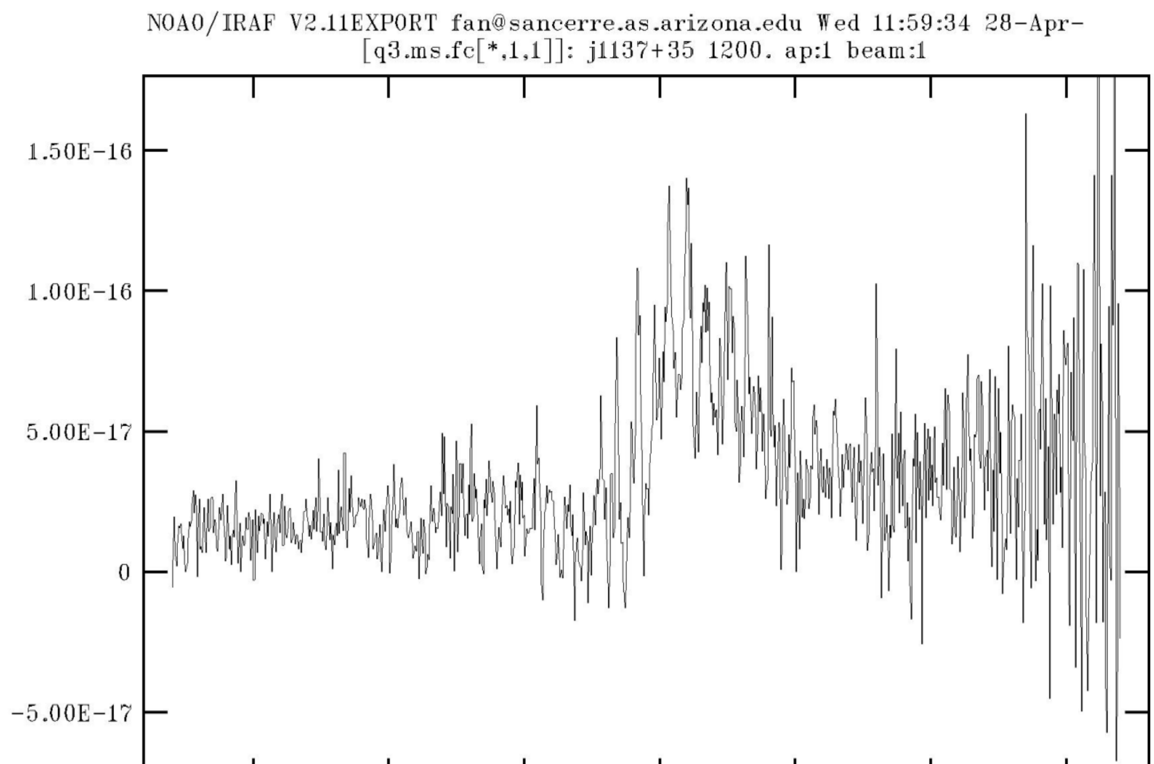
MMT Observatory
Smithsonian Institution &
The University of Arizona®

BIMONTHLY SUMMARY

March - April 2004



Spectrum taken on April 26, 2004 of a new z = 6.02 quasar, selected from SDSS photometry and discovered using the MMT Red Channel Spectrograph. Although it was observed through heavy clouds, the Ly-alpha feature is strong enough for identification. This is the seventh highest redshift quasar so far; the 3rd-highest at z = 6.2 was discovered at the MMT by the same group in June 2003. Observers were Xiaohui Fan, Jennifer Donley, and Linhua Jiang of Steward Observatory.

Personnel

In mid-March Grant Williams was hired as an Assistant Staff Scientist. During his 1.5 years as a Firestone Postdoctoral Fellow, Grant played a key role in installing and debugging the new suite of *f*/5 instruments. He is also leading the analysis of the thermal environment of the MMT primary mirror and telescope site. He works well with engineers and observers alike, and is a valuable addition to the staff. Grant's primary research interests center around γ-ray bursts and the structures of Wolf-Rayet star envelopes.

On March 15 Johnathan Labbe joined the mountain operations group as an electronics technician. Johnathan has proved to be a great addition to the staff, embracing any and all tasks with a cheerful, can-do attitude.

We bid fond farewell to Ricardo Ortiz on April 7, following three years on the operations staff. Ricardo will be sorely missed, and we wish him well in his new career as a distribution manager in Georgia.

Shawn Callahan left the MMTO at the end of April, following more than 14 years of distinguished service, to take up the position of Principal Engineer for the LBTO. Shawn's dedicated efforts helped earn the original MMT its reputation as one of the finest and most reliable large telescopes. He was central to the development and integration of the converted 6.5 m mirror and mount, and he was absolutely essential in bringing the *f*/5 secondary to successful operation. There is virtually no portion of our telescope or facility that has not enjoyed his attention. His energy, enthusiasm, and optimism—to say nothing of his engineering talents—will be greatly missed.

