Smithsonian Astrophysical Observatory & Steward Observatory, The University of Arizona

MMT Observatory
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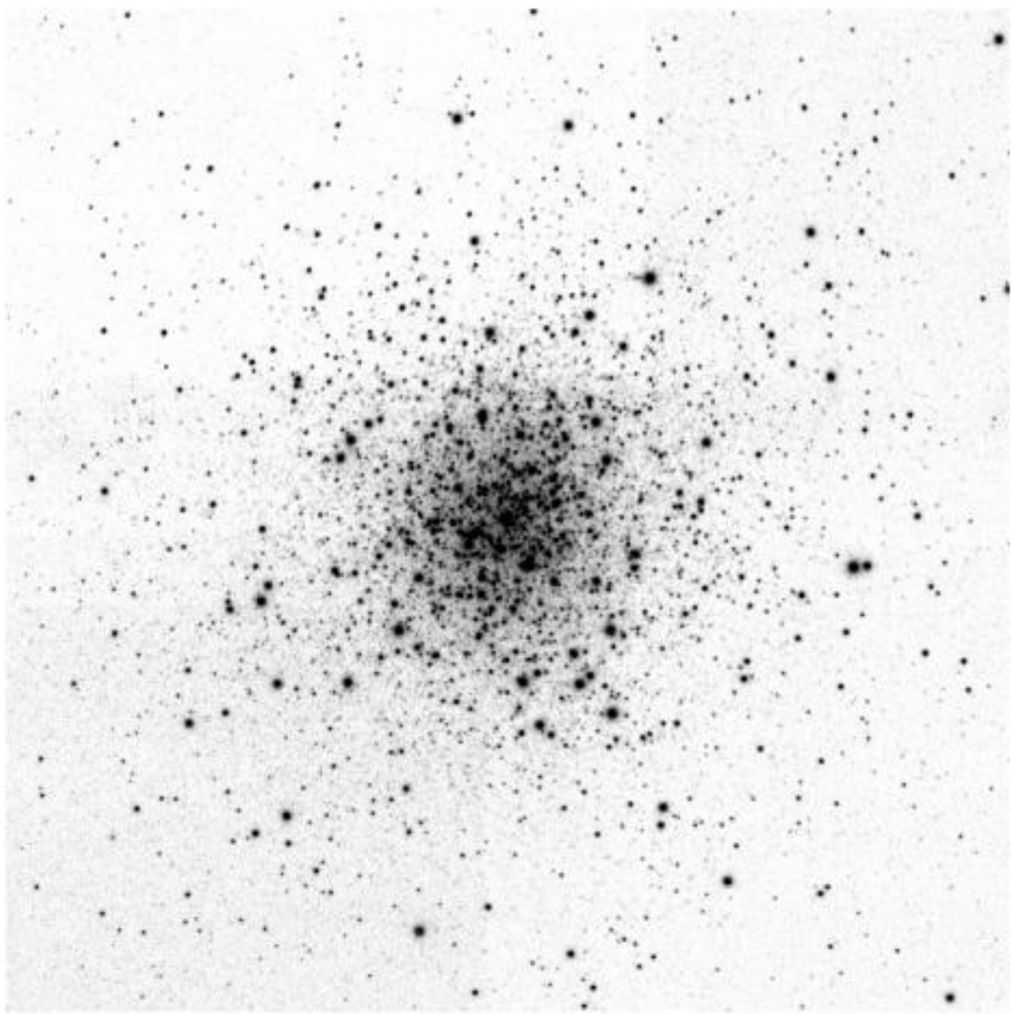
# BIMONTHLY SUMMARY

## May – June 2004



*First light image by SWIRC (SAO Wide-field InfraRed Camera). This is a 24 second H-band (1.6 μm) exposure of the globular cluster M3. The assembled image covers 7 × 7 arcmin, and the seeing was approximately 0.5 arcsec FWHM. Image by W. Brown, M. Pahre, and E. Bowsher.*

## Personnel

Gary Schmidt left the MMTO on May 14, after having served as MMTO Interim Director since March 2003, to return to his former position as professor of astronomy at UA. We express our deepest appreciation for Gary's many contributions during his all-too-brief term, and wish him the best.

After Gary's departure, J. T. Williams took over as Interim Director until such time that a permanent director is named.

After working with the MMTO for more than a year (assisting in the design and fabrication of the *f*/5 baffles, rotator limit switch, and modification of the neutral members), Alberto Ramos left on May 14, having graduated with a degree in Mechanical Engineering. We all wish him the best in his career development.

