

## End of Trimester Summary

September - December 2011



*MMT Staff from left:* D. Smith, D. Gibson, R. Ortiz, B. Russ, D. Porter, T. Trebisky, D. Gerber, M. Alegria, J.T. Williams, B. Kunk, J. McAfee, J. Di Miceli, G. Williams, D. Clark, M. Guengerich, T. Oldham, C. Chang, B. Comisso, C. Knop.  
*(Missing:* A. Milone, S. Gottilla, K. Powell, M. Lacasse, S. Schaller, W. Smith (student), X. Zhu (graduate research assistant).

## **Personnel**

Bryan Cardwell, Electrical Engineer on the mountain staff, left the MMTO for another position. His last day was September 16.

Morag Hastie, Staff Scientist and Instrumentation Coordinator, resigned her position to relocate out-of-state. Her last day was October 28.

Creighton Chang was hired as a half-time Engineer Associate in mid-December. Creighton had been with the MMTO as a student engineer for 5 years.

## **Talks and Conferences**

M. Hastie gave a talk on September 13 at the European Southern Observatory in Germany entitled “Ten Years of Observing with an AO Secondary – Lessons Learned.”

A talk entitled “Latest Ground Layer Adaptive Optics Results and Advancements in Laser Tomography Implementation at the 6.5m MMT Telescope” was given by E. Bendek on September 30 at the 2<sup>nd</sup> *International Conference on Adaptive Optics for Extremely Large Telescopes (AO for ELT)* held in Victoria, BC, Canada.

M. Hastie was a speaker at the *Women’s Science Forum* lunch at Steward Observatory on October 25.

The annual MMTO staff meeting and photo was held at the summit on November 1.

An MMT Council meeting was held November 22.

## **Primary Mirror Systems**

### **Primary Mirror Support**

The mountain spares locker inventory did not have a spare VME CPU for use in the interlock and cell computers. A spare VME167 CPU board was located at the campus office and prepared for use as a replacement cell computer CPU; it is now on the mountain in the spare parts locker.

The upgrade to the primary mirror actuator test stand is continuing. The newly painted and assembled test stand was brought to campus for final integration and testing. Some errors were found in the cable layout with regard to matching load cells to the correct EL3102 analog-to-digital modules. There were also issues with signal integrity on the multiplexer board. These were fixed just before the December holiday break. We plan to finish the upgrade during the next reporting period.

## **Aluminizing**

A series of aluminization meetings with personnel who will be involved in the next aluminization, including former MMTO employee Bill Kindred, have been held to develop plans and procedures to ensure a successful coating. During meeting discussions, it was agreed that the aluminization data acquisition system needs upgrades, particularly the PC used for reading the welder data and running the LabView data acquisition software.

The PC, which is currently running Windows XP, uses the same type motherboard that is used in the mount PC. The CPU is sufficiently outdated that we are unable to upgrade the system to Windows 7. We will purchase a new motherboard and other parts in order to upgrade it and keep the old motherboard as a spare for the mount computer.

## **f/15 Support**

The power on/off control bit from the VCCL supply in the deformable mirror (DM) power supply was re-enabled. It was disabled earlier in the year because the bit could take the supply down at times when the Thin Shell Safety (TSS) would take over and shut down the system. To allow for a remote reset of the supply as needed, a solid-state relay in the AC input was added. It is controlled by one of the remote-controlled outlets on the AO rack Ethernet power switch.

A small aluminum fixture was designed and made to hold DM actuators while we test their coil outputs and capacitive sensor circuits. Using this fixture, we are currently building prototypes to integrate a complete testing circuit. We hope to fix, if possible, a number of shelved actuators that do not work properly.

## **f/9-f/15 Hexapod**

An issue with pod E of the f/9-f/15 hexapod was discovered; during restart of the hexapod-linux server the pod moved 100 microns. With each consecutive restart, the error accumulated so extensive testing was initiated. Disconnecting the motor brake cable stopped the movement, eliminating the actual pod as the cause of the movement. We tested the analog and digital cards in the hexapod controller and found that all inputs were correct. The inputs to the pods were swapped, but the problem stayed with pod E. The command lines were disconnected from the PA39 drive circuit and, again, the pod moved during hexapod linux restart. The motor positive and negative power lines were disconnected and the problem stopped. It was determined that the PA39 drive card was sending a drive voltage to the pod during reboot. The card was swapped with a spare and the system was then tested with no problems.

## **Telescope Tracking and Pointing**

### **Servos**

An intermittent 13 and 25Hz vibration mode was found in the elevation servo that seems to correlate with wind disturbance and the f/5 baffles. Measurements of the open-loop elevation drive system response were performed in December.

It appears that using the absolute encoder for the control loop feedback in place of the drive arc tapes has two modal peaks at 13 and 25Hz that are not notched out in the flexible-mode filter in the controller. The associated phase jump with these modal peaks may cause the closed-loop elevation servo to be marginally stable; more detailed measurements are planned for the next M&E run in January.

## Computers and Software

Progress was made on the implementation of the “hacksaw recovery” plan, which aims to quickly recover from a failure of our mountain central server, “hacksaw.” This server is currently a single-point failure for telescope operations. Implementation of the recovery plan started with the purchase and configuration of a network-attached storage (NAS) device (“nas3”), which is located on campus. This NAS device is now in routine use as part of the data and software backup/archival for the MMTO, including data from nightly telescope operations. The NAS device will also be used for Windows and perhaps Macintosh storage requirements for the MMTO. The newly purchased virtual-machine host computer, “vmhost3,” was configured. Disk space on the campus server, mmto.org, was cleaned up to reduce disk storage and network transfer requirements. The mmto.org server was then virtualized (*i.e.*, converted from a physical machine to a virtual machine) and its hardware was turned off. The mmto.org virtual machine has been running well for several months. Since the mmto.org virtual machine is contained in a single file, it can easily be backed up and, if necessary, run on another host computer in case of a hardware failure. We will continue testing the recovery plan by configuring a second virtual-machine host (“vmhost4”) for campus, and then proceed with implementation of the plan on the mountain. It is anticipated that the campus virtual-machine hosts will also be used for virtualized Windows servers. Virtualization of “vault” and “integral,” both Windows 2003 servers, is planned for the near future. It is planned that they will be upgraded to use the Windows Server 2008 operating system.

Changes to the network, on both the mountain and campus, required modifications to dynamic host configuration protocol (DHCP) and network address translation (NAT).

The servers for azcam-based CCD cameras were upgraded by the Imaging Technology Lab (ITL). A high-accuracy shutter-open timestamp is now written into the header. Continuous temperature monitoring is available, and comparison lamp name-processing was made more robust.

Modifications suggested by the telescope operators for the annunciator were implemented. The alert sound is now delayed and the “reason” window pops up automatically.

## Network Upgrade

Extensive upgrades to the MMTO ethernet network continued this trimester. These upgrades included both MMT operations at the summit (MMT/Summit) of Mt Hopkins and campus (MMT/Campus) on the University of Arizona (UofA) campus. The upgrades were a combined effort between the MMTO, the UofA University Information Technology Services (UITS), the Smithsonian Institution (SI)/Fred Lawrence Whipple Observatory (FLWO), and the SI/Information Technology Operations, based in the Washington, DC area (SI/Washington).

