WIYN Observatory

Wisconsin Indiana Yale & NOAO

Newsletter

July 2007

Director's News

Elsewhere in this newsletter, you will read about a transition at the WIYN Board level. Sidney Wolff will be retiring from NOAO and stepping down from the WIYN Board. Sidney defined and created WIYN, for which the entire WIYN community is extremely grateful. I want to take this opportunity to express my gratitude to Sidney on behalf of WIYN for leading us into a fantastic telescope collaboration. On a more personal note, I wish to thank Sidney for her continuing support and encouragement during the 15 years that I worked for her at Kitt Peak. Sidney always listened to my ideas, even the wildest ones, and usually (but wisely, not always) allowed me the freedom to pursue my visions and to grow with the successes and failures. Sidney, many thanks, and enjoy your "retirement"!

There are a few more transitions to note.

In late August, WIYN will undergo its second external review, as required by the consortium agreement. This review represents the first step toward a major milestone in WIYN history: the first renewal of the partnership in 2010. This transition will take a few years, but be aware that the WIYN Board is focused on this task and will occasionally be looking for help from its constituency.

The WIYN group in Tucson has transitioned vertically to the former Gemini offices on the NOAO rooftop in order for the entire group to be in one location. We are already finding that our internal communication is improved – please look for us when you are next in Tucson!

My term as WIYN Director ends in September 2008 and I've decided that I desperately need to return to research. I mention this now, a year in advance, so that no one is surprised when they see the job ad in the Fall – a search committee has been formed to find my replacement. I've promised the Board to help through this transition in any way that they would like me to participate.

~George Jacoby

Science News

Steve Howell

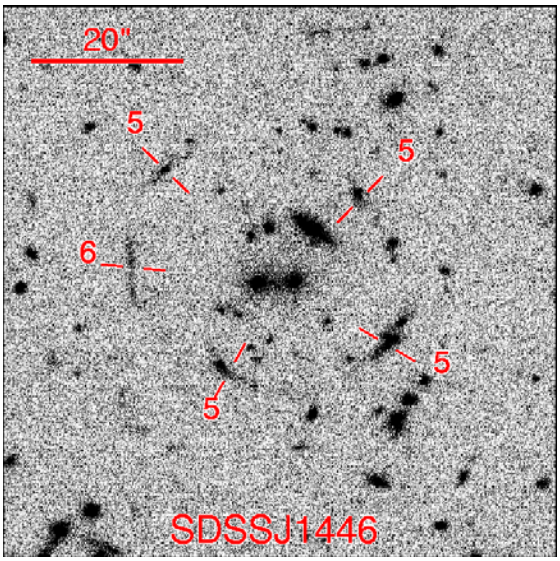

Figure 1: SDSSJ1446

Does the currently favored ΛCDM cosmological model explain the detailed distribution of dark matter in galaxy clusters? Strong gravitational lensing by clusters of galaxies is a powerful test of this model, probing the largest collapsed structures of dark matter in the Universe. The multiply imaged background galaxies and highly distorted giant arcs in well known clusters like Abell 1689 and CL0024+1654 can be used to construct detailed models of the dark matter gravitational potential. Besides providing cosmological constraints, lensing clusters are natural gravitational telescopes, and their high magnification enables the study of the faintest, most distant galaxies ($z \sim 6$-9) known, which would otherwise be unobservable.

Astrophysicists have been studying the same handful of strong lensing clusters for nearly a decade, and their interpretation and understanding have been limited by poor statistics. Joe Hennawi (UC Berkeley) and collaborators (see Astroph/0610061) have undertaken a survey for lensing clusters which aims to dramatically increase the number of known cluster lenses by combining the $\geq 2 \sim \mathrm{Gpc}^3$ cosmological volume of the Sloan Digital Sky Survey (SDSS), with the exceptional imaging capability provided by the WIYN telescope. Clusters of galaxies in range $z \leq 0.6$ can be efficiently identified in the SDSS multicolor imaging, which covers 8000 deg^2; however, the SDSS imaging is too shallow and the image quality too poor to detect the much fainter gravitationally

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The WIYN Observatory is owned and operated by the WIYN Consortium, which consists of the University of Wisconsin, Indiana University, Yale University, and the National Optical Astronomy Observatory (NOAO).