On May 17 Kristy Pearson was hired as a student mechanical engineer.

On June 10 student mechanical engineer Thomas Hair left the MMTO.

T. Pickering, G. Williams, D. Blanco, and S. Callahan (now with LBT) attended the SPIE conference on Astronomical Telescopes and Instrumentation in Glasgow, Scotland, June 21-25. T. Pickering and D. Blanco gave oral presentations and G. Williams presented a poster paper. Their respective papers are listed under Scientific Publications below. Approximately 1,900 delegates attended, making this year's symposium the best-attended in Europe to date.

## Primary Mirror Systems

### Primary Mirror Support

On May 22 actuator #51 failed the initial bump test. The problem cleared on the second try. The actuator continued to exhibit intermittent failures and was deactivated on a few nights, with the support forces redistributed to the other actuators. The day crew continued to work on the problem until K. Van Horn and P. Spencer found a fix on June 21.

Starting on June 9 a large number of actuators began reporting excessive force errors. The day crew spent several days exercising and testing the mirror support. We eventually found that the force errors only occur on elevation slews. The elevation speed was reduced as a temporary fix.

The primary mirror support has been generating significantly more "following error" warning messages. After careful analysis of several nights' errors logs, we concluded that the messages were correlated with times when the telescope was slewing in elevation, and were a reflection of a well known following error in the actuator force servos, fortunately not of serious concern. This would be an issue if the following errors became large enough that the primary hardpoint breakaway forces were exceeded.

As part of this effort, P. Spencer, K. Van Horn, and J. Labbe re-activated the primary mirror actuator test-stand and calibrated a reduced-force single actuator spare. These actuators are used for single puck positions along the mirror edges. J. Labbe fabricated a test tool, designed by P. Spencer and K. Van Horn, to calibrate the actuator Bellofram transducers for span and zero adjustments, with appropriate electrical and air inputs.

**Optics**

On May 11 the telescope was closed and prepared for mirror wash on the 12th. B. Kindred has developed a non-contact (or liquid only contact) washing technique using a pressure sprayer. Measurements after the wash indicate that reflectivity over the range 4000-7000 Å is within 1.5% of that of a protected witness slide from the 2001 coating, and the primary mirror reflectance reaches 90% in the range 4000-5000 Å. The spray wash technique used very nearly approaches what was achieved with a hand-wash over a small portion of the mirror, and adhesion of the aluminum continues to be good. For details see Internal Technical Memorandum #04-2, which is available at *http://www.mmto.org/MMTpapers/pdfs/itm/itm04-2.pdf*.

*Mirror Wash: Bill Kindred cleans the primary using the new pressure spray technique that he developed. Bill does not do windows. Photo by D. Blanco.*

These results easily met the criteria set at the MMT Council meeting for continuing to use the current coating. Thus, it has been decided to forego aluminizing during summer shutdown 2004, postponing the recoat to summer shutdown of 2005.

**Thermal System**

An extensive thermal data set was collected for June 2004. These data are being analyzed to evaluate current thermal system performance. Preliminary results have identified one or more cold spots in the lower plenum. These areas may indicate direct leakage of conditioned ventilation air into the lower plenum. Comparisons will be made between different temperature readings, such as the E-series thermocouples and the TempTrax digital temperature probes. The thermal condition of the primary mirror will be compared under differing ambient temperature conditions and under different rates of cooling with the ventilation system.

## Secondary Mirror Systems

### *f*/5 Baffles

At the beginning of May, modifications were started on the mid-baffle. A. Ramos and T. Hair began by removing the Protostar flocking that was peeling off the baffle. A combination of Boston Felt flocking applied onto powder-coated aluminum proved to adhere much better than previous methods. The mid and lower baffle then had the “zero gloss” epoxy powder-coat (BK11) baked on, and K. Pearson meticulously applied the Boston Felt flocking on all surfaces of the mid and lower baffles.

The fabric sleeves used to darken the eight stainless steel cables used to support the mid-baffle were also modified. These bulky sleeves were removed and replaced with a black shrink tubing. This shrink tubing conformed uniformly to the cable and reduced the area of light blocked significantly, compared to the fabric sleeves.

On June 8 the fully flocked mid-baffle was installed on the telescope. The baffle was realigned using a laser attached to the RAT. Each set of cables was then tensioned to ~925 lbs using the load cells.