Work on the network upgrade will continue into 2012. Following is a summary of the work performed during this trimester.

Figure 1 presents a schematic diagram of the overall network topology used by the MMT/Summit and MMT/Campus. Network interfaces from the MMTO network switches to UofA and SI switches are included in the figure. An entirely new MMTO network system, including new Cisco network switches, a new summit-campus microwave link, new cabling, an additional subnet (199.104.150/24), new UITS firewall rules, and new virtual local area networks (VLAN's), was implemented during September-December, 2011.

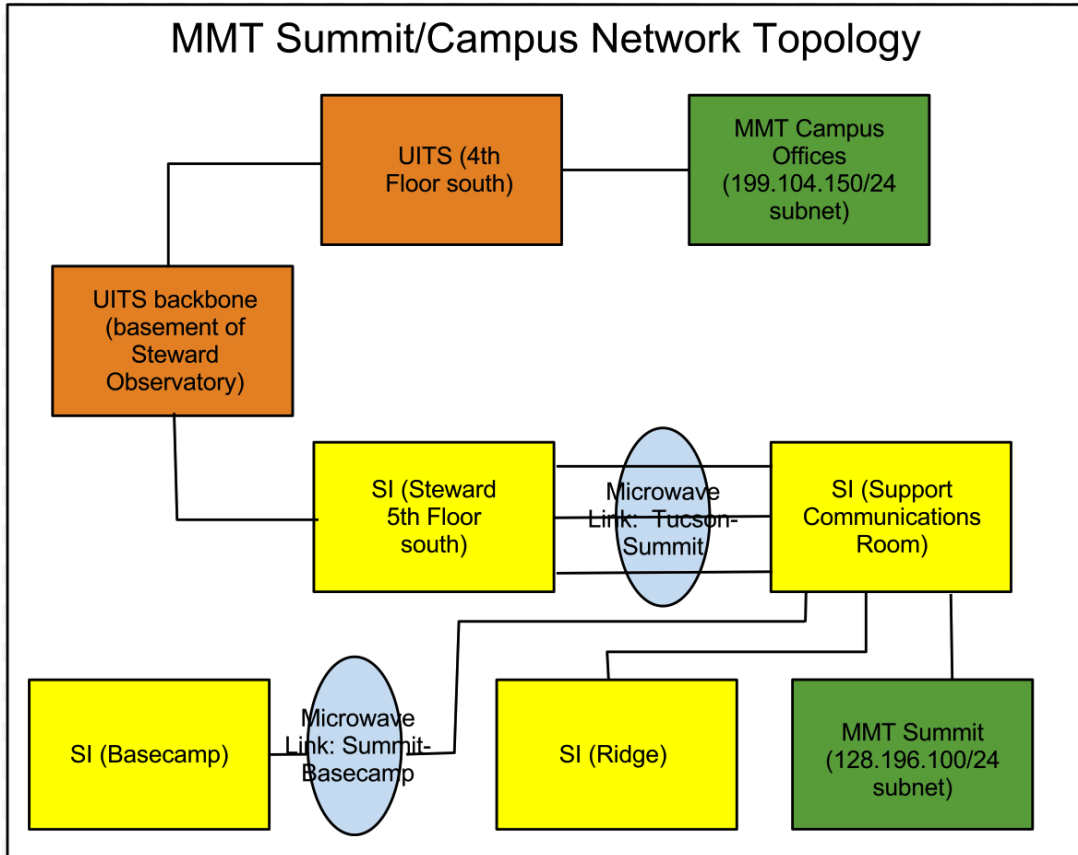


Figure 1. Overall network topology for the MMTO following the 2011 network upgrades. The two MMT facilities (shown in green) include the 128.196.100.0/24 subnet for MMT/Summit and the new 199.104.150.0/24 subnet for MMT/Campus operations. Smithsonian Institution (SI) components of the topology are shown in yellow. University of Arizona (UofA) University Information Technology Services (UITS) network elements are shown in orange.

### Separation of MMT/Summit and MMT/Campus into different subnets

In order to separate network traffic between the MMT, SI, and the UofA, the MMT was given use of subnet 199.104.150.0/24, formerly assigned to SI. Additional virtual local area networks (VLANs) were created by UITS and SI for the MMT/Summit and MMT/Campus subnets to isolate MMTO network traffic from SI and UofA traffic. All MMTO computers, printers, and network devices at the University of Arizona campus (MMT/Campus) were re-assigned static internet protocol (IP)

addresses to the new 199.104.150.0/24 subnet. Dynamic host configuration protocol (DHCP) was enabled for visitors and laptops used at campus operations.

The original 128.196.100.0/24 subnet spanned both the MMT/Summit and MMT/Campus operations through the summit-campus microwave link (see Figure 1). This subnet is now restricted to MMT/Summit use. Leaving the 128.196.100.0/24 subnet unchanged at the summit eliminated the need to reconfigure any computers in use at the MMT itself. With the separation of MMT/Summit from SI/FLWO network traffic, DHCP is now being used at the MMT/Summit to give users, including visiting astronomers, an MMT IP address rather than a SI IP address. This allows users to access printers and other network devices on the MMT subnet while at the MMT.

New firewall rules were implemented for the MMT by UITS for both subnets. Complete access is allowed between the two MMT subnets: 128.196.100.0/24 and 199.104.150.0/24. For computers not on the UofA campus, the new firewall rules allow access to secure shells (SSH) (port 22) to most MMT computers and non-secure and secure web servers (ports 80 [http] and 443 [https]) to select servers. In general, the new firewalls are more restrictive and improve the internet security for the MMT facilities.

In addition, two virtual private network (VPN) profiles, “MMT-Full” and “MMT-Split,” have been implemented by UITS and MMT staff. The “MMT-Full” VPN profile provides the user with a MMT/Campus DHCP IP address for both on-campus and off-campus connections. The “MMT-Split” VPN profile gives the user a MMT/Campus DHCP IP address for UofA campus-related connections and maintains the user’s existing IP address for non-campus connections. Typically, this existing IP address would be that which is provided by the user’s internet service provider (ISP). The “MMT-Split” VPN profile allows the user to access their local printer at home or at another location off the UofA campus. Use of these VPN profiles allow users secure remote access to the MMT subnets, and eliminates potential issues with UITS firewalls from off-campus locations.

### **Upgrade of Network Servers and Cabling for MMT/Campus**

New Cisco network switches were installed by UITS throughout Steward Observatory including the MMT/Campus office, conference, and lab areas. New Category 6 (Cat 6) cabling, the industry standard for Gigabit Ethernet, was run from these switches to MMT/Campus offices by a UITS subcontractor. During this trimester, network connections for all MMT/Campus computers were moved from a MMT-operated Cisco “Catalyst”-series switch, located in Steward/Rm 463, to UITS-operated Cisco switches. The MMT-owned Cisco Catalyst switch can now be used as a backup for other Cisco network switches. Included in this move were all computers and network devices in the office, laboratory, and conference areas used by MMT/Campus operations. New cabling was also run from the UITS Cisco network switch on the Steward 3rd floor to MMT servers and network-access storage devices located in the Steward/3rd floor server room. Computers in the Steward 3rd floor server room include the computer “vmhost3,” which hosts the “mmto.org” virtual server, and “vault,” the MMT Windows Active Directory server.