On March 15, electronic engineer Steve King resigned from the MMTO, prior to completing his 6-month probation period.

Creighton Chute accepted the MMTO's offer to hire him as a mechanical engineer after he graduates in May. Creighton will begin his new position in mid-August.

In late March, Aerospace and Mechanical Engineering student Thomas Hair was hired to work with the MMT mechanical group.

Primary Mirror Systems

Thermal Environment

For some time, thermal maps of the primary mirror have documented the development of localized gradients during the day, when the ventilation system is off. In late February measurements were obtained of the air flow and temperatures around the primary mirror cell. The data reveal clear evidence of passive convection; cold air was flowing out of the cell exhaust ports, and warm air (~7.5C warmer than the exhaust) was being drawn up through the ventilation "elephant" hoses. Based on these observations, shower caps were placed over the cell exhaust ports during the day. This routine continued throughout the two-month period. Though a rigorous analysis has not been carried out, it appears that this simple expedient helps reduce the thermal gradients in the mirror from ~5° C to less than 2° C at the beginning of each night.

On March 16 and March 24, the Carrier chiller used for primary thermal control acted erratically, turning itself off in the middle of the night. A Carrier technician, who paid a service call on March 26, reported that the unit's control computer had suffered memory loss and the control code had reverted to an incorrect state. The unit was reprogrammed. He had several suggestions for communications and control protocol, which D. Gibson incorporated into the thermal control code. The technician recommended replacing a faulty on-off switch. This failed soon after the visit and was replaced by K. Van Horn on April 8. Performance has been reliable since this repair.

RTV Puck Bonds

Concerns about the aging of the glue bonds that attach the support pucks to the back of the primary mirror were reported in the last period. On April 19 and 22, D. Blanco, P. Spencer, and T. Trebisky performed *in situ* measurements of the puck bond compliance. For these tests the mirror was floated while zenith pointing, and several mirror support actuators were instrumented with digital dial indicators with micron resolution. The actuators were biased to apply lateral (shear) force over a -50 to +50 lb range in 10 lb increments. With the mirror actively supported, the control system automatically adjusted the forces on all 132 actuators to hold the mirror in place. Recording the indicator reading and the actual force applied, we were able to measure the compliance of the actuator, cell, and puck. Readings were taken on four actuators along the midline of the mirror, and three on the outer edge of the mirror.

The outer actuators see much larger stresses in normal operation than the midline actuators, and are expected to become more compliant as the glue bond ages to failure. Indeed, we did observe that the outer actuators show greater compliance, but we also found variation in compliance from actuator to actuator. These findings have been reported to B. Olbert (SOML) for analysis. More tests are needed to assess the bond aging and predict a time to failure.

Optics

CO_2 cleanings were suspended during the *f*/5 run as a precaution against contaminating the corrector Sol Gel coating. The mirror was CO_2 cleaned on April 27. Preparations are underway for a mirror wash in May.

Primary Mirror Status

There was no activity on the primary mirror fractures during this period.

Secondary Mirror Systems

f/5 Baffles

On March 4-5, S. Callahan and C. Wainwright installed the mid-level *f*/5 baffle, a large (~2 m diameter x ~1.8 m tall) light-weighted structure suspended on a tensioned spider above the primary. This provides sufficient baffling for the ~½ degree field used by Megacam. Another smaller baffle is required to fully baffle the 1-degree field available for spectroscopy. Installation went well and the baffles were aligned under the supervision of N. Caldwell (CfA). The black flocking material used to cover the baffle came loose in several locations during the run and will need replacement before the next installation. The attachment of the baffle to the OSS proved to be easily adjustable and repeatable, allowing rapid installation and removal of the baffle. The mid-level baffle is too large to store on site, so it will be housed in the basement of the Common Building.

f/9 - *f*/15 Hexapod

Three feet of extension cables were added to the hexapod stationary ring electrical breakout box to simplify access to the hexapod electrical system connections at the secondary hub. This addition also simplifies removal and installation of the hexapod when swapping between the *f*/9 and *f*/15 secondaries.

Another task performed to improve *f*/15 operating conditions was the removal of all cabling, including air lines not required for *f*/15 operation, from the east lower secondary spider vane and then reworking the existing cabling so that it is routed in the spider vane "shadow." The cabling that was removed will be routed to the secondary hub via the east neutral member that is used for the *f*/9 and *f*/5 secondaries. These tasks were completed by P. Spencer and J. Labbe.

C. Chute and B. Comisso designed and fabricated a new transducer mount for the *f*/9 hexapod that should decrease the noise in the position servo.