During the engineering run at the end of June, C. Wainwright and K. Pearson installed the pneumatically actuated lower baffle onto the existing mid-baffle. By the evening of June 30 the lower baffle was made operational on the telescope. A hand-operated pneumatic control valve located on the southeast side of the telescope is used to operate the baffle. The actuation air pressure used to move the lower baffle was set at 55 psi; typical actuation time is 5 seconds.

### Hexapod Control

The present hexapod control system is not smooth enough to make focus or collimation adjustments during observations, resulting in frequent interruptions. We anticipate this will be improved with the delivery and installation of the new PMAC control system expected in August. The *f*/5 hexapod and UMAC box will be set up for testing in the second floor lab, with cables connected to the rack equipment installed in the third floor lab.

*The lower baffle deployed. Photo by C. Wainwright.*

## *f*/9 Hexapod

P. Spencer tracked down the problem with the hexapod anti-collision system. This was traced to faulty electronics in, or an intermittent connection to, the secondary collision detection electronics. These failures appeared as the inability of the hexapod to finish a commanded move, or no response at all to commands. The operators had been able to "fix" the problem by rebooting the crate. Sometimes this worked immediately, but other times it required several reboots to bring the hexapod back to "normal." Occasionally rebooting resulted in further software problems. For instance, when commanded, the hexapod GUI would indicate that the drive amplifiers were operating, when a visual inspection of the electronic indicator lights proved otherwise. One result of this was to configure a better software check of the drive amps by reconfiguring the amplifier status bit at the digital I/O module in the crate. The amplifier status bit now gives us the ability to determine whether the drive hardware is operating, without physical confirmation. The hexapod is now operating normally with software preventing collisions.

## Telescope Tracking and Pointing

### MMT Servo Axes

Telescope oscillations started during the April *f*/5 run and shortly after the installation of the new spectral calibration lamp boxes on the telescope. On May 5 M. Kenworthy (CAAO) and D. Blanco obtained vibration spectra using accelerometers mounted at the secondary hub. By comparing the spectra by striking the structure, then the lamp boxes, it became clear that the boxes were contributing to top end vibrations in the 17 to 22 Hz range. Suspecting that the boxes were acting as oscillators contributing to the servo instability, the boxes were removed on June 6. At first this seemed to help, but over the next few nights the oscillations continued.

It was discovered early in the reporting period that there was a significant imbalance in the elevation drive amplifier gain and offsets. This had the unpleasant consequence of contributing to the elevation oscillations experienced in April and May. In essence, the servo was oscillating in a limit cycle imposed by the servo amplifier's inability to lock into a stable operation point. Careful adjustment of the gain and offset on the amplifiers eliminated this issue.

During their last two observing runs, CAAO had observed and commented upon an apparent high-frequency (84 Hz) oscillation in the MMT azimuth axis. While checking out the elevation axis, we checked the azimuth amplifier outputs and discovered an 84 Hz squarewave present. This was a velocity-loop oscillation caused by the (fairly high) derivative gain in the LM628 controller. Reduction of this gain term eliminated the squarewave.

D. Clark finally tracked the problem to instability in the azimuth axis; this was exciting oscillations in the elevation axis. After a heroic effort, D. Clark restored normal tracking in time for the start of the SPOL run May 12.

### Toward New Servo Controller

J.T. Williams and D. Clark have organized a telescope servo team to update servo performance goals and specifications, measure telescope parameters, and recommend a next-generation servo controller capable of driving the elevation and azimuth axes to fundamental limits of the telescope structure.

We have successfully taken several runs of open-loop data on the elevation servo, and have given the files to E. Bell and K. Powell (SO) for evaluation and reduction into transfer functions. We expect to begin controller design once we have agreed on a transfer function of sufficient quality as to be representative of actual telescope behavior.

In further support of this activity, D. Clark has been learning more about rapid control design and implementation using MatLab and Simulink. A case study was undertaken on the spare *f*/9 hexapod actuator in the campus lab. This allowed a "dry run" of all the steps involved to upgrade the servos (plant identification, control design, control implementation, and testing) without our having to try it on the actual telescope. We successfully "identified" (servo-speak for characterizing servo responses) the actuator, implemented a controller, and collected operational data on the actuator. D. Clark will be presenting a seminar on this design process during the next reporting period.

We expect several more months of servo data collection, design, and prototype testing before we will be able to fully implement new servo controller tests on the MMT axes. An internal technical memo toward servo specifications is being generated to provide a unified design goal document for this project.

### Encoders

The precision resistors needed to complete work on the azimuth encoder electronics modifications have arrived. We await the return of B. Comisso from vacation and available time on the telescope to finish the job.

