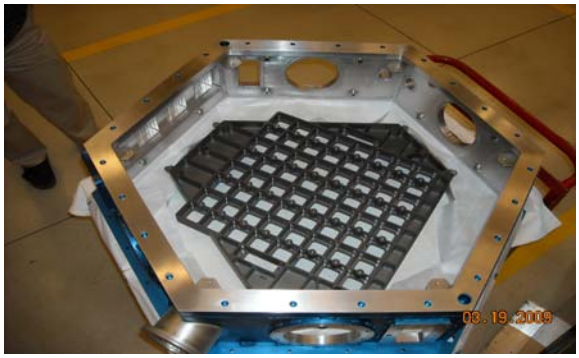
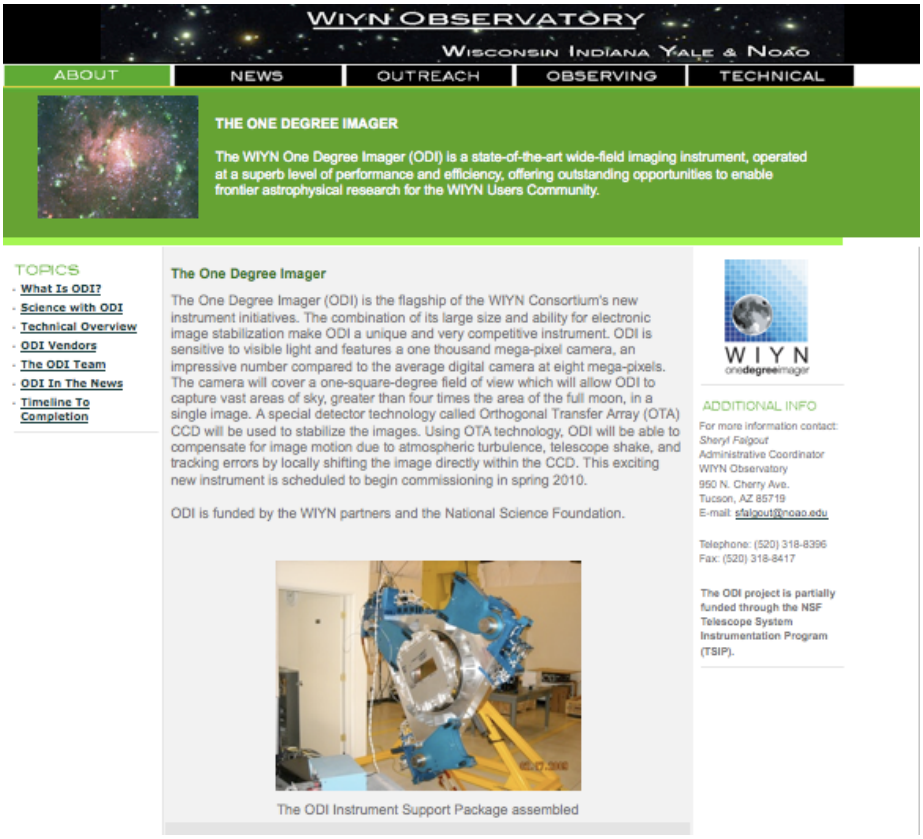


Figure 5: The Silicon Carbide focal plate is mounted

ODI Web-site Gets a New Look

Heidi Schweiker



The WIYN ODI Web-site has been redesigned with a new look and enhanced content. Go to www.wiyn.org/ODI/about to view the new site. Future ODI news and information will be posted on these pages.

ODI Meeting-in-a-Meeting at June AAS

Patricia Knezek

The partners of WIYN Observatory are holding a three-session "meeting-in-a-meeting" on Tuesday, June 9 and Wednesday, June 10 at the AAS meeting in Pasadena to educate and engage the astronomical community in planning science with the WIYN One Degree Imager. Session topics and details may be found at http://www.wiyn.org/instrument/AAS_mim.html. The deadline for submission of poster abstracts for this event is Wednesday, April 29.

Hoosier Night at WIYN

Caty Pilachowski

On Friday, March 20, WIYN and Indiana University hosted a special "Hoosier Night" on the mountain. Guests of the IU Department of Astronomy and College of Arts and Sciences, including IU alumni Katy Garmany and Ron Probst, enjoyed a behind-the-scenes tour of the Mayall 4-m, and a special, yummy dinner prepared in the dining room.

WIYN Director Pierre Martin described progress on the new One Degree Imager, which will become available soon at WIYN. As on previous Hoosier Nights at WIYN, the weather was great, and the group was thrilled by spectacular eye-piece views of Saturn, the Trapezium and Orion nebula, the Crab Nebula, Messier 82, and the planetary nebula NGC 3242.

WIYN staff John Ivens and George Will helped to make the evening a success for all, and the assistance of KPNO staff Mike Hawes, Dave Murray, Liz Alvarez and others is very much appreciated.

Above: Group photo of the Indiana "Hoosier" group.

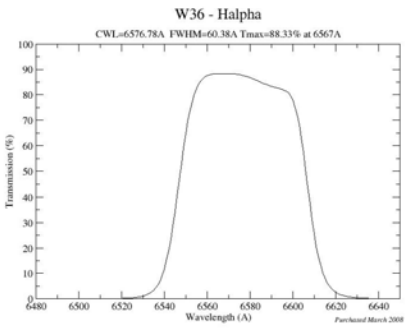
Left: WIYN Director Pierre Martin conducts a presentation on the progress of the One Degree Imager.