Science News, *continued*

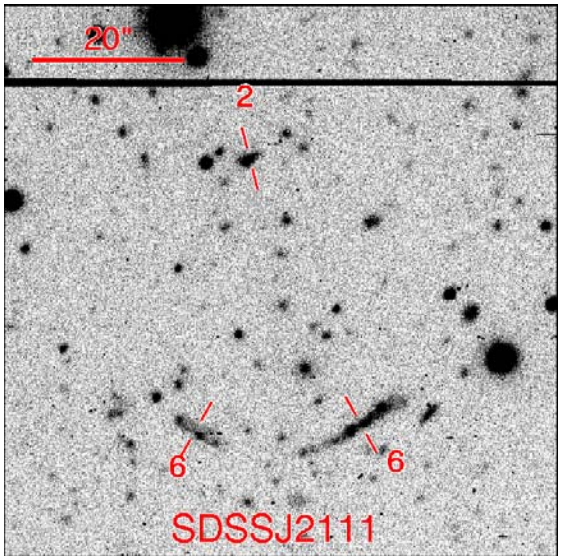

Figure 2: SDSSJ2111

lensed background sources. Their survey strategy is to obtain deep high resolution WIYN images of the most massive clusters in the SDSS volume. Thus far, the group has imaged ~160 clusters in sub-arcsecond conditions and discovered some ~30 new lensing clusters, which nearly doubles the total number of such systems known!

Figure 1 shows a WIYN OPTIC g-band image of SDSSJ1446+3032. This cluster at z=0.47 is one of the most dramatic examples of strong gravitational lensing ever discovered. Owing to the excellent image quality (FWHM=0.63"), Hennawi et al., have detected five extended blue high surface brightness arcs oriented in an ellipse about the cluster center. Figure 2 shows a WIYN Mini-Mo image (FWHM=0.74") of another lensing cluster, SDSSJ2111-0115 at z=0.68. Two very high surface brightness arcs are apparent south of the cluster center, and a possible counter arc is flagged about 40" to the north.

These two new systems (and several others discovered in this survey) will likely become 'poster-child' lenses similar to Abell 1689 and CL0024+1654. By conducting the largest survey for cluster lensing to date, our WIYN imaging survey will help transform strong lensing by galaxy clusters from the study of a handful of rare systems, into a powerful statistical probe of the formation of structure in the Universe.~

WIYN Group Has Moved!

We are now located upstairs (in the former Gemini area). Check our Website at *www.noao.edu/wiyn/* for telephone or fax numbers that may have changed.

WIYN Newsletter Staff

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A Tribute to Sidney Wolff

Dave Sawyer

Sidney Wolff, Caty Pilachowski (Indiana University), and Dave de Young at the groundbreaking ceremony for the new WIYN 3.5-meter telescope at Kitt Peak in 1992.

Sidney Wolff will be stepping down from the WIYN Board of Directors this year as she retires from NOAO. Back in the late 80s, an opportunity presented itself in the form of a 3.5-meter test mirror blank molded in the ovens at the Steward Observatory Mirror Lab. Sidney had a vision of creating a new modern observatory atop Kitt Peak, so she lobbied the user community and helped create the WIYN Consortium. This collaboration between public and private universities and the National Optical Astronomy Observatory was the first of its kind. Starting at a New Haven pub table, Sidney helped carve out a first draft of the WIYN Agreement, which became a fully executed document in 1990. In Sidney's eloquent prose, the incorporation of WIYN was publicly announced that same year. Two years later, she wielded a shovel at the groundbreaking for the WIYN Observatory. Then in 1994 she braved the elements to participate in the very windy WIYN dedication on Kitt Peak.

Sidney served on the WIYN Board of Directors from 1989 through 1992, during which time she was a leader in developing the WIYN agreement, securing funding, and overseeing the start of construction of the WIYN Observatory. Sidney rejoined the WIYN Board in 2002 as the WIYN organization was embarking on a new initiative to build a billion-pixel One-Degree Imager (ODI) for the WIYN 3.5-meter telescope. She was instrumental in writing proposals for ODI, drafting the original management plan, and securing NOAO involvement in this ambitious project.

The WIYN observatory is a pioneering example of a private-public partnership, which draws from the strengths of both constituencies. It serves a broad community through NOAO, delivering wide field multi-object spectroscopy as well as direct imaging with image quality that is unbeaten from the ground. At the same time, data from WIYN has fed an impressive number of Ph.D. theses from the partner institutions. It was Sidney's vision and commitment that forged this link between two "rival" paths in US astronomy, paving the way for more of the same, such as SOAR. Sidney's extensive contributions and tireless support of WIYN have helped to ensure the success of the observatory and to maintain its stature as a world-class astronomical facility. For this, we owe Sidney a profound debt of gratitude. Her quiet wisdom and respected presence on the WIYN Board will be missed by all.~

Bench Upgrade Project

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

Opto-Mechanical design. Initially, the Bench Upgrade Project Team had base-lined an off-axis collimator with four tilted lenses. Optically, this design supplied the desired image performance for all the required combinations of gratings and instruments. Unfortunately, it later became apparent to the team that the optical system would be very difficult to test, adding significant expense and risk to the project. Thus, we decided to revisit the optical design, and now have a new base-line collimator design that is all-refractive, with 3 (30%) fewer surfaces. The new base-line design has comparable (and in some cases is superior) image quality relative to the current system and, overall, outperforms the previous base-line design. Furthermore, the new base-line design will be much simpler to test. This design will be undergoing a review on July 9, 2007. Assuming the review goes well, we plan to proceed with this new design.