## Computers and Software

### Telescope Tracking Errors

Software efforts have taken place on many fronts, often without apparent major visible benefits. We became suspicious that we may have been mishandling the merging of the coarse and fine readouts of the telescope Inductosyn absolute encoders. After careful checking, we concluded that in fact this was being handled properly after all, and was not the source of telescope tracking errors.

### Wavefront Sensor Modifications for SWIRC

The optical design of SWIRC is such that when it is installed and at best focus, there will be significant spherical aberration on-axis as measured by the wavefront sensor. To deal with this correctly, a version of the wavefront sensor GUI was generated that can handle such offsets in much the same way it handles offsets in instrument focus. Work is ongoing to support offsets in all Zernike modes in a unified way. This will be required to support off-axis wavefront sensing.

### Hectospec Data Reduction

With the help of N. Caldwell, accounts, permissions, and software were set up on *alewife* and *homer* to be used by Hectospec (and in the future, Hectochelle) observers for data reduction and analysis.

### Hexapod Control Software

Work continues on the UMAC controller software for the *f*/5 hexapod, primarily now in writing code that will run in the VME crate under VxWorks as an alternate backend to the existing control software.

### VME Console Logs

Lantronix device servers were connected to the serial ports of the following Motorola VME crates: Cell, Mount, Hexapod, and CCD. Diagnostic and error messages that are generated internally by the VxWorks code in these computers are now logged to files. The "service" command was augmented so that it can be used by operators and others to start, stop, and restart daemon scripts that log the output of the serial ports.

## Software Modifications

A number of our scripts that implement operator interfaces have been modified to use the network "all variables" command to obtain values for update in a much more efficient manner. At the same time, some of these GUI programs have been reorganized internally to make them cleaner and easier to maintain and modify. The mount offsets GUI was rearranged so that the operator paddle no longer is handled by a hidden "backend" part of the GUI. Instead, the paddle is handled by an entirely separate background process, which can run on a different machine than the GUI if necessary. This offers flexibility in the unlikely event that the paddle interface hardware on the machine that runs the GUI should ever malfunction.

The hexapod control GUI, "hexgui," was modified to report the target hexapod position. This addition provides needed information to the operators, since the hexapod is controlled by a variety of software packages that include wavefront sensors and guiders. The former "dingus" display, which shows the position of the hexapod relative to allowed limits, has been incorporated into "hexgui."

A Ruby script, which replaces a similar C program, was written for "rerr," the program used by the operators to monitor cell crate activity, especially during system startup. The new Ruby script improves the readability of the output messages and eases maintainability of the code.

Mini-server Perl code was slightly modified to improve performance, especially in network communication.

## MMT Software Documentation

Work began on a set of MMT software "cheat sheets" for use by operators and others. These cheat sheets can be found online at *http://hacksaw/cheatsheets/*. This documentation provides brief, user-friendly instructions on how to use various MMT software programs. Links will be provided to more complete user manuals and tutorials.

The cheat sheets have been divided into six major sections, each representing a telescope subsystem: (1) Cell/Cell Crate; (2) Instruments/Guiders/Wavefront Sensors; (3) Mount/Mount Crate; (4) Secondary/Hexapod Crate; (5) Thermal/Environmental; and (6) System/Other. Each of these major sections is in turn separated into five sections: (1) software used daily by the operators to run the telescope; (2) software used occasionally by the operators to troubleshoot software and hardware problems; (3) software used only by software engineers to debug and maintain the system; (4) deprecated software; and (5) data files and logs.

Input for the web pages has been provided so far by several individuals in a variety of forms, including text, screenshots, and sample program outputs. These web pages will continue to evolve as new documentation is written and incorporated. The web pages have been set up on *hacksaw* so that operators and software staff can add and modify the contents as needed.

## Engineering Web Pages

Work continued on the MMT Engineering Web pages. Several revisions were made to the telescope balancer web page, incorporating new telescope configurations, new instruments, and new data for existing instruments. New web pages were added to show the spatial distribution of air temperatures in the lower plenum of the primary cell. Additional web pages were added from data provided by P. Spencer on the location of E-series thermocouples for the primary mirror. Links to various manufacturers' manuals have also been added, as well as a thermal system "quick start" guide. Archive directories were added that contain daily "snapshots" of selected web pages. These pages are online at *http://www.mmto.org/~jdgibson/engineering.html*.

