



## STAR FIELDS

Newsletter of the  
Amateur Telescope Makers of Boston  
Including the Bond Astronomical Club  
Established in 1934  
In the Interest of Telescope Making & Using

Vol. 25, No. 7 July 2013

### This Month's Meeting...

Thursday, July 11<sup>th</sup>, 2013 at 8:00 PM

Phillips Auditorium

Harvard-Smithsonian Center for Astrophysics

Parking at the CfA is allowed for the duration of the meeting



Tal Mentall at the podium. Image by Al Takeda

### Member Night

July's meeting will be a member night with presentations by members on their latest and greatest projects. It is always interesting to see and hear about what your fellow club members are up to, so please join us. As has been done in past years we also combine this night with a swap table where you may bring in your astronomical goodies that you no longer need or want. Swap them for someone else's goodies, or sell them, or give them away! Or just come and see what you can buy. Sometimes there are some pretty sweet deals.

Please join us for a pre-meeting dinner discussion at [Changsho](#), 1712 Mass Ave, Cambridge, MA at 6:00pm before the meeting.

### President's Message...

At 1:04 AM on June 21<sup>st</sup> we started summer. The sun reached its highest point in the Northern skies at Noon time the next day

and it was the longest day of the year, the sun not setting until 8:25. Of course this means the shortest night too but they get longer from here on out. Personally I appreciate the longest day part of this equation most but come night time, short as it may be, there is such beauty in the summer sky. And it is indeed so pleasant to be able to get out in mere shirt sleeves and feel the mild summer breeze, smell the sweetness in the air, and hear the soft chorus of nearby crickets and night time birds flitting about. When the air is clear and the skies dark, there are such an abundance of things to see. And you don't even need a telescope!

I've come to enjoy just laying back on a blanket with a star atlas and binoculars and just learning the constellations, including trying to memorize the Greek designations of the brighter stars that make up each one. In doing so I have learned that there really are a lot of constellations that we often neglect but take up a lot of real estate on the heavenly dome above us. We look low to the south and all see Scorpius and Sagittarius and perhaps Capricornus. If we look up above we see Corona Borealis, Hercules, Lyra and Cygnus – all classic summer constellations to be sure. But what about that great swath of space in and around these more well know constellations? There are quite a few and some are really big.

Just North-East of Scorpius is Libra and just North of it is Serpens Caput. Some of you may have never heard of this constellation. Well surprise, surprise; there's another Serpens up there too. Serpens Cauda – located to the South-East just above Sagittarius. In between these is the very large, often neglected Ophiuchus. This one has some fairly bright stars that comprise it, is easy to trace out, and there are a fair number of deep sky objects within its realm as well. Now speaking of deep sky objects don't forget that as you scan the Sagittarius portion of the Milky Way and start moving north you quickly sweep out of Sagittarius and into Scutum, a tiny constellation but one packed with lots of interesting objects. From there you enter into Aquila. You might not know this constellation as such but you probably know Altair, its brightest star and the southerly apex of the famous "summer triangle." Last but not least on this list are three small but distinct constellations. I like these because they are easy to find and provide a welcome relief from the overarching attention posed on Cygnus, Lyra and Aquila (or Altair.) They are Sagitta, Delphinus and Equuleus. Have a look for these in the vicinity of Altair next time you're out either visually or with binoculars. And if you have a telescope . . . Well check out M71 in the very center of Sagitta. It's a very nice globular cluster and really easy to find.

I hope you enjoy the short summer nights. Don't forget to bring the deet and don't forget to bring a blanket. And you might even want to bring along a jacket too. As the night wears on it can sometimes get pretty cool – even in summer – and sometimes it catches us by surprise. That happened to me once up at Stellafane and I was truly miserable. There are lots of other lesser known constellations that I have not mentioned but I'll leave it up to you to search these out if you are so inclined. Keep looking up and I wish you all a Happy Summer !!

~ Mike Hill – President ~

## June Meeting Minutes . . .



Jeffrey Dominick, Lincoln Laboratory Field Site Manager. Image by Al Takeda

Minutes of ATMOb meeting held June 13, 2013.

Meeting held in Phillips Auditorium, Harvard-Smithsonian Center for Astrophysics.

Mike Hill, President: called the meeting to order at 8:00 PM.

- The Secretary's Report of the May 9, 2013 meeting was given by Sidney Johnston.
- Mike Hill gave the treasurer's report which had been prepared by Nanette Benoit.
- Mike Hill gave the Membership Committee Report which had been prepared by Tom McDonagh.
- Mike Hill reported the results of the Nominating Committee election held last month to select nominations for officers of the ATMOb for the upcoming year.
  - Motion to accept the election by Mike Hill
  - Seconded
  - Vote, Yes, unanimous.

