WIYN Observatory
Wisconsin Indiana Yale NOAO
Newsletter
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Director's News

George Jacoby

We're squeezing in one more Newsletter before the October Board and SAC meetings, with the expectation that it will raise awareness of the absolutely amazing progress that has been made on several projects since the last Board meeting in March – compare the two Blue Books! The near future at WIYN will be very exciting. Comparing the status of projects at the last WIYN Board meeting to today, it feels as if 6 years have elapsed rather than 6 months, probably because ideas that were fantasy concepts in 2000 have turned into hard realities today. Here are some highlights – check out the individual project articles for details!

QUOTA/ODI Milestones

- ODI specialty corrector glass ordered (June)
- First QUOTA filter delivered and tested (June)
- First thick OTA works (June)
- Software engineer hired (July)
- ODI passes PDR (August)
- QUOTA corrector delivered/AR coated (August)
- First two thinned OTAs work (September)
- MONSOON works with two OTAs (October)
- QUOTA first light on telescope (October)

Bench Upgrade Milestones

- Off-axis collimator design complete (June)
- New 3300 line VPH grating tested (July)
- Collimator design independently reviewed (August)
- Preliminary mechanical design reviewed (October)
- Collimator optics bid packages released (October)

WHIRC Milestones

- Instrument being fabricated (ongoing)
- Optics and filters received (October)
- MONSOON running MUX (October)

Facility Improvements

- Hydra gripper mechanism upgraded (April)
- Azimuth bearings serviced (May)
- Nasmyth rotator bearings serviced (June)
- Tertiary lock mechanism replaced (July)

On the more ethereal level of astro-politics, WIYN is somewhat immune to the current storms swirling around the US today. In just a few weeks, though, we will learn of the recommendations of the NSF's Senior Review panel. Their report will become public in early November. This coming year may be the most exhilarating of any since WIYN operations began, partly due to the consequences of the Senior Review, but mostly by creating our own future with the scientific and technical achievements at WIYN.~

QUOTA Sees First Light!

Daniel Harbeck & George Jacoby

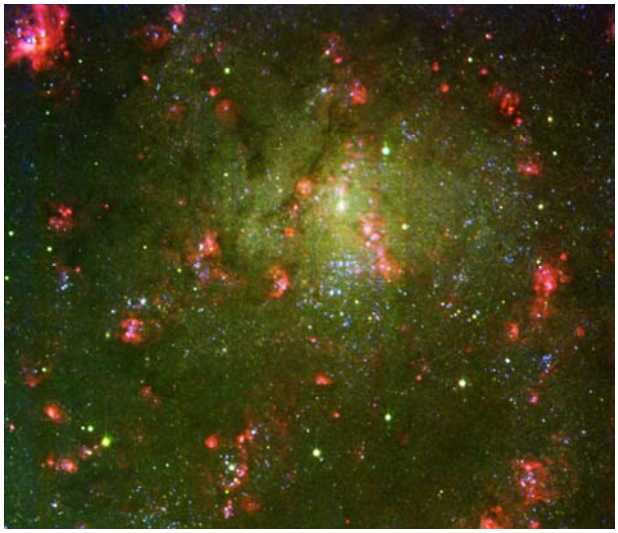

Figure 1: An image of M 33 taken by QUOTA during its first-light campaign (October 8th to 11th). The picture is a composite of 20 minutes exposures taken in the SDSS r'-band, the U-band and in Hα.

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WIYN Science News

Steve Howell

The WIYN telescope and Hydra have been used to conduct a long term spectroscopic survey of solar-like stars in the 4 Gyr old star cluster M67. Dr. Mark Giampapa (NSO) and collaborators performed detailed analysis of the Ca II H&K lines in 60 F9 to G9 stars in M67, a system of solar-age and solar-metallicity stars.

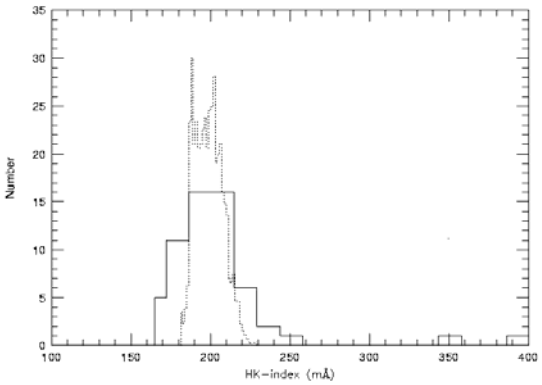

Figure 1: The distribution of the HK index for the M67 solar-type stars (solid) and for the contemporary sun (dotted). This figure shows the larger range for the HK index observed in the "suns" of M67.