In addition, virtual machine host “vmhost4” was purchased and is identical in configuration to the existing “vmhost3” server. Fedora 15 was installed on the new “vmhost4” RAID-1 server. This server will be located in the Steward 3rd floor server room, and act as a backup for vmhost3. Several virtual machines, including mmto.org, can be run on either vmhost3 or vmhost4.

## Changes to MMTO wireless access points

Since the MMT/Campus operations has migrated to the UAWifi and UAPublic wireless systems, the MMT-operated Apple Airport Extreme wireless base station, and three Apple Express repeaters previously used by MMT/Campus operations, were moved to the MMT main building at the summit of Mt Hopkins. This Apple Extreme base station is now located on the second floor of the MMT. Apple Express repeaters are located on the 1st, 3rd, and 4th floors of the MMT, providing good wireless access throughout the MMTO. Use of UAWifi and UAPublic allow MMTO staff to have network access throughout Steward Observatory and most of the UofA campus.

Administration of the “aerosummit” highly directional wireless access point, which provides wireless access from the MMT summit to the Bowl dorm, was transferred from SI to MMTO. This wireless access point is now on the 128.196.100.0/24 MMT subnet.

## MMT/Summit Network Upgrade

Figure 2 summarizes the new network topology and network switches in place at the MMTO. The figure includes both the new Cisco managed-switches and two of the unmanaged (“dumb”) switches that are being used during the network transition.

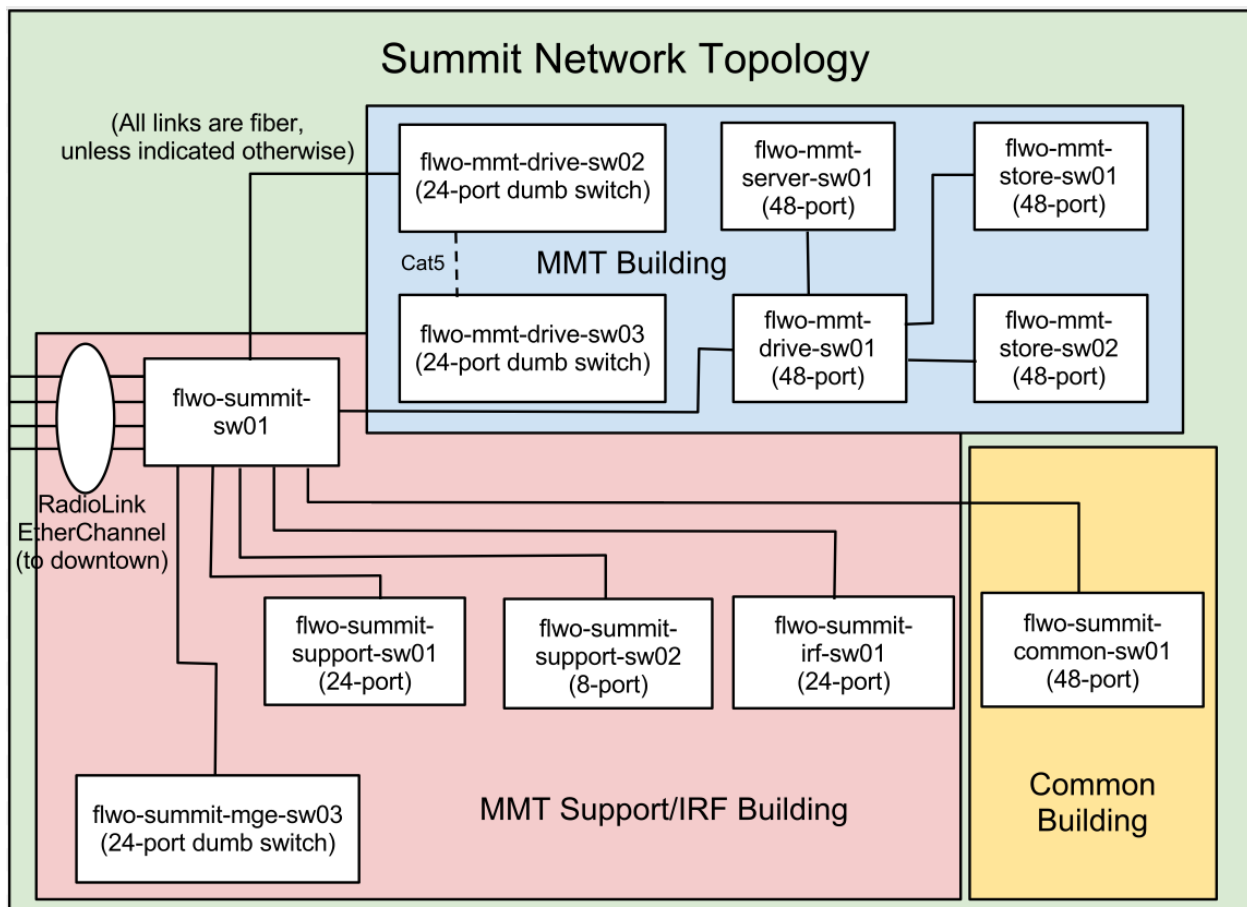


Figure 2. MMT-related Cisco switches at the MMT/Summit. All switch-to-switch connections are fiber links unless noted in the figure. Additional fiber links are planned between select network switches to provide redundancy and improve reliability.

After discussion between SI/Washington and MMTO staff, the 128.196.100 (VLAN 100) network spanning tree-root network switch was moved from the MMTO Support building (switch flwo-summit-support-sw01) to the MMTO drive room (flwo-mmt-drive-sw01). The VLAN 100 was also restricted to the MMT/Summit and no longer extends to SI/Ridge or SI/Basecamp operations. Moving the network spanning tree-root to the drive room switch reduces the spanning tree diameter (*i.e.*, the maximum number of possible hops) between network switches for network traffic within the MMT/Summit subnet. Restricting the extent of VLAN 100 reduces network traffic between MMT and other SI facilities at Mt Hopkins. This network traffic is typically very low.

Fiber connections are being installed between the network switch within the MMT drive room and the MMT 2nd floor, as well as the MMT drive room and the MMT 3rd floor. These additional fiber connections will provide redundant paths as well as potentially reduce the number of hops required for network traffic within the MMT building.

### **VoIP Phones for MMT/Summit**

Included in the network upgrade was deployment of over twenty new voice-over-IP (VoIP) phones at the MMT/Summit. New phone numbers were assigned to all MMT/Summit staff and communal phones. Users now have individual phone voicemail accounts. A “ring group” number, 520-879-4570, was set up that will ring all phones at the MMT summit (MMT building and IRF/Support building), but not at the Common building. This replaces the previous 520-670-6747 phone number used to contact the MMT. This new phone system allows users to call a specific individual or phone at the MMT, simplifying the process of contacting someone at the summit. The base stations of the phones also have a data port and can be used for a computer or other network device connection. Plans are also underway to install new Cisco wireless access points and Cisco wireless VoIP phones at the MMT.