Telescope Tracking and Pointing

Encoders

The azimuth encoder electronics were successfully upgraded to the current revision. Unfortunately, the signal-matching pots did not have enough range to completely minimize the sin/cos mismatch. We have since ordered a new set of precision resistors and re-sorted the preamplifiers, and hope to complete this work during the next reporting period.

Servos

On the evening of March 8 we saw the first evidence of servo instability. Oscillations of the elevation axis, with occasional azimuth oscillations, recurred with increasing frequency throughout the two-month period. Oscillations were reported on almost every night that weather permitted observing: March 8, 12, 13, 16, 22, 23, 26, 28, 29, 30, and on April 11, 13, 14, 15, 18, 19, 20, 22, 23, and 30. D. Clark attempted to retune the servos several times during the period.

On April 6 a "screech" was reported from the east elevation arc but the source of this noise was not found until later. While tracking on the night of April 13, the elevation brake came on, driving the current demand to 26 amps (normally <4 amps). This occurred again on the 22nd and was finally traced to a failure of the motor brake on the east elevation drive. The brake was removed and a replacement brake (plus 2 spares) were ordered.

Ed Bell, our consultant on the mount servos, is creating a continuous-time model of the elevation axis as a preliminary step to a new controller design. Early results on initial controller topologies are encouraging, and we await more data collection on the open-loop behavior of elevation to refine the model/controller design.

For open-loop data collection, we are now using the Mathworks xPC Target RTOS kernel running on a surplus desktop PC. With a PCI-bus IP-module carrier and the appropriate IP-modules (i.e. DAC, A2D, digital I/O, encoder counters), we can drive the telescope and collect data in real time from all the system encoders and sensors over an Ethernet connection. Custom Simulink I/O modules (written by D. Clark), representing the I/O hardware, are drawn into a Simulink diagram with the appropriate signal-handling blocks and compiled to run on the xPC Target machine. This method of graphical programming and real-time hardware testing is fast, flexible, and powerful. We plan to use this to develop the new controller system and test it on the telescope.

Computers and Software

Instrument Rotator Safety

Motivated by concern about the potential for serious consequences should we experience uncontrolled motion of the instrument rotator, a number of software changes were made to help avoid such an event. The most likely cause of such an event is loss of encoder feedback. This can happen if a cable is not properly connected, if electronics are not powered on, or if a cable is damaged by any number of things, not least of which is motion of the instrument rotator itself. Although it is possible for this to happen while the rotator is in operation, the most common runaway scenario occurs when the system is first powered on. Thus, many of the safety checks focus on what happens during the first several seconds after the rotator is powered on. We now require that some motion is sensed by the encoders within the first few seconds after the rotator is energized. Because two heads are mounted 180º apart on our tape encoder, we also require that the readings from both heads change commensurately. Servo error is monitored at all times and all motion is halted if the error becomes excessive. This "following-error" check is active at all times and will quickly halt motion if encoder feedback is lost.

The safety checks that have been developed and tested for the instrument rotator are immediately available for use on the other telescope axes (elevation and azimuth). The times and thresholds that trigger these emergency shutdowns have to be carefully adjusted so that they are sensitive enough to stop a real problem, yet do not interfere with normal operation. These runaway checks are in addition to software limits as well as final limits (and lanyards) that are handled independently of software.