### Miscellaneous

The thermal/environmental system no longer uses the 32-port Cyclades terminal server. New Lantronix device servers were deployed for the Rainwise remote weather station and for the shop data acquisition unit (DAU). The Carrier Lantronix was moved from the drive room to the shop.

## Instruments

### MIRAC/BLINC and ARIES

The May IR run was troubled by elevation servo oscillation, hexapod problems, and by very poor seeing. These compounded hindrances made for the loss of several nights.

### Blue Channel Spectrograph

On May 10-11, D. Smith and D. Ouellette repositioned the Blue Channel camera to work in cross-dispersed configuration. Currently the chip does not pick up all the light orders necessary for useful cross-dispersion operation. More engineering time is required to find answers.

A focus problem was reported during the Blue Channel run starting on May 14. The observer reported a significant focus offset between the best focus found with the calibration lamps and best focus on a star. G. Schmidt, M. Wagner, J. Bechtold, D. Smith, and D. Blanco discussed the problem. Research showed that this has been reported at least once before and probably dates to the detector upgrade last year. Several theories have been discussed, but the problem has not been solved. We hope to address the issue before the next run in July.

### SCCS

The new scheme for calculating grating angles has worked very well for all Red and Blue Channel gratings used so far. The IR-optimized 1200 g/mm grating for Red Channel used to be very problematic with the old system due to its very large initial tilt (it does not mount flat like the other gratings), but came up nearly spot-on during the last Red Channel run. There are still offsets of 20-50Å that can appear — these change between mountings. They correspond to offsets in grating angle of about 0.1 degrees. For most purposes, this level of accuracy in reported central wavelength is fine, but it's also easy to calibrate when the gratings are mounted. The SCCS interface will be updated to support this during summer shutdown.

**Rayleigh Laser Beacon**

June 2-7 saw the first engineering tests of the MMT Rayleigh laser beacon. This was a very successful shakedown and test firing of the beacon — and provided quite a spectacle for the crew. See the CAAO website for details (*http://caao.as.arizona.edu/*).

*Two views of the MMT during tests of the Rayleigh laser beacon. Left: the view from the bowl. Right: the laser beam transfer optics — the laser, mounted on the west side of the OSS, fires forward to the pupil optics box on the head frame, then across the telescope beam path to projector optics in the secondary hub, then to the sky. Photos by D. Blanco.*

**Hectospec/Hectochelle**

First light for Hectospec and Hectochelle occurred in the third trimester of 2003. Following engineering runs, the first Hectospec and Hectochelle observations were scheduled in March and April. The coatings on the Hectospec spectrograph optics were renewed prior to the April run. The new LLNL overcoated silver coatings on the Hectospec mirrors are performing well.

The Hectochelle run was plagued by bad weather, allowing only a few hours on the sky, but several projects on open clusters were completed and a preliminary test of the iodine cell precision radial velocity mode was carried out. The weather improved for the later Hectospec run, and about 10,000 spectra were collected in approximately seven usable nights. The fiber positioner and spectrograph worked superbly throughout.

The Hectospec was scheduled for 19 nights in June, and collected an additional 20,000 spectra for eight programs. The spectra were of high quality, and standard sky subtraction techniques were demonstrated to work well for galaxies as faint as R=22. At the end of the 18th night, a spring failed in the gripper for one of the two Hectospec robots, temporarily disabling the fiber positioner. Repairs will be carried out during the August shutdown. Including testing, commissioning, and scheduled observing, the robots completed about 100 nights worth of positioning sequences without failure. Despite poor weather near the end of the run, about 85% of the scheduled data for all of the programs were obtained.

During April and June, Perry Berlind and Mike Calkins (FLWO) underwent training to become fiber robot operators. Both Perry and Mike successfully operated the robots solo during the June run. Hectospec and Hectochelle observations will be made in queue mode, with Perry or Mike operating the robots. Observers are expected to be present on the mountain during their assigned time to operate the spectrograph and monitor data quality.

The Hectochelle spectrograph mirrors will be removed for recoating during the week of July 12, and Hectochelle will be restored to full operations by November 1. We look forward to a productive fall of observing with Hectospec and Hectochelle.

### SWIRC

The Hectospec run was followed by first light for SWIRC, the SAO Wide-field InfraRed Camera, a J and H band imager based on a 2048x2048 pixel HAWAII-2 HgCdTe engineering-grade detector. At *f*/5, SWIRC has a 0.15 arcsec per pixel plate scale, and a field of view of 5 by 5 arcminutes.