Other aspects of the upgrade project include the need to relocate the ATV and rear-illuminator, and modifying the Hydra fiber toes to enable the full throughput gains. This need has been present with all working designs for the upgraded collimator. A solution that integrates the ATV and rear-illuminator with the new all-refractive collimator has been developed. This solution will be integrated into the modified toe design.

Finally, we have developed several viable options for the overall layout with the new optical design. We are working toward optimizing the layout in terms of operations ergonomics, and enumerating the detailed set of changes that will be made to accommodate the new layout.

New Detector/Controller/Dewar for the Bench Spectrograph. Mark Hunten of NOAO has been able to successfully read an engineering grade STA1042 CCD in the lab with MONSOON. A science grade STA1042 CCD is the baseline for the new Bench dewar. A noise performance of ~7-9 e- was achieved on the engineering device with no effort to optimize the electronics, as it is believed that the current MONSOON system is detector limited. This is already close to the measured performance of T2KA (read noise of ~6.7 e-). The science-grade device is now being installed, and is expected to have read noise as low as 3.5e- in at least one amp. For reference, the older T2KC system had a delivered read noise (on telescope) of 4.9-5.3e-. If all goes well, the new dewar and electronics may be tested on the Bench over the summer.~

WHIRC is Coming to WIYN!

Patricia Knezek (WIYN, Co-I) & Margaret Meixner (STScI, PI)

Testing of the WIYN High Resolution Near-Infrared Camera (WHIRC) in Baltimore is nearly complete. A delay in the vendor delivery of the lens cell holders caused a slip in the final assembly and testing schedule to the end of June. Thus the WHIRC team is delaying the first commissioning run to 21-25 July 2007.

Figure 1: Filter wheel mechanism with filters installed.

Hardware. Figure 1 shows an image of the filter wheel mechanism with the filters installed. One filter (the low airglow filter) delaminated prior to installation, and has been returned to Barr for repair. If the filter is not delivered prior to the final assembly and test of WHIRC in Baltimore (see below), then it will be delivered to WIYN and installed at a later date – possibly not until summer 2008. Other hardware, including filters, optics, and detector, have now been completely assembled and tested cold under vacuum. A low level vacuum leak was detected, and determined to be in the weld of the vacuum gauge. A solution was defined, and the vacuum vessel has been sent out for repair. All other hardware testing has gone quite well. While some minor adjustments are needed, no show-stoppers have been identified.

Controller Electronics. Figure 2 shows an image of the MUX obtained using the MONSOON controller electronics. The MUX testing was very successful, and initial testing of the Virgo array with MONSOON has also gone well. Once the vacuum vessel is repaired, and the final assembly and cool down complete, the electronics will be optimized for the Virgo performance. Some final tweaking may be needed once on-sky testing begins.

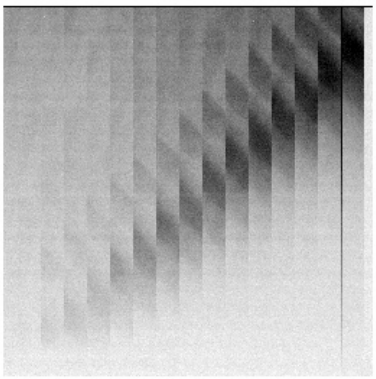

Figure 2: Image of the MUX obtained using the MONSOON controller.

In May, two support personnel from KPNO, electronics technician Ken Don and CCD expert Bill Ditsler, traveled to Baltimore to familiarize themselves with the WHIRC system. This is part of the preparation of WIYN and KPNO to support WHIRC as a facility instrument once commissioning is complete and the instrument is accepted by the WIYN SAC and Board. As a part of that, a set of Acceptance Requirements has been defined and appended to the Memorandum of Understanding between WIYN and STScI. The plan is for this to be in place prior to delivery of WHIRC to WIYN for the first time.