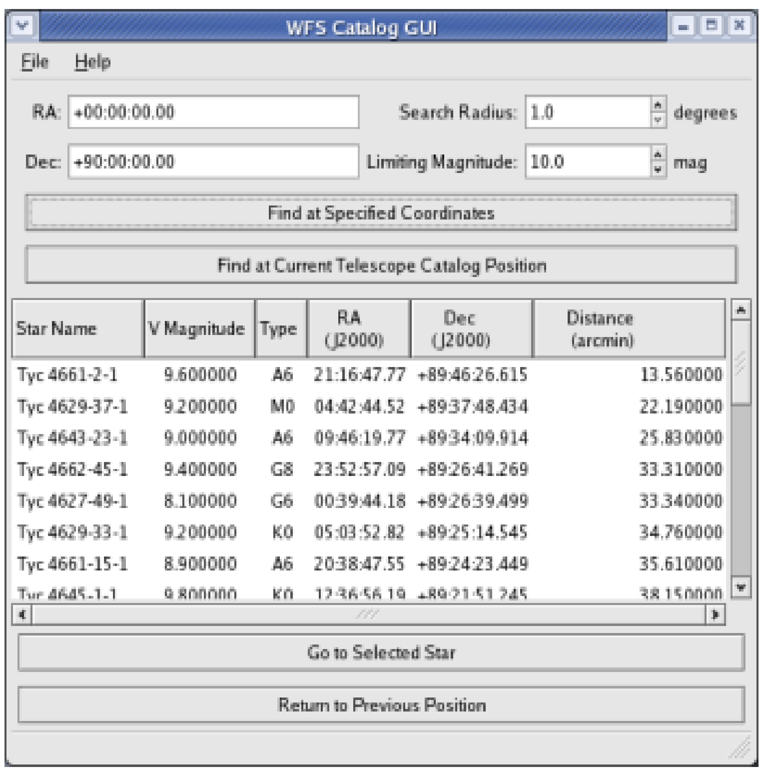
Hexapod Control Software

Work continues on the new Turbo UMAC controller that will be used to control all of the hexapods. This controller is accessed using TCP packets over an Ethernet. We have experienced some unexpected behavior with the network communication, and the Delta Tau engineers have been helpful, informing us about undocumented features of the protocol. The latest version of the Delta Tau controller uses entirely different network hardware, and we have been told that it gives much better performance.

Software has been written in the C language that will run under VxWorks to communicate with the Turbo UMAC controller. We also have diagnostic software that is written in Ruby/GTK that runs under Linux and communicates with the UMAC controller.

Wavefront Sensor Catalog GUI

A new window has been added to the *f*/9 and *f*/5 wavefront sensor (WFS) interfaces to help simplify and speed up the task of finding nearby stars suitable for wavefront sensing (see image below for a screenshot). Previously, the operator had to juggle between observer catalogs and several different WFS catalogs using the scope GUI on hacksaw. This was a rather cumbersome and slow process due to the large sizes of the WFS catalogs, and due to frequently having to swap between two computers to run the telescope and the WFS. The WFS catalog window accesses a binary version of the full Tycho2 catalog (from which the original WFS catalogs are derived) and can search this >2 million star catalog extremely quickly. A 1º radius search down to 10th magnitude around any position occurs almost instantaneously. Clicking on the column headings will cause the listing to be sorted by the selected column. Clicking a selected column heading again will reverse the direction of the sort. When the button to find stars at the current telescope position is clicked, the current catalog coordinates and mount offsets are queried and stored. The "Go to Selected Star" button commands the telescope to slew to the selected star's coordinate, clears any mount offsets, and turns off rotator tracking. After wavefront sensing is complete, the "Return to Previous Position" button puts the telescope back at the original catalog coordinates, restores the mount offsets, and turns rotator tracking back on. Thus, all of the telescope movement and configuration required to do wavefront sensing can now be done easily in once place.



Screenshot of the new WFS Catalog GUI

WFS Interfaces

Work has begun on a remote network interface to the WFS interfaces that will allow greater automation of the wavefront sensing process while retaining access to the fine-grained control that is currently available. Hooks are now in place to display and analyze data remotely, query and send Zernike coefficients and M1/M2 corrections, and query and set the WFS reference focus. Work is ongoing to make more capabilities available via the network and to build interfaces to take advantage of them.

VME Crate Network Protocol and Console Logging

Several VME computers running VxWorks are central to control of the telescope (the mount, cell, and hexapod computers). These all run servers that allow control of the telescope via packets sent over the network. As more and more use is made of these servers, it has become necessary to enhance and improve the protocols involved. A number of changes have been made to our remote protocol software, in many cases to aid diagnosis of problems that we were heretofore unable to easily fix. These computers are old and fairly slow by today's standards. We have found that they are typically able to handle 30 to 40 messages per second without sacrificing their ability to handle control tasks in real time, and it has been a challenge to achieve this level of performance.

New console logs have been developed to record the output of the serial ports of VME crates that operate the mirror cell, mount, hexapod, and CCD camera. Each unit uses a Lantronix device server that is assigned to a new private network for the MMT. The information originally designed to be displayed on a console terminal by the C code running within the crate is now being logged and should be extremely useful for debugging system problems. The scripts for logging data from the serial ports of the VME crates via the Lantronix units run on hacksaw and can be controlled by the "service" command.

Thermal System Mini-Servers

Much work was done on transferring the mini-servers used to monitor the MMT's thermal and environmental systems from the Ruby programming language to Perl. This conversion was done because of persistent memory management problems with the Ruby versions of these programs.

The following mini-servers were written in Perl:

1) Carrier
2) Cell
3) DataserverRelay
4) DustTrak
5) NE Cell Hewlett-Packard (HP) Data Acquisition Unit (DAU)
6) SE Cell HP DAU
7) NW Cell HP DAU
8) NE Cell HP DAU
9) Hexapod
10) Loft Neslab
11) Pit Neslab
12) Mount

13) RainWise
14) Pit HP DAU
15) Shop HP DAU
16) TempTrax
17) TempTrax2
18) New Vaisala, and
19) Old Vaisala

Each of these mini-servers involves two separate Perl scripts: a network server and a hardware client. The network server uses a common DataPorts.pm Perl module to establish a single-threaded, non-blocking, multiplexing socket server based upon the Perl IO::Socket and IO::Select modules. A separate Perl script, the hardware client, performs the communication with a hardware device such as the Carrier unit. The client then sets values in the appropriate server, the Carrier server in this case. In addition, the client reads values from the server to see if new values, such as setpoints, need to be changed in the hardware. The network servers also store values for all variables at 5-minute intervals. These values are used for 24-hr plots, such as of the ambient temperature. These plots are available on the MMT engineering web pages. The mini-servers are currently running on alewife. They can be started, stopped, or restarted via the "service" command.