*Editor: Refer to the last page of this newsletter for the names of the newly elected ATMOb Executive board.*

- Glenn Chaple gave the Observing Committee Report.
- Steve Clougherty gave the Clubhouse Report.
- The Summer Solstice Festival star party event at Harvard University, scheduled for June 21, was announced. Event time: 5:00 PM – 9:00 PM.
- Several other star parties were announced.
- An exhibit of historical scientific instruments at the Harvard Museum was announced.
- Bob Naeye announced that a new magazine, *Astronomy 60*, contains sixty articles about astronomical developments and

is on sale as a magazine/book at the Sky and Telescope web page.

- Mario Motta announced the publication in medical journals of several articles about the harmful biological effects of light pollution on humans.
- The ATMOb Executive Board meeting scheduled for June 25, 2013 was announced.
- Old Business:  
The Clay Center thanked the ATMOb for help in their Astronomy Day presentations.
- New Business:  
President Mike Hill held a vote on whether or not to have an ATMOb meeting in July.  
Vote: Yes, unanimous

Mike Hill introduced Jeff Dominick, who is the Lincoln Laboratory Field Site Manager, as the invited speaker. The topic of Jeff's talk was "**Haystack Historically Speaking**", a history of the MIT Haystack Observatory.

A photograph taken on October 1956 showed a muddy road up the hill, the present ATMOb Clubhouse as part of a farm, and an MIT warehouse building near the Clubhouse. A contrasting photo from May 2009 shows the current MIT warehouses, the "Westford Radiotelescope", the "Firepond Complex", the "Milestone Tracking Radar", the "Incoherent Scatter Radars", and the "Main Haystack Complex".

Today, the land holding of the site is approximately 1,200 acres covering land in the towns of Westford, Groton, and Tyngsboro.

A photograph from September 1956 showed the laying of a concrete foundation for buildings and a radar antenna pedestal. A steel structure of a high bay building steel framework showed construction during October 1956. A radar antenna pedestal was nearing completion by December 1956. Radar traces showing the detection of Sputnik were available soon after in 1957 and 1958.

Separation of Science and Defense, explains the difference between Haystack Observatory and MIT Lincoln Laboratory. Why are there two? Early years through 1969 – MIT Lincoln Laboratory (one of 39 Federally Funded Research and Development Centers (FFRDCs)) performed experiments at the field site under DoD funding. In 1969-1970 – the Mansfield Amendment was enacted. The Amendment, named for Senator Mike Mansfield, authorized legislation prohibiting the expenditure of DoD funds for research lacking "a direct or apparent relationship to specific military function". This legislation forced the separation of scientific and defense-related endeavors. Funding for Scientific research was transferred to the National Science Foundation, et al. The scientific research is now administrated through MIT and a new entity called "MIT Haystack Observatory". Funding for Defense-related activities remained with the DoD, administered through MIT under the existing entity MIT Lincoln Laboratory.

Some of the accomplishments of this observatory include: radar detection and tracking of Sputnik I and II; re-entry physics experiments: a project where needles were placed in orbit and tracked by radar; tests of general relativity using radar in the solar system, which proved Einstein right; tracking debris fields from Traffic Accidents in Earth orbit, etc.

Some of the accomplishments of the radar include:  
1959 - First telephone relay via moon bounce;  
1960 - First Range-Doppler image of moon surface;  
1962 - Conversion from UHF to L-band –to better give capability to address smaller space vehicles;  
1972 - First real-time track of geosynchronous satellite using coherent integration, etc.

Developments by the Firepond Facility include: April 1959 – Re-Entry Physics Experiments; missile launches were out of Wallops Island, Virginia; characterize physics of reentry vehicles (RV); and distinguish decoys and the real thing.

In September 1967 an Active Optical Sensor for “Laser Radar”, LIDAR was installed. LIDAR stands for Light Detection And Ranging. In the LIDAR, a Ruby Laser was inside a protective canopy. In 1968 a CO2 Laser replaced the Ruby. Later the canvas cover was burned off by the powerful laser (lesson learned).

The Strategic Defense Initiative (SDI) during Reagan years included: science: measurement of middle atmospheric layers during day and nighttime. A Nd:YAG laser with 10 MW peak power (neodymium-doped yttrium aluminum garnet; Nd:Y3Al5O12) was installed. Today optical imaging of orbiting space craft is routine.

The Millstone Hill Steerable Antenna (MISA) was built in 1963 at Sagamore Hill Air Force Base in Wenham, MA. The MISA antenna was moved to Millstone Hill in 1978. The antenna operates in UHF (440 MHz). The 150-foot diameter dish is used as incoherent scatter radar. This technique is considered the most powerful ground based technique for measuring the properties of near-Earth space. The MISA antennas include a 220 foot zenith pointing antenna and a steerable 150 foot antenna.

