The Future of Imaging at WIYN

Steve Howell

Some of you may remember the transition from the original WIYN imager, known as S2KB, to today’s workhorse, Mini-Mosaic. S2KB was used to help commission WIYN and for early science. It was removed from service at the WIYN 3.5-meter telescope in 1999 and moved to the WIYN 0.9-meter, where it is still in use today. “Mini-Mo” offers smaller pixels (higher spatial resolution) than S2KB and approximately four times the imaging area. To date, Mini-Mo has imaged the skies over Kitt Peak for more than 1,200 nights, generating roughly 100,000 science frames.

WIYN continues to stay at the forefront of astronomical imaging through the development of new imaging cameras that are larger in areal coverage and provide electronic image stabilization, as well as conventional use, across their entire field of view. For the past few years, WIYN has made available a prototype CCD camera called OPTIC, which uses a new type of CCD called an Orthogonal Transfer CCD (OTCCD). (See the September 2004 NOAO/NSO Newsletter for more details.)

WIYN is now nearing completion of the next step toward its ultimate goal, a full One-Degree Imager (ODI). This step, known as the QUAD OTA camera (QUOTA), will consist of four Orthogonal Transfer Arrays (OTAs), each of which is a 4K × 4K checkerboard arrangement of OTCCDs (see the March 2005 Newsletter). The field of view for QUOTA will be 16 arcmin on a side, and full array readout will take about four seconds. QUOTA is slated to begin on-sky testing in the 2006B semester, and to be offered on a shared-risk basis in 2007A. It is anticipated that QUOTA will replace Mini-Mo as the default imager at WIYN beginning in 2007B.

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### Imagers available at WIYN - Past, Present, and Future

<table>
<thead>
<tr>
<th>Instrument</th>
<th>CCD Type</th>
<th>CCD size</th>
<th>Pixel size (microns,&quot;/pix)</th>
<th>FOV (arcmin)</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2KB*</td>
<td>STIS</td>
<td>2K × 2K</td>
<td>21, 0.20</td>
<td>4.8 × 4.8</td>
<td>1997-1999</td>
</tr>
<tr>
<td>Mini-Mo</td>
<td>SITE</td>
<td>two-2K × 4K</td>
<td>15, 0.14</td>
<td>9.6 × 9.6</td>
<td>1999-2007</td>
</tr>
<tr>
<td>WTTM/WEEV</td>
<td>EEV</td>
<td>2K × 4K</td>
<td>13.5, 0.11</td>
<td>3.8 × 4.7</td>
<td>2003-2007</td>
</tr>
<tr>
<td>OPTIC</td>
<td>OTCCD</td>
<td>two-2K × 4K</td>
<td>15, 0.14</td>
<td>9.6 × 9.6</td>
<td>2003-2006(7)</td>
</tr>
<tr>
<td>QUOTA</td>
<td>OTAs</td>
<td>four~4K × 4K</td>
<td>12, 0.11</td>
<td>16.0 × 16.0</td>
<td>2007-2009</td>
</tr>
<tr>
<td>ODI</td>
<td>OTAs</td>
<td>64~4K × 4K</td>
<td>12, 0.11</td>
<td>60.0 × 60.0</td>
<td>2009-TBD</td>
</tr>
<tr>
<td>WHIRC (IR)</td>
<td>Raytheon</td>
<td>2K × 2K</td>
<td>13, 0.11</td>
<td>3.8 × 4.7</td>
<td>2007-TBD</td>
</tr>
</tbody>
</table>

* S2KB is currently in use at the WIYN 0.9-m telescope
Future of Imaging at WIYN continued

QUOTA is a large step toward the future of direct imaging at WIYN in the form of ODI. This new technology camera will consist of 16 QUOTAs, placed together in the focal plane to provide a full square degree of sky per image, with an anticipated readout time equal to that of QUOTA, as each OTA is read out in parallel. ODI is expected to arrive on Kitt Peak in 2009.

The new OTCCD imagers are designed to take full advantage of the great seeing at WIYN, both in conventional mode (working as a normal CCD), and in “OT” mode, where they provide electronic tip-tilt-type image motion compensation. The WIYN OTCCD cameras are designed to provide delivered image quality ranging from the median seeing at WIYN (0.65–0.7 arcsec) to the optical performance limit near 0.28 arcsec.

In addition to optical imagers, WIYN is currently well along in the construction of a new infrared camera, the WIYN High Resolution Infrared Camera (WHIRC), to be placed on the WIYN Tip-Tilt Module (WTTM) in early 2007. WHIRC will use the WTTM to provide near diffraction-limited performance in near-infrared bands. Once QUOTA and WHIRC are fully commissioned, it is expected that Mini-Mo and WTTM/WEEV will be retired from service at WIYN. The future of imaging at WIYN is bright indeed.