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WHIRC

Patricia KnezekKnezek (WIYN, co-I) and Margaret Meixner (STScI, PI)

Work on the WIYN High Resolution Near-Infrared Camera, or WHIRC, continues at an excellent pace, with a success-oriented schedule that anticipates full instrument testing in spring 2007, delivery to WIYN in June 2007, and the first commissioning runs in June and July 2007. Recent progress includes the near-completion of all shop drawings (98%), receipt of the optical lenses, receipt of all of the science filters, receipt of 60% of the hardware components, completion of the draft observation planning and control software, and reading images successfully with MONSOON from the MUX.

Figure 1: The WHIRC optical bench assembly fitted to the precision optical surface on top of the WHIRC dewar. This optical bench will be coated with Z306 black paint in the next and final manufacturing step.

Hardware. WHIRC is well into its fabrication phase (see Figure 1 for example, which shows the optical bench assembly). All of the mechanical components are on schedule with the exception of the filter wheel. It is about two weeks behind schedule, but it is not on the critical path, and thus should not impact the schedule as a whole.

Optics. All of the optics have been received except for the dichroic. The dichroic purchase order has been issued, and the vendor has the substrates (supplied by WIYN) and is in the process of coating them. The vendor will supply three – one for use and two spares. The drawings for the lens cell holders have been sent out for bid.

All 13 of the filters have now been received and accepted. One narrowband filter, Pa β, was delivered slightly out of specification. The problem is that the FWHM goes 1 nm out of specification when the filter is cooled to 77 K. The PI, Margaret Meixner, compared the profile of the 77 K Pa β filter with the Pa β continuum (extragalactic) filter profile to make sure that the increase in FWHM does not cause too much overlap between the two. She found it does not because the increase in FWHM is on the short wavelength side of the profile. Thus the decision was made to accept this filter, even though it is slightly out of specification.

Controller Electronics. The WHIRC MONSOON system is now able to take exposures, save them as (correctly sized) image fits files, and repeat the process. Right now, the team is using a MUX for testing and debugging the electronics prior to connecting to the actual Virgo detector. This was a key step in the process.

Software. The WHIRC software team has drafted an easy-to-use operational interface for the astronomer with software tools. It has been designed to provide a seamless environment to the control of WHIRC camera and the coordination of the WHIRC observations with WTTM and the WIYN telescope. The astronomer can control the filter selection, exposure setting, mapping and dither patterns for the observations. In addition the astronomer can monitor the temperature of the detector and subsystems and display the resulting image from WHIRC on ds9.

The WHIRC software team is also developing a GUI-based observation planner to allow observers to plan their observations (including mapping patterns, filters, exposure times, etc.) in advance of the observing run itself. This will be an invaluable tool, since most near-infrared scientific programs require many dithered short exposures with good sky subtraction.~

WIYN Science News, *Continued*

Their work has revealed some surprising results such as the fact that the variation in the HK index provides a broader range in values than that measured for the contemporary Sun (Fig. 1).
Approximately 17% of the M67 "suns" show an HK index less than the solar minimum value and may be in Maunder minimum like states. Ten percent or so of the stars show HK index value greater than the sun at solar maximum while the vast majority, ~80%, have Ca II core strengths that lie within the range of the modern solar cycle values. Thus, 20-30% of the suns in M67 show chromospheric Ca II strengths outside the range we have observed in the sun over the past 30 years. The work will appear in the 1 Nov. 2006 issue of the Astrophysical Journal.~

Personnel News

NEW PERSONNEL:

Observing Assistant Karen Butler (at right) joined the KPNO/WIYN team in August. Welcome to the team, Karen!

WIYN Newsletter Staff

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QUOTA Sees First Light! *Continued from Page 1*

QUOTA, the prototype camera for the One Degree Imager, saw first light during the October T&E run. The current configuration of QUOTA features two thinned OTA CCD detectors, and two (disconnected) thick devices that serve to baffle the focal plane.

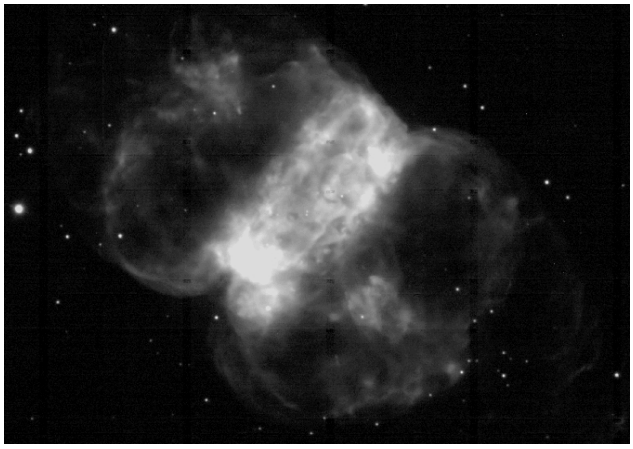

Figure 2: The planetary nebula M76 observed in Hα. The image is a composite of three 300 sec exposures. The seeing during these exposures was 0.6".