The MISA systems are used in predicting space weather. The need for predicting Space Weather includes: geomagnetic storms disrupt technological systems and produce radiation hazards and can produce damage to Satellites. Geomagnetic storms also can produce communications system failures and can disrupt navigational systems such as the Global Positioning System (GPS).

In 1961 – 1963 the Westford Antenna was an X-band radar at 7750-8350 MHz, and there was a twin site at Camp Parks in California. In project WEST FORD - very small copper dipole antennae were dispersed into space to form a dipole belt around the earth. Earth-based radar sites could then bounce communication signals off the dipole belt to each other. In 1962 the Westford antenna was used in conjunction with Camp Parks to successfully transmit the first television picture via space by bouncing the signal off of the ECHO-I satellite.

Another lesson was learned in March 1962 when heavy snow fell in the dish of an antenna and an attempt was made to empty the dish by slowly lowering it toward the horizon. The snow load “tumbled” from the top to the bottom edge of the antenna dish, and the resulting imbalance caused the center of gravity to shift, dramatically toppling the antenna dish to the ground. The antenna was rebuilt over the next year and was enclosed within an inflatable radome to protect it from the weather.

The first range-Doppler Image of the Moon was made on 7 January 1960. From October 1961 the site was already preparing for Apollo. Landing site maps were needed in less than ten years, and so the radar was busy. The Haystack 8-GHz Planetary Radar map of the lunar crater Tycho had 1 km range resolution. This was an early achievement in Range-Doppler imaging. This work set a foundation for modern capabilities.

One of the First Venus Range-Doppler Images was made in 1967. Haystack-Westford interferometer data helped map Venus surface features with imaging resolution on the order of a few dozen centimeters (compared to 1 km in 1964).

Irwin Shapiro performed a “Fourth Test” of Einstein’s Theory of General Relativity during 1964-1967 following Haystack upgrades. Haystack was used to illuminate Mercury and Venus as their orbits were in conjunction with the Sun. Measurements were done showing a slowing of radar waves. The radar waves were slowed down (delayed) by the Sun’s gravitational field.

Haystack radar and auxiliary radar (HAX) radar were upgraded and modernized between 1964 – 2013 for imaging space debris and to produce the Haystack Ultrawide Satellite Imaging Radar (HUSIR).

Current developments and scientific research includes outreach where New England Cable Network (NECN) was on site in March 2012 to interview John Foster following the eruptions of major solar flares. As the sun approaches the maximum of its 11-year cycle, these solar flares may become more frequent.

NASA Orbital Debris Program, see link:  
<http://orbitaldebris.jsc.nasa.gov/measure/radar.html>.

Recently a “traffic accident” at 780 km occurred. The Iridium Satellite Constellation provides global telephone communications via satellite for a variety of subscribers. On 10 February 2009 a “dead” Soviet era Cosmos spacecraft collided with an active Iridium satellite at an altitude of 780 KM (485 Miles) above the Earth. Both satellites were destroyed and a debris field of several hundred objects resulted. Haystack and HAX debris collection capability proved instrumental in assessing the debris field resulting from this collision.

Historically, the 1940s Henry Tizard / Tizard Mission to exchange technical information with the British involved MIT Lincoln Laboratory and was significant in the outcome of World War II.

New scientific developments include:

The Haystack Ultra-wideband Satellite Imaging Radar (HUSIR) – is an upgrade adding W-Band (100 GHz) capability to the Haystack radar and radio astronomy capability, see link at: <http://www.haystack.mit.edu/obs/haystack/LincolnUpgrade.pdf>

Shep Doeleman's Black Hole research – delving into the center of the Milky Way Galaxy using interferometry with antennas on different continents (that is, legs of 1,000s of miles) in order to image environs of the 4 million solar mass black hole believed to be at the center of the Milky Way Galaxy;

Haystack is used to discover hydrocarbons molecules in interstellar space and the use of Haystack's Planetary Radar to redefine our understanding of the orbital periods and rotational periods of the planets; etc.

The meeting was adjourned at 9:45 PM

~ *Sidney Johnston, Secretary* ~

## Clubhouse Report . . .

June 2013



Meade 10" Schmidt-Cassegrain in the Clamshell Obs. Photo by Al Takeda

Summer arrived for the June Work Session on Full Moon Saturday June 22<sup>nd</sup>, with reports of bear sightings on the hill received earlier. Work proceeded as scheduled without any encounters. 21 members and friends donated their day to keep the clubhouse humming, as indicated with the following activities.