## General Facility

Mid-May through June saw some of the smoothest observing and operation we have yet seen with the new MMT, with almost no time lost to telescope or facility.

### Building Drive

On May 24 we had a single building to telescope collision. The day crew spent part of the next day exercising the building, and P. Spencer completed the installation of a data monitoring system to log the building servo commands, but we have not had a recurrence.

The spare Copley Controls building drive amplifier has been temporally installed in the rack and tested with building slews up to full speed. The new spare Copley building drive amp (model 262 PN) was successfully tested. Since the original drives are a different model (#264), some connector adaptors are required to run the spare in the existing building drive setup. The spare will be kept at the Common Building with appropriate adaptors.

### Instrument Rotator

An enclosed Nexen brake, EMB-1625 965321, and its accessories were ordered mid-June. The estimated time of delivery is July 8. The brake mounts and support structure are currently being designed and are to be ready for summer shutdown. A three-gallon accumulator and regulator have already been installed just above the air distribution cabinet on the east side of the telescope.

### Calibration Source Lamps

The calibration lamp boxes removed on June 6 were reinstalled on June 9 for the Hectospec run, and removed again on the 28th. We are planning to move them permanently to new locations supported on the chamber walls rather than on the telescope. A. Szentgyorgyi (CfA) met with M. Rademacher (CAAO) to discuss possible locations and mounting schemes.

**Safety**

D. Smith wrote a forest fire procedure that is posted on our web site at *http://www.mmto.org/misc/forestfire.shtml*.

The SI safety committee visited on May 4 for the MMT's annual safety review. Their report, issued late in June, gave the MMT good marks.

**Miscellaneous Facility Improvements**

On May 11 work began on restoring the building Freon system back into service. This system was dismantled during the conversion. Comfort Control Inc., a Tucson refrigeration contractor who installed much of the original system, came to inspect and repair the Freon lines. The goal for the first phase of restoration is to activate air conditioning in the control room. Over several visits during May and June they sealed off inactive runs, charged the system with Freon, and restored the compressors to service. New control wiring has to be run, and we soon expect to have an air-conditioned control room. A second phase will restore cooling for electronics racks on the dock, second floor west wing, and the third floor east wing.

On May 18 P. Ritz, K. Van Horn, and J. Labbe finished several months of effort re-connecting the telescope to the building fabric skirt and reinstalling the yoke room fan. Both the skirt and the fan had been dismantled during the conversion. The fan is now in regular nightly use and should provide a small improvement to the facility seeing by scavenging air from the area around the elevation drives and Cassegrain instruments. During this process some electrical code violations were discovered in the fan control and in the controls for the hydraulic lift platform. K. Van Horn and J. Labbe fixed the lift problems; work on the fan controls is underway.

Over the last two weeks in May, some large laser projection equipment was installed on the telescope in preparation for first trials of the new Rayleigh laser beacon. We thank all MMT users for their understanding and patience during this time, particularly those who gave up some of their afternoon time usually used for instrument setup and calibration flats.

During the week of June 4, Tucson Building and Remodeling installed a drawbridge hatch into the chamber wall by the west elevation axle. This penetrates into the bench spectrograph lab and provides a path to remove the Hectochelle collimator for recoating. The drawbridge also proved to be a useful platform for accessing the Rayleigh laser box that resides on the OSS just above the west elevation bearing.

K. Van Horn fixed a problem with the controls to the rollup door to the west wing instrument lab; these were improperly installed by the contractor. J. Labbe and K. Van Horn also cleaned up phone and network wiring in the fourth floor west wing.

The Rainwise and its Lantronix have been moved to the penthouse outside the elevator room. Unfortunately this places them in a turbulent zone subject to eddies and gusts, making the location unsatisfactory. We intend to move them, but a better location has not yet been determined.

A new three-bay electronics rack was installed in the yoke room and populated with laser electronics. P. Ritz cut ventilation paths to extract waste heat into the pit. K. Van Horn and J. Labbe installed AC power strips in each of the three racks, and by the end of June SAO had started to install their new computers.

The metal halide lamp in the northwest corner of the chamber has been repaired by replacing the starting capacitor.

The Carrier glycol system pump controls have been rewired to include phase-loss detectors to protect the motors.