Dedicated Telstat Monitor

G. Williams purchased a 20˝ LCD monitor and a network-bootable diskless computer that provide a dedicated telescope status display in the control room. The diskless computer runs a version of Linux from the Linux Terminal Server Project (http://www.ltsp.org). It boots via the network from hacksaw, mounts its file system from hacksaw:/mmt/ltsp/i386, and starts a display server with a browser window pointing to PHP-based web pages written by D. Gibson. The various pages can be cycled by clicking with a wireless mouse.

PC-NFS Server

Several PI instruments still run DOS on their data acquisition computers and use PC-NFS to access drives on networked machines. Providing PC-NFS support was one of the primary roles of our last remaining Sun workstation, ringo. Thanks to the help of J. Fookson at Steward Observatory, the PC-NFS server has now been ported to Linux. This port was installed within the /mmt hierarchy under /mmt/pcnfsd. It can be run on any one of the Linux machines on the summit, but by default is only run automatically on alewife. PIs should thus now use alewife as their PC-NFS server instead of ringo. As in the past, the mmtobs account is to be used for this purpose.

IRAF/Telescope Interface

Another one of ringo's roles was to act as a gateway between IRAF's ICE protocol and the SAO MSG protocol for querying the telescope and inserting queried data into CCD image headers. This was done via a small server provided by M. Conroy at CfA. In addition to being difficult to port to Linux, this server had not been updated in a long time and had a few bugs, including malformation of a couple of header entries. Starting with the most recent version of similar code that SAO used for Hecto and Megacam, a new server was assembled to fix these problems and run on packrat. It is now running on a port completely separate from similar SAO servers and was used successfully during the most recent Red Channel run. Hooks have been added to make the server start automatically when the computer boots, but these have not yet been fully tested.

Miscellaneous

The "chiboni" workstation has been upgraded to a ShuttleX computer and dual-monitor system. The system is loaded with Fedora Core 1 software. The old chiboni has been renamed "owl" and remains a dual-boot, Linux/Windows system.

The "rerr" program, which is used by the operators to view cell crate events and errors, is being rewritten from C to Ruby. This rewrite will facilitate code maintenance and improvement. Changes are being made to the Ruby version of rerr to make descriptions of events and errors from the cell crate more understandable. The log files related to rerr are now rolled over at noon each day.

We are in the process of replacing the Cyclades interface for the Carrier, RUPS room DAU, and Rainwise. These will be placed on Lantronix devices and into fiber access to the network in the RUPS room. We will also be putting the MGE UPS into this net interface. This operation will leave the blower controls and monitors in the original RUPS room fiber modem. K. Van Horn proposes placing the status monitor for the MGE UPS, which will operate without the network, into this fiber modem also.

A new Linux machine called homer has replaced ringo in the control room. It is configured the same as alewife and is to be used as a second observer's workstation. It could also be put into use as a spare for either hoseclamp or hacksaw should the need arise.

Minor changes have been made to the MMT engineering web pages. Among other changes, certain web pages now automatically cycle through a series by clicking anywhere on the page with the mouse. The balancer web page was updated based upon new equipment and values for existing equipment.

The operator's control console computer, hacksaw, froze on March 18, 19, and 30, and on April 6 and 30. Each time the computer required multiple reboots (up to six) to clear.

Instruments

Megacam

A total of 1360 exposures were recorded during the two-week Megacam commissioning and science run of March 12-29. During the week of instrument commissioning, several engineering tasks were completed as listed below:

- A new data analysis computer, "crunch," was installed and used during the run. The system uses dual-Xeon processors and has 1.5 Tb of disk space. The computer will be moved to the yoke room following the installation of the air-conditioned racks. Crunch will eventually replace packrat and cfaguider.

- Measurements of the background light in the Megacam images indicate that the mid-baffle greatly reduces the stray light. Modifications, which should be completed prior to the next Megacam run, include the addition of a lower-baffle and improved flocking on the mid-baffle.

- A source of scattered light introduced during readout was identified as a reflection off the wavefront sensor instrument package. Light was grazing off a vertical surface and entering the camera through a guider opening in the shutter. The surface will be flocked before the next run and perhaps baffled at a later date.

- The apparent 0.3 mm peak-to-valley focal plane curvature was investigated. Structural analysis is being performed to determine the cause of the curvature.