### **Documentation of MMT Port Assignments**

A database of the network computer/device, the patch panel identifier, the Cisco switch port number, and the internal Cisco network topology interface, is being developed. As new devices and patch cables are deployed, the details of the connections between the network devices and the Cisco switches are being documented. Through the diagnostic tools available for the Cisco switches, network issues with individual network devices can be monitored.

### **Debugging of MMT/Summit Network Transition Issues**

A variety of issues have developed during the migration of MMT/Summit computers and network devices from the “old” network to the “new” network. These issues have had some impact on telescope operations, including a few hours of lost telescope time. Issues associated with the network upgrade include:

- 1) intermittent loss of the 10-Hz UDP “heartbeat” between the “mount” and “interlock” computers and when this heartbeat is interrupted, the drive amplifiers are de-energized for safety reasons,
- 2) various older network devices (*e.g.*, Temptrax digital thermometers) not being recognized by the new Cisco switches,



3) increased UDP checksum errors reported in the main MMT/Summit server, “hacksaw.”

As a result of these issues, various combinations of “old” and “new” network switch configurations have been tried. One recent change that has corrected at least a portion of these issues is disabling Power-over-Ethernet (PoE) for most ports on the new Cisco switches. By default, PoE had been enabled. PoE is now disabled on all switch ports except for those network devices that need it. For older devices, it is believed that the initial “handshake” between the Cisco switch and network device was not properly negotiating whether PoE was needed. This resulted in the network device not being detected by the switch.

Future testing will include the migration of “hacksaw,” the “mount,” and “interlock” crates to direct connection to the new Cisco switches.

### **Development of command-line and web-based tools for debugging network issues**

Read-only SNMP and Cisco command-line interface (CLI) user accounts and passwords were provided to the MMT by SI/Washington. Work continues on the development of web-based tools for monitoring network traffic, error messages, and other network activity from the Cisco switches.

### **Summary of Service Request (SR) Activity**

The MMT Service Request (SR) system is a web- and email-based informational system of operational issues that are segregated within a MySQL database by priority, subject, and category. The SR system is used by the entire staff for immediate communication and long-term documentation as operational issues are addressed and resolved.

Figure 3 shows the distribution of the 38 newly created or re-opened service requests (SRs) during the reporting period September through December 2011. Figure 4 illustrates the distribution of the 89 SR entries on which work was reported during the same reporting period. The three largest SR categories for both figures are: 1) Telescope, 2) Weather Systems, and 3) Software. Figure 5 summarizes the priority levels of the 38 newly created (or re-opened) SRs, with “Important” being the most common priority.

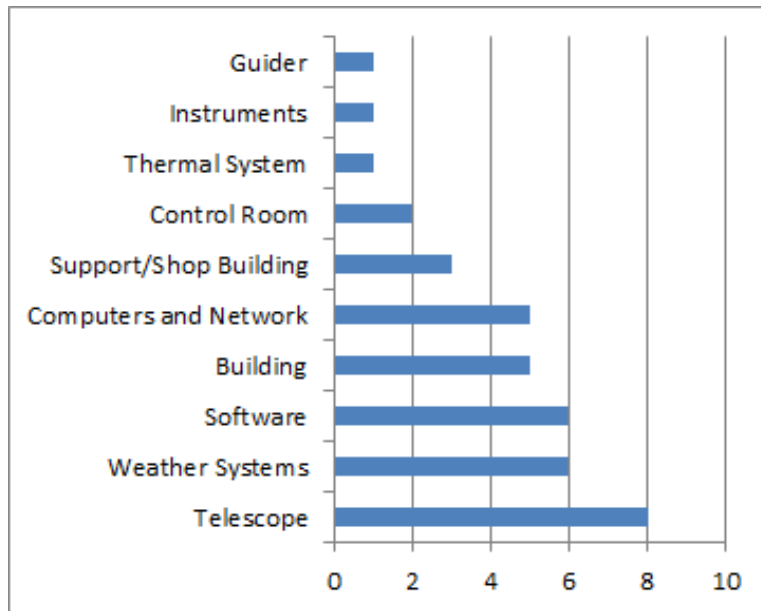


Figure 3. Categories of new or re-opened SRs from September through December 2011.