Installing the instrument at the telescope was a very smooth process with minor obstacles that were easily resolved with a bit of machine work. Firing up the control software was similarly straightforward, requiring only some debugging during the first (cloudy) night. During the three remaining nights, QUOTA was a very stable system – perhaps more stable than some other facility instruments.

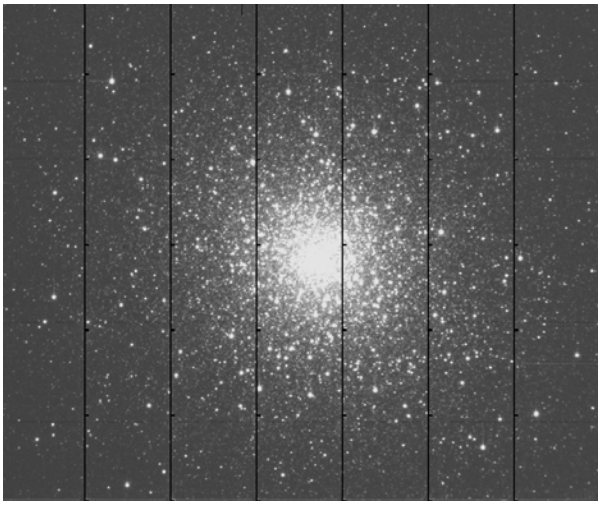

Figure 3: Three 60 second exposures are combined in this I band image of the globular cluster M2. The seeing in this image is 0.56"!

Since QUOTA was working so reliably, we were able to obtain on-sky images under excellent conditions. The seeing was never above 0.8" with QUOTA's excellent sampling (0.11" pixels), and we typically obtained images with seeing of order 0.6". The best images were 0.45". Some examples are shown: the globular cluster M2 (the I-band image is shown here), the planetary nebula M76 (in Hα), and the spiral galaxy M33 (processed by Brian Brondel, IU). More observations – in particular of standard stars – are under reduction.

The detectors and the optics are very well-behaved. The images flat-field very well, and we could not detect any sign of cross-talk between the detectors or cells, indicating a level at least 10 times better than Mosaic or MiniMo – note that each OTA CCD consists of 64 independent CCDs, and the controller has 16 independent data channels!

There are still issues to work out on the current OTA CCD detectors from our Lot 2 foundry run. In particular, a pronounced amplifier glow and high power consumption (3 watts per device) require special attention and must be addressed in the next revision to the detector design. We are currently limited in our ability to cool the detectors below 190ºK (-80ºC) and so dark current is high. Upgrades to the cooling system and eventually the revised design for Lot 3 devices will address these issues.

We look forward to the next upcoming T&E runs in November and December. During the November testing we will concentrate on the fast guide star feed from the instrument. The December run will be dedicated to testing QUOTA with four thinned devices. Next spring we expect to operate QUOTA in a tip/tilt guided mode with up to 32 guide stars.

Figure 4: The QUOTA first-light team in front of the instrument. Left to right are Eugene McDougall, Charles Corson, Dave Sawyer, Dave Mills, Steve Howell, Daniel Harbeck, and Brian Brondel. Not pictured are George Jacoby and John Cavin. Notice the large cable wrap behind the camera (blue dewar) and the Monsoon controller

Note that this run represents a number of important "firsts:"

- First OTA sky images from our foundry run detectors
- First MONSOON controller data from any telescope
- First use of the Bonn shutter at WIYN
- First use of the new ACE 8-position filter wheel
- First use of the MONSOON user software

The relatively smooth installation and subsequent reliable operation is the product of an intense effort by many very dedicated individuals across the WIYN institutions. They deserve a lot of credit! Please visit http://www.wiyn.org/ODI/odi_news.htm for a complete list of names and a gallery of QUOTA pictures.

Bench Upgrade Project

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

The Bench Upgrade Project continues to progress. The highlights during this time include the completion of a preliminary opto-mechanical design for the off-axis collimator (OAC), a successful external review of that preliminary design, the completion of an independent tolerancing analysis of the OAC by a consultant, the submission of a request for bids for the OAC lenses, and the identification of NOAO personnel to act as the local engineering lead for the new CCD detector project.