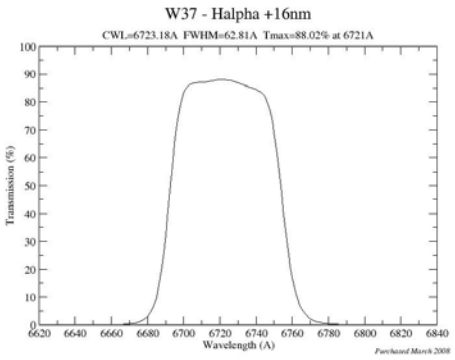
New Filters for WIYN

Heidi Schweiker & Steve Howell

Most of the WIYN filters are now more than ten years old and some are beginning to show signs of degradation. The state of all WIYN filters was assessed last year, and those with the greatest degradation were replaced. The H-alpha filters W015 and W017 have severely deteriorating coatings and were replaced by filters W036 and W037. These are now in use at WIYN.

As a reminder, WIYN had previously purchased a new Harris prescription I band filter to replace the old I band filter (W005). The old one shows bad edge effects and degradation of the coatings. The new filter (W035) is essentially the same as the old one.

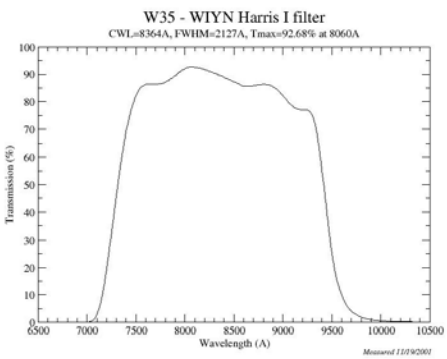




Shown are the transmission curves for the replacement H-alpha filters, and well as the transmission curve of the newer I filter.

We encourage users to request and use the new filters. Specifications can be found on the WIYN filters web page with the new filters being 8Å bluer in official central wavelength (central=8364 Å), 25 Å wider in formal FWHM (=2127 Å) and slightly better in maximum transmission with a much smoother filter bandpass than the older version.

Go to www.wiyn.org/observe/filters.html for a full list of the available WIYN filters with transmission curves. If you have any questions related to these (or other) filters at WIYN, please contact Steve Howell or Heidi Schweiker.



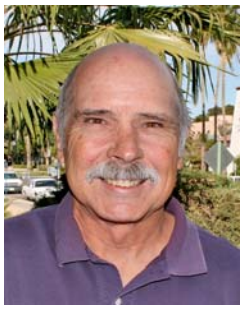
Personnel News

WELCOME John Ivens, our new **ODI Software Engineer**. John came on board in early February and is working with Andrey Yeatts on the ODI control system and user interface. He received his BS in Computer Engineering from the University of Arizona, and has many years of experience in database design and programming in C and Java.

John comes to us from the University of Arizona Lunar and Planetary Lab. Previous accomplishments include the design of the observation planning software for the Visual and Infrared Mapping Spectrometer (VIMS) flown on the Cassini mission. He is married and is the proud parent of seven dogs—yes, seven!—all of whom were strays. He enjoys hiking, biking, climbing, reading, and movies.

John is "looking forward to learning more about Astronomy and astronomical instrumentation during my tenure here, and of course I am looking forward to working with the researchers and staff here at NOAO."

WELCOME Rick McCloskey. Rick was hired in April by the Kitt Peak Engineering group, and will be working on the ODI project as a **Systems Engineer**.



Rick has many years of experience in the development of new instrumentation and support systems, including the Phoenix Mars Lander payload testbed, and Cassini VIMS remote sensing instrument ground data system.

CONGRATULATIONS to **Daniel Harbeck**, who will become a WIYN employee and **ODI Scientist** in July. Daniel is a very familiar face here at WIYN; he was hired by the University of Wisconsin in 2005 to work with us in Tucson as the ODI Project Scientist.

Daniel is an avid nature and wildlife photographer, and practices Kendo, a traditional form of Japanese fencing.

CONGRATULATIONS to **Heidi Schweiker** and **Lou Lederer,** who were recently honored for the completion of **ten years of service**.

Heidi began her career with NOAO/WIYN as a Telescope Operator, and became the WIYN 0.9-meter Site Manager in 2001. In 2008, she was promoted to her current position as the 3.5-meter Operations Coordinator.

Lou has worked on many projects in his ten years at NOAO. He has recently been working exclusively for WIYN. Lou is currently manufacturing various components for ODI and was also involved with the Bench Spectrograph Upgrade project.

Thanks Heidi and Lou!

WIYN 0.9-meter Telescope Report

Hillary Mathis

The WIYN 0.9-meter Executive Committee has addressed many critical items recently. Although the first round of bids for the Half Degree Imager did not produce a bid that met our desired specifications, we are now pursuing other possible avenues. The Committee is also organizing contracts that will be included in the consortium from 1 August 2009 to 30 June 2015. During this process, we expect to welcome new partners to our consortium and look forward to involving them in our future operations.

In telescope news, I am happy to report that the telescope is running more smoothly than ever before. While weather hampered most of our observing time through the winter, the time on sky was productive and rarely interrupted by technical problems. One new addition to the facility is a dry air system that replaces the dry nitrogen to keep the dewar window clear of condensation. The system is very effective and will save money as well as the time it takes to change out the dry nitrogen bottles when they are empty.

Our 0.9-m observers are (hopefully) sleeping better now on the newly replaced mattresses in the 0.9m house. Better sleep equals more productive nights, which equals more data for all those great research papers!