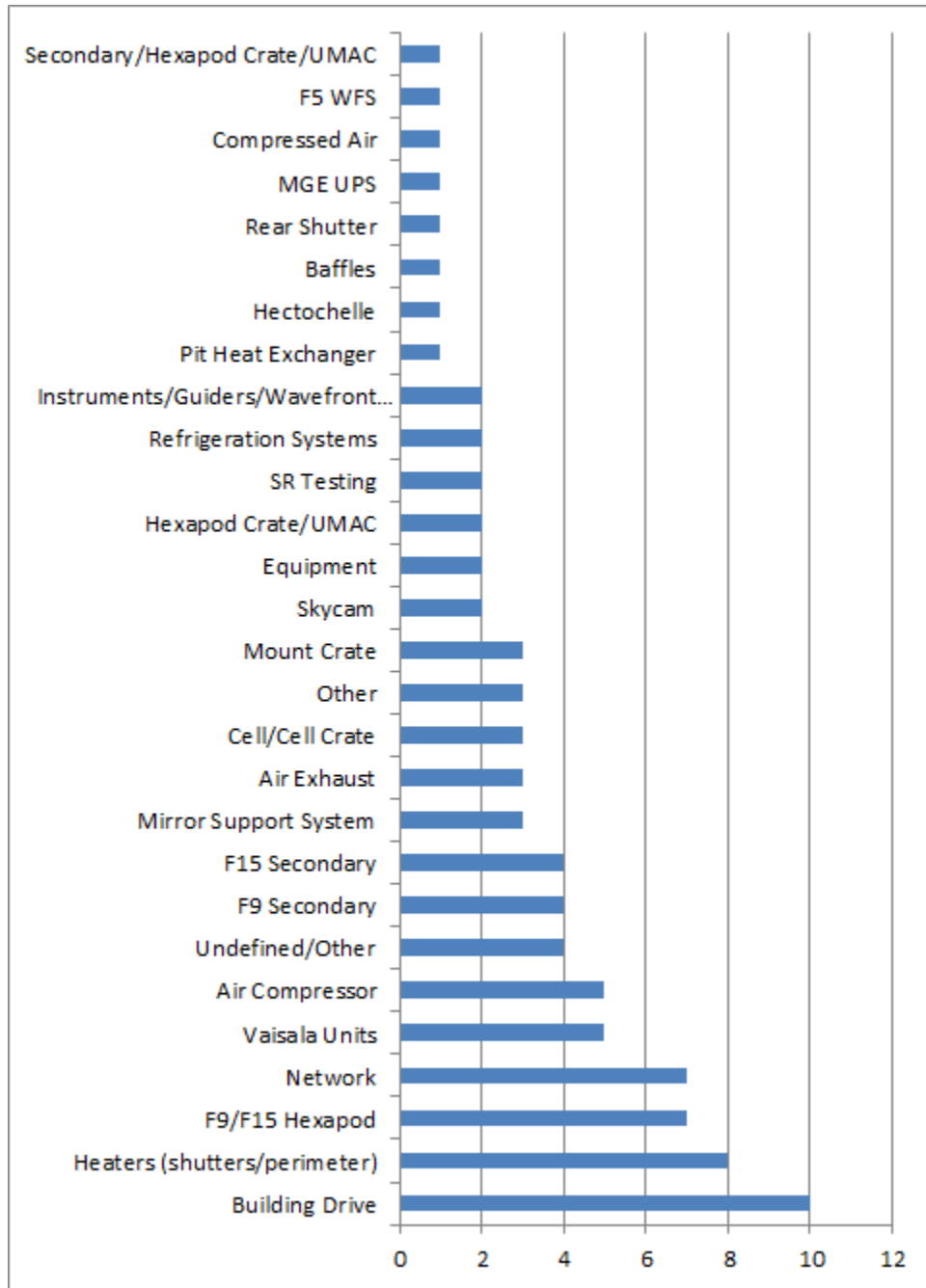


Figure 4. There were 89 responses within different categories from September through December 2011.

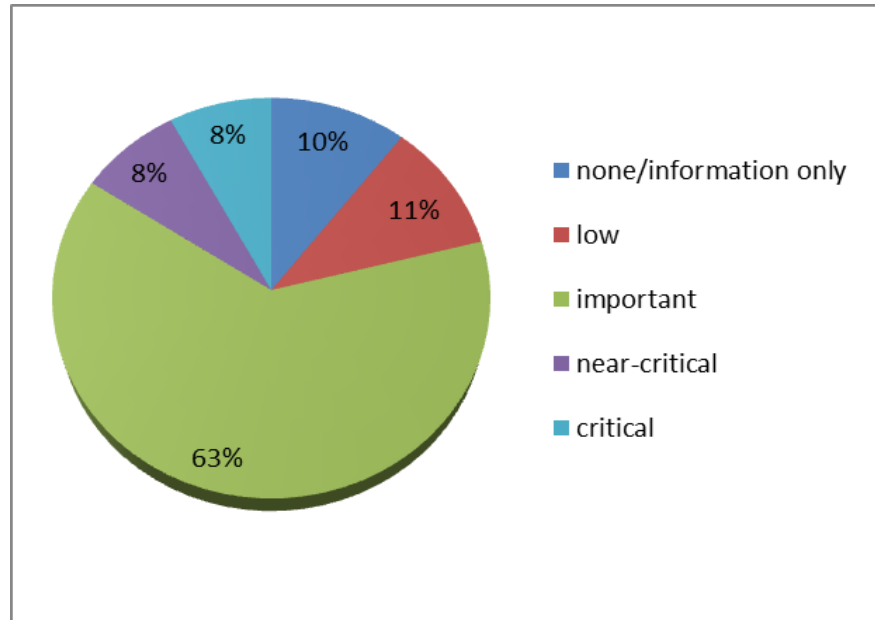


Figure 5. Percentages of the SRs in the five different priority categories from September through December 2011.

## Instruments

### f/9 Instrumentation

#### *Blue Channel and Red Channel Spectrographs*

A new 1200 lpm diffraction grating for the red channel spectrograph was purchased and received in December. A new cell which accommodates a large tilt for very red operation is being designed.

### f/5 Instrumentation

A total of 551 Hecto exposures were obtained on 154 fields over 31 nights. Losses were mostly due to weather but there was an hour and a half lost to hexapod and annunciator problems. A half hour was lost to a power failure and another half hour of sky time was lost when an encoder on the Hecto positioner failed. There were 5468 SWIRC exposures gathered over its 7 nights on the sky.

Two problems with the Robot electronics surfaced early in the trimester. Robot 2 X axis reported a comparison error between two of the three redundant encoders in early September. After looking at various values in the system, D. Fabricant, J. Rawling, and M. Lacasse believed that the rotary encoder for this axis was not working properly. The reporting of the compare error has been suppressed until the positioner can be serviced and the encoder fixed or replaced.

The next problem to surface was a fault condition for the Robot 1 P gimbal axis. The suspect controller was replaced and the system operated for a couple of days before the same error

resurfaced. The PMAC board was reading a fault condition on a line that should have been terminated with a pull up resistor, and was not even connected to the controller. This particular motor controller reports a fault condition until it is brought on-line, but the firmware will not bring it on-line until the fault condition is cleared. The software was again modified in multiple places so that this condition, which should have been ignored by circuit design, was being ignored by software implementation.

Another motor issue surfaced late in the trimester. There was a shift in the limit positions of the Robot 1 Y axis. It is believed that the glass encoder slide moved relative to its housing. To keep the robots within their 25 micron position tolerances, control of this axis was assigned to the rotary encoder attached to the motor shaft, by changing some cables and appropriate modifications of software.

A few problems appeared following the switchover to the new network. The connections had been changed from local hubs and switches to the new "smart" switches in early November, and connectivity to several of the internal network components were verified at that time. When the corrector was mounted on November 14, the server computers were not able to communicate with the computer named "hardware," which handles motor control. The connections were checked and found to be solid, the cable was checked and found to allow communication, but the servers were still unable to communicate or ping this computer. After using a laptop to initiate a ping to the gateway location from hardware's network cable, connectivity was restored. Communications to some other components also dropped out in mid-November. Communications to an edas (ethernet-to-serial) converter was corrected by unplugging the cable for several seconds and reconnecting. Connectivity to the camera housekeeping computer was corrected by swapping its network cable from a different fiber to a copper converter channel. The problem with communication to hardware recurred a few days later, but was corrected by rebooting the hardware computer. In early December, there were a couple more events of difficulty communicating with the edas unit that were solved by unplugging and reconnecting the ethernet cable.

The controller for the Turbo pump used with the Hecto dewars failed at the start of the trimester. Dewars were evacuated with the MMT pump station a few times until the replacement controller arrived and was installed.

A new battery was soldered onto the memory board in the SAO instrument rack. The last replacement had been 18 months earlier. A battery holder will be installed when the issue resurfaces.

## Seeing

### Summary of Wavefront Sensor Seeing Values

Figure 6 presents a histogram of wavefront sensor (WFS) seeing values in bins of 0.1 arc-seconds from September through December, 2011. The histogram shows the combined data sets as well as the individual data set for the f/5 and f/9 secondaries. As seen in Table 1, the median for the combined f/5 and f/9 WFS seeing values for this time period is 0.78 arc-seconds. A slightly higher

median value of 0.86 arc-seconds was obtained from the previous trimester. During the September - December period, the median f/5 seeing, 0.79 arc-seconds, was similar to the f/9 seeing, 0.76 arc-seconds. Improvement was seen in the f/9 seeing with a decrease from 0.92 arc-seconds in May-August, to 0.76 arc-seconds for September-December. The exact reason for this improved seeing is unknown, but may be related to more stable weather patterns in the fall and winter months.