- Improvements to the guiding software were implemented. These modifications will make the software much more robust.

- Dome flats were recorded to determine if they could be used for data reduction. We found that with the existing set-up excessive scattered light prohibits the use of dome flats.

- The Megacam "Installation and Operation Notes" web page was updated.

- Shutter uniformity was measured by taking several flats using different integration times.

Rayleigh Beacon Laser Projector

In preparation for their June engineering run, the CAAO laser group, assisted by MMT staff, carried out a test fit of the projection optics and pupil box on April 15-16. Due to the tight clearance to the building, the cell was craned into position using a mobile crane situated in the parking lot. Measurements were made and the cell and box were removed for installation of the launch optics.

On March 30 the old laser bench was removed from the yoke room to make way for an electronics rack that will house the control electronics and amplifiers for the new laser.

f/9 Top Box

D. Smith and G. Schmidt installed a new CCD guider camera in the Top Box. This involved engineering and machining a mounting flange plate for our focal length. Also installed were a power supply, camera controller, and cooling bath on the Top Box access doors. The guider was successfully used in late April during both the SPOL and Red Channel observing runs.

General Facility

Unusual weather hampered observations in March and April. At the beginning of March a major snowstorm dropped more than 8 inches. Thunderstorms, unusual for this time of year, forced several shutdowns for lightning protection, though no strikes were recorded. At the beginning of April a second storm moved through southern Arizona depositing about 4 inches of snow, which kept the facility closed for several days. The FLWO road crew was very busy plowing and sanding to keep the road open. Thanks for their outstanding efforts.

Instrument Rotator Brake

During the installation of Hectospec on April 5, the instrument rotator experienced a runaway. Inspection found that a rotator encoder had been damaged while maneuvering the 3,000 lb instrument into position. This event precipitated an emergency effort to install safeguards to prevent a recurrence that might damage the 300 optical fibers. The software modifications discussed above were initiated immediately, and by April 8 the rotator was deemed safe enough to operate. C. Wainwright is leading a further effort to install a brake to safely stop the rotator in the case of an imbalance runaway. This is targeted for installation before the next Hectospec run in June.

K. Van Horn discovered that the modification he installed to prevent any of the axes from operating when the encoders are not powered interferes with the operation of the manual rotator control. The fix will be easy to accomplish but must be carefully planned, and will be carried out in the near future.

Building Drive

The new Copley building drive spare amplifier was received and installed but was found to be defective. It was therefore returned to Copley for inspection/repair. (Attempts to get the unit to power up in normal mode proved unsuccessful.)

Work on the building drive crash software for the DAU continues with much assistance from D. Gibson. A simple Tcl GUI has been completed, and work continues on automating the software so that the DAU receives and records data automatically. We note, however, that no telescope-building collisions occurred during this period.

RUPS

On March 15 our aging RUPS, which provided power backup for the facility, gave up the ghost. For years K. Van Horn had nursed this obsolescent unit, cannibalizing parts from a similar non-functional unit in the basecamp yard. This time he could not keep it alive. With help from S. Criswell and K. Myres (FLWO), a rush order was placed for a replacement solid-state UPS. The new ~1 ton unit was delivered and installed with assistance by T. Welsh (FLWO), and went into operation on April 16. RUPS is dead. Long live UPS.

Future maintenance for the new MGE UPS is enabled by a 90% spares kit ordered with the system. Tech support is available in Phoenix, and K. Van Horn recommends entering into a maintenance agreement. The tech has recommended additional parts to help recover from any lightning damage, and is going to recommend additional protection we should have. Ken recommends an additional module to give us status in the control room when the computers and network are down. He will be gathering all of the documentation in order to place it into a new H-file.

Miscellaneous

During M&E time on March 7-8, new calibration lamp boxes were installed on the OSS. Weighing some 600 lbs total, the boxes contain Th-Ar, He-Ar, Xe, Ne, Hg, and continuum lamps together with power supplies and communications for remote operations. Some 250 lbs of lead ballast were added to the drive arcs to offset the load. The lamps were tested during the subsequent Hectospec run.

On March 17 the limit switch on the rear shutter failed, causing alarmingly loud noises upon opening. FLWO provided a cherry-picker that K. Van Horn used to access and repair the switch from outside the building.

On April 12 Comfort Control, a Tucson HVAC contractor, began work on a Freon system that will provide AC to the control room and cooling for several electronics racks. Work is ongoing.

J. Labbe, P. Ritz, and K. Van Horn installed thermostatically-controlled exhaust fans and temperature-sensitive louvers in the support building compressor room. This will allow the back door to be closed to rats and other vermin that have had free reign of the facility.