The WHIRC team currently plans to do a final assembly and test the first week of July, and ship the instrument to WIYN on July 10 for arrival July 12. After integration and testing on the mountain July 12-20, as noted above, WHIRC will go on-sky July 21. Watch this space for an update.~

QUOTA and ODI News

Daniel Harbeck and Steve Howell

QUOTA. Since January, there have been two campaigns with QUOTA with some success. Observations during the T&E run at the beginning of February were restricted due to snow, so time was spent working on some software issues. The available open-dome time was dedicated to testing a new SDSS g'-band filter, which revealed substantial internal ghosting in this filter, and so was a valuable lesson for the design of large filters for ODI.

Three-color composite of M51; blue: U-band; green: SDSS i' band, red: Windhorst p–band.

The overall progress of QUOTA as a science instrument was slow. We encountered issues like broken bondwires on the detectors and two vacuum leaks. QUOTA returned to the telescope in April, although at that time we had only one detector available that was meeting science requirements. Some time was used for software testing, but we also obtained science observations. A light curve of EU Cnc, an X-ray selected variable star in the open star cluster M67, was recorded. It is known to be a short periodic, interacting binary consisting of a highly magnetic white dwarf orbiting an M star.

We also obtained a remarkable picture of M51 (see figure above). The 3-color composite image consists of a 50-minute exposure in the U-band, and 40-minute exposures in a newly received SDSS i' band filter, and in a filter that closely resembles a future Y-band filter (Windhorst p filter). The M51 picture summarizes three of ODI highlights: (i) blue sensitivity, demonstrated in the U-band, (ii) potential high red sensitivity in the Y-band, (iii) the remarkable image quality obtainable at WIYN. The combined 50-minute U-band exposure has a delivered image quality of 0.4"!!

While all T&E campaigns with QUOTA demonstrated the potential of this instrument in a very impressive manner, QUOTA will require more work before becoming a useable facility instrument. On the other hand, our work with QUOTA was valuable as a prototype for ODI. The availability of QUOTA for science in the future is a bit unclear, and we are working on a plan to advance QUOTA without conflicting with the work on ODI.

ODI. The ODI project made substantial progress during the last few months. The ODI team devoted several months this year revisiting the science requirements for ODI and creating a clear flow down of engineering requirements. This exercise helped us to identify loose ends, and will protect the project from changes in scope. The new science requirement document is now under version control by the WIYN Board. If you would like a copy, please ask your local SAC or ODI SWG member.

The foundry run for our Lot 3 OTA CCD devices finished production in March, and so far the detectors seem to be healthy and do produce images on a probe station. This is a very good sign as modifying CCD designs and redoing lithographic masks bears risks. The next step is to package some devices and test them in the test dewar.

Two major contracts for ODI production were signed. First, we contracted with the Imaging Technology Laboratory (ITL) of the University of Arizona to process (i.e., to thin and connect), package, and mount ODI's OTA-CCDs on the focal plane within the flatness requirement. Secondly, we awarded a contract to SESO (France) to deliver the optics for the ODI corrector. This includes two lenses and the prisms for the atmospheric dispersion compensator. These two contracts mark major milestones toward making ODI a reality.

The ODI critical design review for instrument support package, HEMI (Housing for Elements and Mechanical Interface) was held in June. The panel, consisting of Bruce Bigelow (Panel Chair), Tom O'Brien, and Tim Pickering, concluded that the mechanical design is mature and that we should go ahead and build it! In fact, we have started construction. We thank all of the panelists for their support of the ODI project.~

PERSONNEL NEWS

Sheryl Falgout is now the full-time WIYN/ODI Administrative Coordinator. She will also continue her work with the NOAO PAEO office as managing editor of the *NOAO/NSO Newsletter*. Sheryl edits, designs and does the layout of the *WIYN Newsletter* as well.

Brian Brondel is returning to Indiana University to finish his Ph.D. thesis. He has worked on several projects during his stay in Tucson. His contribution to the ODI project was significant. Brian was part of a team building a reference implementation for the fast guiding functionality for QUOTA and ODI. He played an important role in defining the first software interface between the MONSOON CCD controller and the QUOTA fast guiding functionality, the "guide core." Brian also programmed a prototype user interface that will allow the developer, and eventually the observer, to see the guide process. Brian's data reduction skills were utilized to process the data from the QUOTA first light. The WIYN team is very grateful to Brian for his help, and we wish him much success in all his future endeavors.

Lou Nigra, a grad student from UW Madison, visited WIYN to work with the ODI team to help evaluate options for testing the large filters that will be needed for ODI. We thank Lou for his help!

The WIYN Newsletter and Contacts List are available on the WIYN Website at *www.noao.edu/wiyn/*.