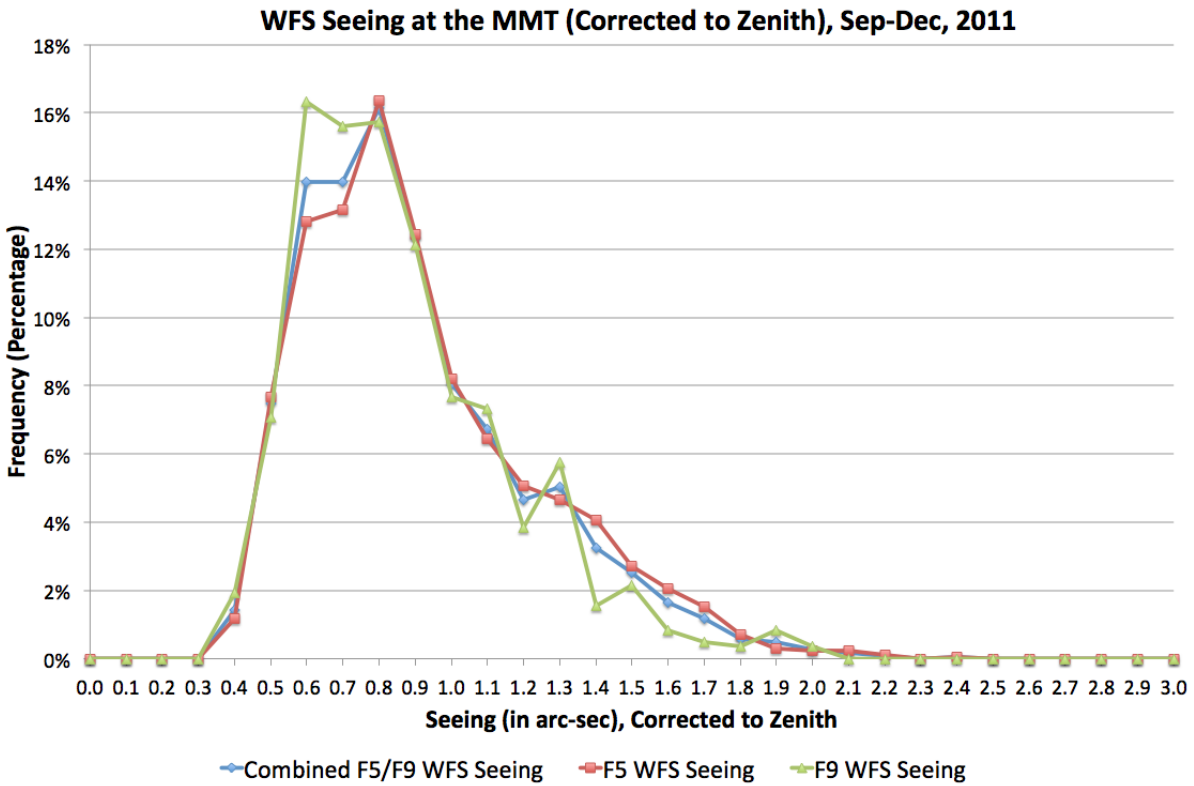


Figure 6. Histogram of WFS seeing values, September through December 2011.

Table 1. Statistics of WFS seeing values (corrected to zenith), September through December 2011.

	<b>Combined F5/F9 Seeing (Corrected to Zenith)</b>	<b>F5 Seeing (Corrected to Zenith)</b>	<b>F9 Seeing (Corrected to Zenith)</b>
<b>Count</b>	<b>2528</b>	<b>1695</b>	<b>833</b>
<b>Median</b>	<b>0.78</b>	<b>0.79</b>	<b>0.76</b>
<b>Mean (Average)</b>	<b>0.85</b>	<b>0.87</b>	<b>0.82</b>
<b>Mode</b>	<b>0.8</b>	<b>0.8</b>	<b>0.6</b>

## **Safety**

A CPR/First Aid Training class was held on November 9 at the campus office with six staff members attending. A second training was held November 22 at the Mt. Hopkins Administrative Complex with six mountain staff members attending. These classes were conducted by Desert Fire, Inc.

FLWO quarterly safety meetings were held on September 21 and December 15. J. Di Miceli conducted a walk-through inspection of the MMTO prior to the meetings and attended as the MMTO representative.

## **General Facility**

### **Building Drive**

There were a number of intermittent “major fault” incidents with the building drive during the reporting period. B. Comisso built a test harness to sample the building drive logic signals to determine which sensed item was dropping out and triggering the fault condition. The test harness showed that there was an intermittent motor field sensor failure. The motor field voltage is continuously sensed electronically based on a voltage from the field supply fuses. The fuses and wiring were checked and showed no problems. However, the fuse holder did not have proper tension on the fuse. A new fuse block was temporarily installed, along with new spring clip connections on the fuses, which fixed the intermittent field supply dropouts in the sense circuit. The new fuse holder will be permanently installed in the future.

While working on the building drive cabinet, the ventilation fan assembly was found to have bad rubber mounts again. We replaced the entire unit with a muffin-fan frame to prevent having ozone-damaged rubber mounts in the future.

The aluminum tape applied over the small section of the roof and heat traces last summer is still well-adhered. The aging test-piece kept at the shop roof bell-jar storage is also showing no signs of deterioration so far.

### **Other Facility Improvements and Repairs**

On October 26, a freon leak was repaired by Cactus Cooling in the air conditioning unit on 2nd floor west, where the f/5 instruments are stored.

Organization of the Instrument Repair Facility (IRF) building is on-going. Instruments are repaired and/or stored in the facility.

Two new microwave dishes were installed on the summit by SI contractors. One dish is located behind the shop, pointing at the MMT campus office at Steward Observatory. The second dish is located on the west side of the summit, pointing at the basecamp. (See Figure 1 on p. 6 showing network topology.)

## Visitors

9/7/11 – A British film crew from the Discovery Channel filmed video of the MMT rotating, opening, and of the Laser Guide Star firing during the first few hours of the night. It will be incorporated into a program to be aired in 2012.

9/12/11 – Four engineers, led by J. Kern, from the Jet Propulsion Laboratory in Pasadena, CA toured the MMTO.

9/29/11 – Grant Williams conducted a tour of the MMTO for Green Valley, AZ newspaper editor, D. Shearer, reporter P. Franchine, and S. Kardel, public information officer for the International Dark Sky Association (IDA).

10/31/11 – Members of the Antique Telescope Society visited the MMTO along with the regularly scheduled public tour group.

## MMTO in the Media

11/4/11 – Dr. Michael Hart, Astronomer at Steward Observatory, UofA, gave a public lecture entitled “How to make lasers and telescopes give the best views of the sky” at the Arizona Science Center in Phoenix, Arizona. The abstract for his talk began “The MMT Observatory is leading the way in new technologies that let telescopes see the heavens more clearly than ever before.”