During the reporting period TBR neared completion of the Common Building basement. While there are a few construction details to attend to, the basement storage is now available. D. West (FLWO) acquired industrial shelving and some cabinets on surplus, which we have stored in the basement. Once assembled, this will receive spare parts and miscellaneous equipment currently residing in the pit.

The R.M. Young wind instrument is not providing correct azimuth information. Replacement parts and spares have been ordered and should soon be installed.

D. Smith installed a stronger battery in the man-lift. There were problems with cold weather and heavy recharging on the existing deep cycle lead acid battery, so an AGM (Absorbed Glass Mat) battery was installed that should handle the problems.

The PI panels are now complete, including the repair of some of the original fiber connections.

Additional Ethernet ports have been added to the east end of the control room.

Visitors

March 24: Dr. Sheila Burke, Smithsonian Institution Department Secretary, visited in the evening.

March 25: Chris Walker and Andy Marble escorted a group of prospective grad students to the MMT to watch Jill Bechtold et al. observe with Megacam.

Publications

MMTO Internal Technical Memoranda

None

MMTO Technical Memoranda

None

MMTO Technical Reports

None

Scientific Publications

04-2 Hα-derived Star Formation Rates for the $z = 0.84$ Galaxy Cluster Cl J0023+0423B
Finn, R. A., Zaritsky, D., McCarthy, Jr., D. W.
ApJ, **604**, 141

04-3 Confirmation of SBS 1150+599A as an Extremely Metal-Poor Planetary Nebula
Jacoby, G. H., Feldmeier, J. J., Claver, C. F., Garnavich, P. M., Noriega-Crespo, A., Bond, H. E., Quinn, J.
AJ, **124**, 3340

04-4 The Tully-Fisher Relation in Coma AND Virgo Cluster S0 Galaxies
Hinz, J. L., Rieke, G. H., Caldwell, N.
AJ, **126**, 2622

04-5 SDSS J115517.35+634622.0: A Newly Discovered Gravitationally Lensed Quasar
Pindor, B., Eisenstein, D. J., Inada, N., Gregg, M. D., Becker, R. H., Brinkmann, J., Burles, S., Frieman, J. A., Johnston, D. E., Richards, G. T., Schneider, D. P., Scranton, R., Sekiguchi, M., Turner, E. L., York, D. G.
AJ, **127**, 1318

04-6 Discovery and Asteroseismological Analysis of the Pulsating sdB Star PG 0014+067
Brassard, P., Fontaine, G., Billères, M., Charpinet, S., Liebert, J., Saffer, R. A.
ApJ, **563**, 1013

04-7 Extraordinary Late-Time Infrared Emission of Type IIn Supernovae
Gerardy, C. L., Fesen, R. A., Ken'ichi, N., Garnavich, P. M., Jha, S., Challis, P. M., Kirshner, R. P., Höflich, P., Wheeler, J. C.
ApJ, **575**, 1007

04-8 Discovery of a New Class of Pulsating Stars: Gravity-Mode Pulsators among Subdwarf B Stars
Green, E. M., Fontaine, G., Reed, M. D., Callerame, K., Seitenzahl, I. R., White, B. A., Hyde, E. A., Østensen, R., Cordes, O., Brassard, P., Falter, S., Jeffery, E. J., Dreizler, S., Schuh, S. L., Giovanni, M., Edelmann, H., Rigby, J., Bronowska, A.
ApJ, **583**, L31

04-9 Cl 1358+62: Characterizing the Physical Properties of Cluster Galaxies at $z = 0.33$
Tran, K.-V. H., Simard, L., Illingworth, G., Franx, M.
ApJ, **590**, 238

04-10 *CHANDRA* Observation of 3C 212: A New Look at the X-Ray and Ultraviolet Absorbers
Aldcroft, T. L., Siemiginowska, A., Elvis, M., Mathur, S., Nicastro, F., Murray, S. S.
ApJ, **597**, 751

04-11 The Nature of E+A Galaxies in Intermediate-Redshift Clusters
Tran, K.-V. H., Franx, M., Illingworth, G., Kelson, D. D., Van Dokkum, P.
ApJ, **599**, 865

04-12 The H II Regions of the Damped Lyα Absorber SBS 1543+593
Schulte-Ladbeck, R. E., Rao, S. M., Drozdovsky, I. O., Turnshek, D. A., Nestor, D. B., Pettini, M.
ApJ, **600**, 613

04-13 Variability Tests for Intrinsic Absorption Lines in Quasar Spectra
Narayanan, D., Hamann, F., Barlow, T., Burbidge, E. M., Cohen, R. D., Junkkarinen, V., Lyons, R.
ApJ, **601**, 715

04-14 First Light of the 6.5-m MMT Adaptive Optics System
Wildi, F. P., Brusa, G., Lloyd-Hart, M., Close, L. M., Riccardi, A.
SPIE, **5169**, 17