B. Comisso installed the cabling to allow monitoring of the azimuth amplifier currents.

K. Van Horn is creating real schematics in ORCAD as an alternative to using the tedious Access database for the 26 V rack. T. Trebisky discovered the procedure to save ORCAD drawings in PDF format, which can be viewed with Adobe Acrobat, and is looking at ways to make these available on our website. C. Knop translated all the drawings, which were in the Completed Projects folder on mmt/electronics. K. Van Horn has placed preliminary copies of the new schematics here also. At this point the new schematic has eight "C" size sheets that cover all the systems, but they still need much clean-up. During this process we suddenly lost access to ORCAD when the University installed a new firewall on their server. We now must submit a list of all our computers and their IP addresses for inclusion through the firewall.

P. Spencer, J. Labbe, and P. Ritz rerouted the *f*/5 hexapod cabling along the neutral beam, and moved the *f*/5 cabling breakout box to accommodate telescope counterweights.

The DustTrak aerosol monitor, sent out for repair, has been returned and is now installed and operating normally.

## Visitors

May 25: Three members of Senator John McCain's (R-AZ) Committee on Commerce, Science and Transportation (Floyd Des Champs, Tamara Jackson, and Ken LaSala) visited the MMT, accompanied by Roger Angel of Steward; Judy Bernas, Associate VP for Federal Relations; and Prof. Jonathan Lunine, UA Lunar and Planetary Lab.

## Publications

### MMTO Internal Technical Memoranda

04-1 Pointing/Derotator Coalignment for Alt-Az Telescopes
G. Schmidt

04-2 MMT Primary Mirror Wash Results of May 11, 2004
W. Kindred

**MMTO Technical Memoranda**

None

**MMTO Technical Reports**

None

**Scientific Publications**

04-21 The First Measured Electron Temperatures for Metal-Rich H II Regions in M51
Garnett, D. R., Kennicutt, Jr., R. C., Bresolin, F.
*ApJ*, **607**, L21

04-22 Lessons Learned from the First Adaptive Secondary Mirror
Lloyd-Hart, M., Brusa, G., Wildi, F. P., Miller, D. L., Fisher, D. L., Riccardi, A.
*SPIE*, **5169**, 79

04-23 Interstellar Polarization in M31
Clayton, G. C., Wolff, M. J., Gordon, K. D., Smith, P. S., Nordsieck, K. H., Babler, B. L.
*AJ*, **127**, 3382

04-24 Double-Damped Ly$\alpha$ Absorption: A Possible Large Neutral Hydrogen Gas Filament Near Redshift $z = 1$
Turnshek, D. A., Rao, S. M., Nestor, D. B., Vanden Berk, D., Belfort-Mihalyi, M., Monier, E. M.
*ApJ*, **609**, L53

04-25 The New MMT
Blanco, D., Alegria, M., Callahan, S., Clark, D., Comisso, B., Gibson, J. D., Kindred, W., King, S., Knop, C., Lester, H., McAfee, J., Milone, A., Ortiz, R., Pickering, T., Ritz, P., Russ, B., Schmidt, G., Smith, D., Spencer, P., Trebisky, T., Van Horn, K., Wainwright, C., Williams, G., Williams, J. T.
Presented at SPIE conference, Glasgow, Scotland, June 21-25

04-26 Active Optics and Wavefront Sensing at the Upgraded 6.5-meter MMT
Pickering, T. E., West, S. C., Fabricant, D. G.
Presented at SPIE conference, Glasgow, Scotland, June 21-25

04-27 Performance and Control of the MMT Thermal System
Williams, G., Callahan, S., Gibson, J. D., Blanco, D., Williams, J. T., Spencer, P.
Presented at SPIE conference, Glasgow, Scotland, June 21-25

04-28 The MMT *f*/5 Secondary Support System: Design, Implementation, and Performance
Callahan, S., Cuerden, B., Fabricant, D., Martin, B.
Presented at SPIE conference, Glasgow, Scotland, June 21-25

**Observing Reports**

Copies of these publications are available from the MMTO office. We remind MMT observers to submit observers' reports, as well as preprints of publications based on MMT research, to the MMTO office. Such publications should have the standard MMTO credit line: "Observations reported here were obtained at the MMT Observatory, a facility operated jointly by the Smithsonian Institution and the University of Arizona."

Submit publication preprints to *bruss@mmto.org* or to the following address:

MMT Observatory
P.O. Box 210065
University of Arizona
Tucson, AZ 85721-0065

**MMTO in the Media**

No activity to report.