## Publications

### MMTO Internal Technical Memoranda

11-03 Actuator and Electronics Card Troubleshooting  
D. Gerber, September  
<http://www.mmt.org/node/245>

11-04 Single Actuator Teststand Installation Instructions  
D. Gerber, September  
<http://www.mmt.org/node/245>

11-05 Dual Actuator Teststand Installation Instructions  
D. Gerber, September  
<http://www.mmt.org/node/245>

### MMTO Technical Memoranda

None

### MMTO Technical Reports

None



## Scientific Publications

(online publication list can be found in the MMTO ADS Library at <http://www.mmt.org/node/244>)

- 11-21 An Analysis of Pluto Occultation Light Curves Using an Atmospheric Radiative-Conductive Model  
A.M. Zalucha, et al.  
*Icarus*, **211**, 804
- 11-22 Disk Evolution in W5: Intermediate-Mass Stars at 2-5Myr  
X.P. Koenig and L.E. Allen  
*ApJ*, **726**, 18
- 11-23 The Mid-IR- and X-ray-Selected QSO Luminosity Function  
R.J. Assef, et al.  
*ApJ*, **728**, 56
- 11-24 First Spectroscopic Measurements of [O III] Emission from Ly $\alpha$  Selected Field Galaxies at  $z \sim 3.1$   
E.M. McLinden, et al.  
*ApJ*, **730**, 136
- 11-25 Evidence for Rapid Redshift Evolution of Strong Cluster Cooling Flows  
R. Samuele, B.R. McNamara, A. Vikhlinin, & C.R. Mullis  
*ApJ*, **731**, 31
- 11-26 Direct Confirmation of the Asymmetry of the Cas A Supernova with Light Echoes  
A. Rest, et al.  
*ApJ*, **732**, 3
- 11-27 The Diversity of Massive Star Outbursts. I. Observations of SN2009ip, UGC 2773 OT2009-1, and Their Progenitors  
R.J. Foley, et al.  
*ApJ*, **732**, 32
- 11-28 The Highly Dynamic Behavior of the Innermost Dust and Gas in the Transition Disk Variable LRL 31  
K.M. Flaherty, et al.  
*ApJ*, **732**, 83
- 11-29 Hot-Dust-Poor Quasars in Mid-Infrared and Optically Selected Samples  
H. Hao, et al.  
*ApJ*, **733**, 108
- 11-30 The Mid-Infrared Luminosity Function at  $z < 0.3$  from 5MUSES: Understanding the Star Formation/Active Galactic Nucleus Balance from a Spectroscopic View  
Y. Wu, et al.  
*ApJ*, **734**, 40

- 11-31 The NEWFIRM Medium-Band Survey: Photometric Catalogs, Redshifts, and the Bimodal Color Distribution of Galaxies Out To  $z \sim 3$   
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- 11-32 A Census of Star-Forming Galaxies at  $z = 1-3$  in the Subaru Deep Field  
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- 11-33 The High Albedo of the Hot Jupiter Kepler-7 b  
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- 11-34 The 2001-2003 Low State of Nova Lacertae 1950 (DK LAC)  
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- 11-35 Mapping the Asymmetric Thick Disk. II. Distance, Size, and Mass of the Hercules Thick Disk Cloud  
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- 11-36 Near-Infrared Imaging of Six Metal-Rich Quasar Absorber Galaxy Fields  
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- 11-37 The Most Slowly Declining Type Ia Supernova 2001ay  
K. Krisciunas, et al.  
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- 11-38 Discovering the Missing  $2.2 < z < 3$  Quasars by Combining Optical Variability and Optical/Near-infrared Colors  
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- 11-39 New Constraints on Companions and Dust Within a Few AU of Vega  
B. Mennesson et al.  
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- 11-40 Characteristics of Planetary Candidates Observed by *Kepler*. II. Analysis of the First Four Months of Data  
W. J. Borucki, et al.  
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- 11-41 A Comprehensive Spectroscopic Analysis of DB White Dwarfs  
P. Bergeron, et al.  
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- 11-42 Re-examining High Abundance Sloan Digital Sky Survey Mass-Metallicity Outliers: High N/O, Evolved Wolf-Rayet Galaxies?  
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- 11-43 Infrared Studies of Epsilon Aurigae in Eclipse  
R.E. Stencel, et al.  
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- 11-44 The Relationships Among Compact Stellar Systems: A Fresh View of Ultra Compact Dwarfs  
J.P. Brodie, A.J. Romanowsky, J. Strader, D.A. Forbes  
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- 11-45 Dust Grain Evolution in Spatially Resolved T Tauri Binaries  
A.J. Skemer, et al.  
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- 11-46 Kepler-14b: A Massive Hot Jupiter Transiting an F Star in a Close Visual Binary  
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- 11-47 Wide-Field Precision Kinematics of the M87 Globular Cluster System  
J. Strader, et al.  
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- 11-48 Hectochelle: A Multiobject Optical Echelle Spectrograph for the MMT  
A. Szentgyorgyi, et al.  
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- 11-49 The Formation and Early Evolution of Brown Dwarfs Viewed Through the Orion Dispersed Populations  
J.J. Downes, et al.  
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A.L. Coil, et al.  
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- 11-51 Constraining Halo Occupation Properties of X-Ray Active Galactic Nuclei Using Clustering of *CHANDRA* Sources in the Boötes Survey Region  
S. Starikova, et al.  
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- 11-52 Minor Merger-induced Cold Fronts in Abell 2142 and RXJ1720.1+2638  
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- 11-53 Radio Stacking Reveals Evidence for Star Formation in the Host Galaxies of X-Ray-Selected Active Galactic Nuclei at  $z < 1$   
C.M. Pierce, D.R. Ballantyne, and R.J. Ivison  
*ApJ*, **742**, 45
- 11-54 Galaxies in X-Ray Groups. I. Robust Membership Assignment and the Impact of Group Environments on Quenching  
M.R. George, et al.  
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- 11-55 SDSS J163030.58+423305.8: A 40-min Orbital Period Detached White Dwarf Binary  
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A.L. Coil, et al.  
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- 11-57 A Multiwavelength Study of Binary Quasars and Their Environments  
P.J. Green, et al.  
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- 11-58 Estimating the Effects of Structural Vibration on Adaptive Optics System Performance  
K. Powell  
*Applied Optics*, **50**, 2185
- 11-59 Mapping the Universe: The 2010 Russell Lecture  
M.J. Geller, A. Diaferio, and M.J. Kurtz  
*AJ*, **142**, 133
- 11-60 The Frequency of Hot Jupiters in the Galaxy: Results from the SuperLupus Survey  
D.D.R. Bayliss and P.D. Sackett  
*ApJ*, **743**, 103
- 11-61 Pan-STARRS1 Discovery of Two Ultraluminous Supernovae at  $z \approx 0.9$   
L. Chomiuk, et al.  
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- 11-62 The Stellar, Molecular Gas, and Dust Content of the Host Galaxies of Two  $z \sim 2.8$  Dust-Obscured Quasars  
M. Lacy, et al.  
*AJ*, **142**, 196
- 11-63 The Relationships Among Compact Stellar Systems: A Fresh View of Ultracompact Dwarfs  
J.P. Brodie, et al.  
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- 11-64 The Hidden Mass and Large Spatial Extent of a Post-Starburst Galaxy Outflow  
T.M. Tripp, et al.  
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- 11-65 Birth of a Relativistic Outflow in the Unusual Gamma-Ray Transient Swift  
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B.A. Zauderer, et al.  
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- 11-66 A Compact System of Small Planets Around a Former Red-Giant Star  
S. Charpinet, et al.  
*Nature Lett.*, **480**, 496