04-15 MMT Adaptive Secondary: First AO Closed-Loop Results
Brusa, G., Riccardi, A., Wildi, F. P., Lloyd-Hart, M., Martin, H. M., Allen, R., Fisher, D. L., Miller, D. L., Biasi, R., Gallieni, D., Zocchi, F.
SPIE, **5169**, 26

04-16 Optical and Near-Infrared Study of the Cepheus E Outflow, A Very Low-Excitation Object
Ayala, S., Noriega-Crespo, A., Garnavich, P. M., Curiel, S., Raga, A. C., Böhm, K.-H., Raymond, J.
AJ, **120**, 909

04-17 Optical/Near-Infrared Spectroscopy of 10 Late-Type Dwarfs: Comparison with Models
Dawson, P. C., De Robertis, M. M.
AJ, **120**, 1532

04-18 A Broad Search for Counterrotating Gas and Stars: Evidence for Mergers and Accretion
Kannappan, S. J., Fabricant, D. G.
AJ, **121**, 140

04-19 The Optical Spectroscopic Evolution of V1974 Cygni (Nova Cygni 1992)
Moro-Martín, A., Garnavich, P. M., Noriega-Crespo, A.
AJ, **121**, 1636

04-20 A Medium-Resolution Near-Infrared Spectral Library of Late-Type Stars. I.
Ivanov, V. D., Rieke, M. J., Engelbracht, C. W., Alonso-Herrero, A., Rieke, G. H., Luhman, K. L.
ApJ Supp, **151**, 387

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 University of Arizona and the Smithsonian Institution."

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

Appearing in the Spring 2004 issue of *Arizona Alumnus*, volume 81/3, is a synopsis of the article entitled "Astronomers at MMTO Capture Planetary Nebula in Glowing Detail" that appeared on the *uanews.org* web site in January. The URL to the original article is below:

http://uanews.org/cgi-bin/WebObjects/UANews.woa/3/wa/SRStoryDetails?ArticleID=8434

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

March 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	29	297.20	101.50	1.00	24.70	1.50	128.70
Engr	0	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	2	21.30	0.00	0.00	0.00	0.00	0.00
Total	**31**	**318.50**	**101.50**	**1.00**	**24.70**	**1.50**	**128.70**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	93.3
Percentage of time scheduled for engineering	0.0
Percentage of time scheduled for secondary change	6.7
Percentage of time lost to weather	31.9
Percentage of time not lost to weather lost to instrument	0.5
Percentage of time not lost to weather lost to telescope	11.4
Percentage of time not lost to weather lost to general facility	0.7
Percentage of time lost	40.4

* Breakdown of hours lost to telescope
primary temp 1, raising primary 0.25
rotator 15.2
rotator, crane interlock, el oscillations 3
ventilation and hexapod 1, wavefront sensor 1
loose baffle flocking 1
mount software 2, hacksaw 0.25

** Breakdown of hours lost to facility
Carrier HVAC system 1, power failure 0.5

April 2004

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	* Lost to Telescope	Lost to Gen'l Facility	Total Lost
MMT SG	2	17.60	9.30	0.00	0.00	0.00	9.30
PI Instr	25	231.00	99.90	16.00	4.10	0.00	120.00
Engr	2	19.10	19.10	0.00	0.00	0.00	19.10
Sec Change	1	8.90	0.00	0.00	0.00	0.00	0.00
Total	**30**	**276.60**	**128.30**	**16.00**	**4.10**	**0.00**	**148.40**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	89.9
Percentage of time scheduled for engineering	6.9
Percentage of time scheduled for secondary change	3.2
Percentage of time lost to weather	46.4
Percentage of time not lost to weather lost to instrument	10.8
Percentage of time not lost to weather lost to telescope	2.8
Percentage of time not lost to weather lost to general facility	0.0
Percentage of time lost	53.7

* Breakdown of hours lost to telescope
elevation oscillations 3.6
primary panic, el servo bugs 0.5

Year to Date April 2004

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	Lost to Telescope	Lost to Gen'l Facility	Total Lost
MMT SG	32	363.90	244.30	3.00	9.00	2.00	258.30
PI Instr	77	786.80	311.60	26.00	30.30	1.75	369.65
Engr	8	90.50	19.10	0.00	0.00	0.00	19.10
Sec Change	4	41.80	0.00	0.00	0.00	0.00	0.00
Total	**121**	**1283.00**	**575.00**	**29.00**	**39.30**	**3.75**	**647.05**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	89.7
Percentage of time scheduled for engineering	7.1
Percentage of time scheduled for secondary change	3.3
Percentage of time lost to weather	44.8
Percentage of time not lost to weather lost to instrument	4.1
Percentage of time not lost to weather lost to telescope	5.6
Percentage of time not lost to weather lost to general facility	0.5
Percentage of time lost	50.4