**MMTO Home Page**

The MMTO maintains a web site (*http://www.mmto.org*) that includes a diverse set of information about the MMT and its use. Documents that are linked to include:

1. General information about the MMT and Mt. Hopkins.

2. Telescope schedule.

3. User documentation, including instrument manuals, detector specifications, and observer's almanac.

4. A photo gallery of the Conversion Project as well as specifications related to the Conversion.

5. Information for visiting astronomers, including maps to the site.

6. The MMTO staff directory.

**Observing Database**

The MMTO maintains a database containing relevant information pertaining to the operation of the telescope, facility instruments, and the weather. Details are given in the June 1985 monthly summary. The data attached to the back of this report are taken from that database.

# Use of MMT Scientific Observing Time

**May 2004**

| Instrument | Nights Scheduled | Hours Scheduled | Lost to Weather | Lost to Instrument | * Lost to Telescope | ** Lost to Gen'l Facility | Total Lost |
|---|---|---|---|---|---|---|---|
| MMT SG | 15 | 121.40 | 24.50 | 1.13 | 0.13 | 1.50 | 27.25 |
| PI Instr | 14 | 117.90 | 24.50 | 6.00 | 16.25 | 0.00 | 46.75 |
| Engr | 2 | 16.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sec Change | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total** | **31** | **256.10** | **49.00** | **7.13** | **16.38** | **1.50** | **74.00** |

Time Summary Exclusive of Shutdown

| | |
|---|---|
| Percentage of time scheduled for observing | 93.4 |
| Percentage of time scheduled for engineering | 6.6 |
| Percentage of time scheduled for secondary change | 0.0 |
| Percentage of time lost to weather | 19.1 |
| Percentage of time not lost to weather lost to instrument | 3.4 |
| Percentage of time not lost to weather lost to telescope | 7.9 |
| Percentage of time not lost to weather lost to general facility | 0.7 |
| Percentage of time lost | 28.9 |

* Breakdown of hours lost to telescope
az/el oscillations 6
el oscillations/tuning 4
hacksaw 0.25
hexapod 6
telserver 0.13

** Breakdown of hours lost to facility
Laser group working late in chamber 0.5
power failure 0.5
sewer pump 0.5

**June 2004**

| Instrument | Nights Scheduled | Hours Scheduled | Lost to Weather | Lost to Instrument | * Lost to Telescope | Lost to Gen'l Facility | Total Lost |
|---|---|---|---|---|---|---|---|
| MMT SG | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PI Instr | 27 | 209.30 | 18.75 | 13.45 | 0.25 | 0.00 | 32.45 |
| Engr | 2 | 15.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sec Change | 1 | 7.80 | 3.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| **Total** | **30** | **232.50** | **21.75** | **13.45** | **0.25** | **0.00** | **35.45** |

Time Summary Exclusive of Shutdown

| | |
|---|---|
| Percentage of time scheduled for observing | 90.0 |
| Percentage of time scheduled for engineering | 6.6 |
| Percentage of time scheduled for secondary change | 3.4 |
| Percentage of time lost to weather | 9.4 |
| Percentage of time not lost to weather lost to instrument | 6.4 |
| Percentage of time not lost to weather lost to telescope | 0.1 |
| Percentage of time not lost to weather lost to general facility | 0.0 |
| Percentage of time lost | 15.2 |

* Breakdown of hours lost to telescope
hexapod 0.25

**Year to Date June 2004**

| Instrument | Nights Scheduled | Hours Scheduled | Lost to Weather | Lost to Instrument | Lost to Telescope | Lost to Gen'l Facility | Total Lost |
|---|---|---|---|---|---|---|---|
| MMT SG | 47 | 485.30 | 268.80 | 4.13 | 9.13 | 3.50 | 285.55 |
| PI Instr | 118 | 1114.00 | 354.85 | 45.45 | 46.80 | 1.75 | 448.85 |
| Engr | 12 | 122.70 | 19.10 | 0.00 | 0.00 | 0.00 | 19.10 |
| Sec Change | 5 | 49.60 | 3.00 | 0.00 | 0.00 | 0.00 | 3.00 |
| **Total** | **182** | **1771.60** | **645.75** | **49.58** | **55.93** | **5.25** | **756.50** |

Time Summary Exclusive of Shutdown

| | |
|---|---|
| Percentage of time scheduled for observing | 90.3 |
| Percentage of time scheduled for engineering | 6.9 |
| Percentage of time scheduled for secondary change | 2.8 |
| Percentage of time lost to weather | 36.5 |
| Percentage of time not lost to weather lost to instrument | 4.4 |
| Percentage of time not lost to weather lost to telescope | 5.0 |
| Percentage of time not lost to weather lost to general facility | 0.5 |
| Percentage of time lost | 42.7 |