Yunnan Observatory Mirrors Coated by KPNO

Buell T. Jannuzi

The British company Telescope Technologies Limited is currently building a telescope at the Yunnan Observatory in the People’s Republic of China. This telescope will have a 2.4-meter primary mirror and a 0.7-meter secondary mirror, both of which were configured at Rayleigh Optical Corporation in Baltimore, Maryland. These mirrors were brought to Kitt Peak on their way to China to be aluminized in our 4-meter telescope chamber.

Thanks to the careful and skillful work of Will Goble, Jose Montes, Hector Rios, Wally Thurn, and Fred Wortman, both mirrors were safely unloaded, successfully coated, and safely repackaged in their shipping containers. These mirrors (see photo) were the first to be coated using the new Filament Power Controller commissioned in fall 2005. Final coating thickness was 118 nanometers on the inner monitor and 102 nanometers on the outer monitor.

Kitt Peak was allowed to coat these mirrors for a commercial contractor because the telescope is being used for peaceful scientific purposes in China, and there is no commercial vendor with a coating chamber large enough for the 2.4-meter primary mirror. In addition to coating the mirrors of the Mayall 4-meter, KPNO 2.1-meter, and WIYN 3.5-meter telescopes, and those of the National Solar Observatory, the coating chamber is used every year to coat the mirrors of many telescopes in North America, including the Astrophysical Research Consortium (ARC) 3.5-meter at Apache Point and the Sloan Digital Sky Survey telescopes.
The NOAO Extremely Wide-Field Infrared Imager (NEWFIRM) project passed a significant milestone last month. Following internal modifications, reassembly, a thorough electronics checkout, and installation of an engineering grade array, the NEWFIRM instrument was moved from the basement clean room area of the main NOAO Tucson building, across a parking lot, and attached to the Flexure Test Rig.

Here, NEWFIRM is undergoing on-axis optical flexure tests that simulate orientations it will experience on the telescope. These activities test the passive flexure compensation design by which the internal optical assembly and the external guider, working together, keep the infrared focal plane registered to the sky. On-axis testing is enabled with small temporary lenses while we await delivery of the remaining large aspheric optics. The MONSOON array control system is also being verified with multiple arrays installed in the cryogenic focal plane.

We presently expect first light in October-November 2006, followed by commissioning and science verification in Semester 2007A, and transition to full science use in Semester 2007B. Potential users interested in science planning for Science Verification and subsequent Survey projects are encouraged to visit the project Web site www.noao.edu/ets/newfirm (click on “Science Planning”).

1. NEWFIRM Dewar is hoisted out of the basement clean-room assembly area.
2. ...and relocated to the Flex Rig Facility.
3. Truss and guider are fitted to the Dewar.
4. First flight! NEWFIRM installed and in motion on the Flex Rig.
5. The Integration Team is all smiles, From left to right: Ron Harris, Ron George, Ron Probst, John Andrew, Bill Ditsler, and Roger Repp.
Changes In KPNO Support Office Staff

Buell T. Jannuzi

We would like to welcome Kiki Atkinson and Sheryl Falgout to the Kitt Peak National Observatory (KPNO) Support Office. The Support Office works with all areas of KPNO to meet the needs of our visiting observers, Kitt Peak technical staff, and the WIYN Observatory. Kiki Atkinson joined the office in June 2005 and Sheryl Falgout joined in February 2006.

Kiki was familiar with NOAO before joining the KPNO Support Office, having done contract work with several divisions of NOAO. She brings more than 15 years of administrative support experience in academic environments, as well as several years in public outreach for museums. In addition to general support for KPNO and WIYN, Kiki assists the NOAO public affairs office as Managing Editor of the NOAO/NSO Newsletter.

Sheryl joins us from the College of Public Health at the University of Arizona. Sheryl has more than 15 years of experience in administrative support and budget management/analysis for astronomy. She worked for the User Support Branch of the Space Telescope Science Institute during the exciting early days of the operation of the Hubble Space Telescope (1989-1992), and for the Department of Physics and Astronomy of The Johns Hopkins University. In addition to general KPNO and WIYN support, Sheryl will support the WIYN One-Degree Imager (ODI) project. We are very happy to welcome her back to AURA, this time in a sunnier local!

Kiki and Sheryl join Judy Prosser, who has agreed to postpone her retirement until the end of February in order to facilitate this transition. An article celebrating Judy’s exemplary service to KPNO and WIYN will appear in the next Newsletter.

Scott Bulau Joins NSO and ATST

Tony Abraham

Scott Bulau has joined the Advanced Technology Solar Telescope (ATST) project as Controls Engineer, leaving Kitt Peak National Observatory at the end of 2005. Scott had been Electronic Supervisor for the Kitt Peak engineering group since August 1987. During this time, he played a major role in the design, development, and maintenance of many of our telescopes, facilities and instrumentation projects. His recent accomplishments include the completion of a new guider for NEWFIRM, and technical support for the new IRMOS instrument developed by NASA/Goddard/STScI and tested successfully on both the 2.1-meter and 4-meter telescopes. We thank Scott for all his years of productive service and dedication to Kitt Peak, and wish him continued success at the National Solar Observatory.