### **Non-MMT Scientific Publications by MMT Staff**

None

### **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 [mguengerich@mmt.org](mailto:mguengerich@mmt.org) or to the following address:

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

### **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

### September 2011

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>*Lost to Instrument</u>	<u>**Lost to Telescope</u>	<u>***Lost to Gen'l Facility</u>	<u>****Lost to Environment</u>	<u>Total Lost</u>
MMT SG	10.00	98.20	49.60	0.00	0.00	3.30	0.00	52.90
PI Instr	19.00	188.70	78.05	0.00	1.50	0.50	0.00	80.05
Engr	1.00	9.60	7.50	0.50	0.00	0.00	0.00	8.00
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>30.00</b>	<b>296.50</b>	<b>135.15</b>	<b>0.50</b>	<b>1.50</b>	<b>3.80</b>	<b>0.00</b>	<b>140.95</b>

#### Time Summary

Percentage of time scheduled for observing	96.8
Percentage of time scheduled for engineering	3.2
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	45.6
Percentage of time lost to instrument	0.2
Percentage of time lost to telescope	0.5
Percentage of time lost to general facility	1.3
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	47.5

#### \* Breakdown of hours lost to Instrument

0.50 Hecto robot

#### \*\* Breakdown of hours lost to telescope

0.50 Annunciator indication of false M1 status  
1.00 Hexapod

#### \*\*\* Breakdown of hours lost to facility

0.30 Lamp  
0.50 Shop breaker  
3.00 Power outage

### October 2011

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>*Lost to Instrument</u>	<u>** Lost to Telescope</u>	<u>***Lost to Gen'l Facility</u>	<u>****Lost to Environment</u>	<u>Total Lost</u>
MMT SG	9.00	97.20	25.30	0.00	1.00	0.00	0.00	26.30
PI Instr	20.00	218.00	20.50	0.00	2.00	0.00	0.00	22.50
Engr	2.00	21.20	21.20	0.00	0.00	0.00	0.00	21.20
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>31.00</b>	<b>336.40</b>	<b>67.00</b>	<b>0.00</b>	<b>3.00</b>	<b>0.00</b>	<b>0.00</b>	<b>70.00</b>

#### Time Summary

Percentage of time scheduled for observing	93.7
Percentage of time scheduled for engineering	6.3
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	19.9
Percentage of time lost to instrument	0.0
Percentage of time lost to telescope	0.9
Percentage of time lost to general facility	0.0
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	20.8

#### \*\* Breakdown of hours lost to telescope

2.00 AO loop & software issue  
1.00 Rotator guider software

### Year to Date October 2011

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>Lost to Instrument</u>	<u>Lost to Telescope</u>	<u>Lost to Gen'l Facility</u>	<u>Lost to Environment</u>	<u>Total Lost</u>
MMT SG	102.00	991.70	288.65	13.55	1.75	6.55	8.60	319.10
PI Instr	159.00	1530.80	388.10	4.00	45.50	2.50	5.00	445.10
Engr	15.00	145.60	38.10	1.50	0.00	7.30	0.00	46.90
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>276.00</b>	<b>2668.10</b>	<b>714.85</b>	<b>19.05</b>	<b>47.25</b>	<b>16.35</b>	<b>13.60</b>	<b>811.10</b>

#### Time Summary Exclusive of Summer Shutdown

Percentage of time scheduled for observing	94.5
Percentage of time scheduled for engineering	5.5
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	26.8
Percentage of time lost to instrument	0.7
Percentage of time lost to telescope	1.8
Percentage of time lost to general facility	0.6
Percentage of time lost to environment (non-weather)	0.5
Percentage of time lost	30.4

**November 2011**

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>*Lost to Instrument</u>	<u>**Lost to Telescope</u>	<u>***Lost to Gen'l Facility</u>	<u>****Lost to Environment</u>	<u>Total Lost</u>
MMT SG	11.00	128.20	39.40	4.50	0.00	0.00	0.00	43.90
PI Instr	18.00	209.00	132.00	0.00	9.00	0.00	0.00	141.00
Engr	1.00	11.40	11.40	0.00	0.00	0.00	0.00	11.40
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>30.00</b>	<b>348.60</b>	<b>182.80</b>	<b>4.50</b>	<b>9.00</b>	<b>0.00</b>	<b>0.00</b>	<b>196.30</b>

Time Summary

Percentage of time scheduled for observing	96.7
Percentage of time scheduled for engineering	3.3
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	52.4
Percentage of time lost to instrument	1.3
Percentage of time lost to telescope	2.6
Percentage of time lost to general facility	0.0
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	56.3

\* Breakdown of hours lost to Instrument

0.50 Hecto robot  
4.00 CCD readout error

\*\* Breakdown of hours lost to telescope

9.00 Drying out DM contamination

**December 2011**

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>*Lost to Instrument</u>	<u>** Lost to Telescope</u>	<u>***Lost to Gen'l Facility</u>	<u>****Lost to Environment</u>	<u>Total Lost</u>
MMT SG	16.00	191.50	107.10	0.00	0.00	0.00	0.00	107.10
PI Instr	12.00	143.90	107.25	3.00	8.00	0.00	0.00	118.25
Engr	2.00	23.90	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>30.00</b>	<b>359.30</b>	<b>214.35</b>	<b>3.00</b>	<b>8.00</b>	<b>0.00</b>	<b>0.00</b>	<b>225.35</b>

Percentage of time scheduled for observing	93.3
Percentage of time scheduled for engineering	6.7
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	59.7
Percentage of time lost to instrument	0.8
Percentage of time lost to telescope	2.2
Percentage of time lost to general facility	0.0
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	62.7

\* Breakdown of hours lost to Instrument

3.00 Laser beam focus problem

\*\* Breakdown of hours lost to telescope

2.50 AO system issues  
5.50 AO & WFS issues

**Year to Date December 2011**

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>Lost to Instrument</u>	<u>Lost to Telescope</u>	<u>Lost to Gen'l Facility</u>	<u>Lost to Environment</u>	<u>Total Lost</u>
MMT SG	129.00	1311.40	435.15	18.05	1.75	6.55	8.60	470.10
PI Instr	189.00	1883.70	627.35	7.00	62.50	2.50	5.00	704.35
Engr	18.00	180.90	49.50	1.50	0.00	7.30	0.00	58.30
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>336.00</b>	<b>3376.00</b>	<b>1112.00</b>	<b>26.55</b>	<b>64.25</b>	<b>16.35</b>	<b>13.60</b>	<b>1232.75</b>

Time Summary Exclusive of Summer Shutdown

Percentage of time scheduled for observing	94.6
Percentage of time scheduled for engineering	5.4
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	32.9
Percentage of time lost to instrument	0.8
Percentage of time lost to telescope	1.9
Percentage of time lost to general facility	0.5
Percentage of time lost to environment (non-weather)	0.4
Percentage of time lost	36.5