Optical design. Matt Bershady and Charles Harmer have concluded that the f/5 optical design is robust enough that the design can be opened up to f/4, allowing for increased throughput particularly in VPH configurations, with only minimal image degradation (<10% for VPH and < 3% for echelle and low-order SR-grating configurations). An f-stop is integral to the overall design; this will allow observers to return to f/5 when the best possible image quality is required for their scientific program. An independent consultant, David Vaughnn, has confirmed that the overall image degradation is minimal, and determined that the impact on the tolerancing analysis (which was done for the f/5 design) is negligible. We will need to pay close attention to the tolerances of the off-axis paraboloid (OAP), but that was also true with the initial f/5 design.

As a result of the favorable review and analysis of the optical and opto-mechanical designs, we are moving forward with determining the cost of the optics. A bid package for the four lenses of the off-axis collimator has been prepared and sent out to vendors for bid. While the lenses are small, the fact that they are rectangular rather than circular, and have very tight centration tolerances, could make them tricky to manufacture to specification. We are approaching coordinate-measuring machine (CMM) vendors for possible independent, post-manufacturing confirmation to mitigate this risk.

Mechanical design. As noted in the highlights section, Joe Keyes has completed a preliminary opto-mechanical design. A senior mechanical engineer at NOAO, Ed Hileman, was contracted to review the opto-mechanical design. Overall, the design was found to be sound, and no show stoppers were identified. Joe will address some concerns expressed in the report as he proceeds forward to the critical design. Some simplification of the design may be possible with improved estimates of the range of operating temperatures now that we have 8+ months of thermal monitoring in the spectrograph room.

A physical layout on the Bench with the new off-axis collimator has been chosen that will allow *all* of the required grating configurations and most of the goal configurations. This alleviates one of the project risks.

VPH gratings. The 740 l/mm grating is now officially in service as a facility grating. We encourage observers to consider using this grating! Figure 1 (courtesy Kyle Westfall) shows a comparison of VPH 740 l/mm versus the single-ruled (SR) 790 l/mm grating throughput. The data were taken using the Hydra red cable. *The VPH grating has 2 times (1.7-2.5) the throughput as the SR grating.* (Note that only the central third of the sampled wavelength range has been used in this analysis because focus degradation away from the central wavelength makes a fair comparison of flux from extracted spectra tricky.) The strongly peaked distribution does reflect the relatively sharp blaze function of the VPH grating. Consequently, depending on your science program, it can be important to choose your central wavelength accordingly.

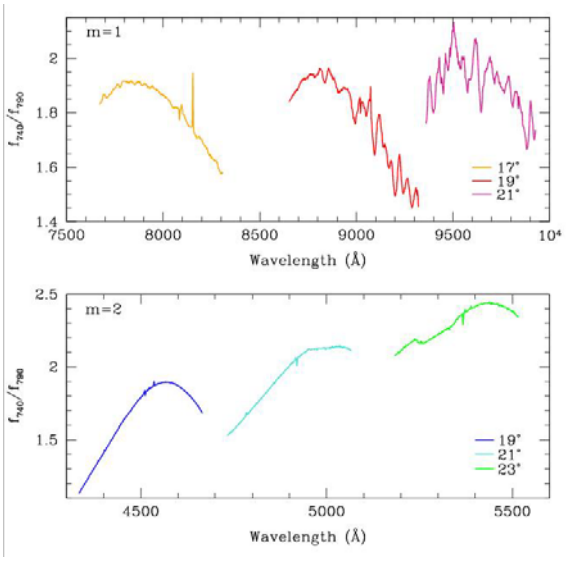

Figure 1: A comparison of VPH 740 l/mm versus the single-ruled (SR) 790 l/mm grating throughput.

The table below gives some representative setups for this grating (all with the Hydra red cable) from the January 2005 T&E run.

T&E Setups for the 740 l/mm VPH grating, Hydra Red Cable

Order	α	Starting wavelength (A)	Ending Wavelength (A)	Dispersion (A/pix)
1	15.0	6010	8259	1.08
1	17.0	6907	9188	1.00
1	19.0	7860	10044	1.06
1	21.0	8688	10948	0.99
2	19.0	3904	5038	0.54
2	21.0	4332	5435	0.54
2	23.0	4789	5872	0.53

The commissioning effort of the 3300 l/mm grating will continue in the spring, once the grating has been coated, and we plan to release is for shared-risk observations in the 07B semester.

New Detector/Controller/Dewar for the Bench Spectrograph. Mark Hunten of NOAO has recently agreed to serve as the lead engineer for the new CCD effort for the Bench. He will be working with the Bench Upgrade team to ensure that the MONSOON electronics and the selected CCD will meet the science requirements. We expect this effort to ramp up quickly now that Mark in on-board.~