- The excessive moisture this season has made lawn cutting a necessity; cut only a week ago, another cutting was started earlier this day by John B under cooler temperatures. Trimming was started by Mike D, followed by hand mowing tractor-inaccessible areas and hand raking by Al T, and late day barrowing of the trimmings by Bill T. It looks like another trimmer has failed, making this effort more labor intensive.
- A big effort was undertaken for the observatory and storage cleanup/out. The shed reorganization was tackled by Steve C, Joe H, George P, and Mike D. The clamshell observatory cleanup was handled by John M and Courtenay S. The sliding roof Knight observatory was opened to show the visiting Siparamann family by Sai V. Later it was cleaned by Bill T

and Paul C. Testing the home dome observatory electrical switches was handled by Bruce B assisted by Bill T. Later, John M continued to check members out on clamshell opening, operating and closing procedures. A list of checked out members for the Clamshell observatory is available inside the locked key cabinet in the clubhouse.

- The storm windows chosen for recycling last month were separated into glass and metal stacks by Paul C, with broken pieces packaged separately by Bill T, Sai V and John R. They are now ready for transport to the dump and recycling center.
- Dead limb removal continued along the road side of the observing site after the temperature started to drop from 90 degrees; work was performed by Bill T, Eric J, John R assisted by Bill T's two students volunteering community assistance (Joe B and astronomy club member Jacob B). Debris was added to the chipping pile at the rear across from the far barn. The refreshing breeze made this work possible.
- Lunch was served to the hungry crew through the efforts of Eric J, Eileen M & Sai V Cleanup was handled by Eileen M, Al T, Eric J and Sai V; Eileen later cleaned the entire clubhouse to maintain our occupancy permit. After lunch there was a traditional hike up the hill. The crew received verbal affirmation of the bear sighting from security, as had Sai V earlier from the visiting family whose son had seen the bear standing to reach high into a tree (his estimated height was equivalent to the height of the Wray 17" Dob. in the vertical position).
- Work was done on the 16" Dob. used at Bailey Hill. A relocation of the finder and Telrad will make searching for faint fuzzies more efficient; completed by John B, Sai V, and John R. Solar observing in white light (through high thin clouds) was provided by Paul C. Telescopes set up by Brian L and Phil R were supplemented by Bill T's scope (Clubhouse loaner) and camera set up with his student's assistance. As the evening progressed, more telescopes were set up on the observing field. The bright, large full moon presented quite an image of contrasting dark and lighter lava flows over the Moon's surface; as the clouds thinned, the full brightness returned. Saturn also presented its usual satisfying image.

A big thank you to John Blomquist, Paul Cicchetti, Steve Clougherty, Mike Dudley, Joe Henry, Eric Johansson, Dick Koolish, Brian Leceau, John Maher, Eileen Myers, George Paquin, John Reed, Phil Rounseville, Cartenay Smith, Art Swedlow, Al Takeda, Bill Toomey with his student Joe Bernardo and his school's astronomy club member Jacob Ballerini, Sai Vallabha, and Bruce Berger. Please mark your calendar with our next work party date on 'Full Moon' Saturday July 20th; and realize that you are invited to lend your hand with keeping our clubhouse humming. Meanwhile Saturday night club observing, Friday night member Astronomy class, and Thursday night mirror grinding (except the 2nd Thursday meeting night) continue every week at your clubhouse.

~ *Clubhouse Committee Directors* ~

~ *John Reed, Steve Clougherty and Dave Prowten* ~

### Clubhouse Saturday Schedule

July 13	Bill Robinson	Rich Burrier
July 20	John Maher + Glenn Meurer <b>WORKPARTY #7</b>	
July 27	Henry Hopkinson	Eileen Myers
August 3	Brian Maerz	John Panaswich
August 10	<b>CLOSED – Stellafane Convention</b>	
August 17	Rich Nugent + N. & S. Sonawane <b>WORKPARTY #8</b>	
August 24	Dave Siegrist	Bill Toomey
August 31	Bruce Berger	Mike Hill
September 7	Brian Leacu + Phil Rounseville <b>ATMoB PICNIC</b>	
September 14	John Maher	Rich Nugent
September 21	Eileen Myers + Tom Wolf <b>WORKPARTY # 9</b>	

## Membership Report . . .

Membership Report June 2013

Membership count as of May 23, 2013 is at 315 individuals  
Same time last year: 307

The membership renewal period begins in June and ends September 1st.

Please feel free to send along your payment now. Contact me if you require a renewal form by phone (617-966-5221) or via email ([membership@atmob.org](mailto:membership@atmob.org)).

*Editor: The renewal form is also located on the ATMoB website under [Library/Forms/Membership renewal](#) - no logon needed.*

**Please note that if you are a new or returning member in 2013, there is no need to renew till next June.**

The renewal process can be completed on-line using PayPal. No PayPal account is required. Follow the link below to renew now.

<http://www.atmob.org/members/person.php?frid=renewals>

Renewal checks may also be mailed:

ATMoB  
c/o Tom McDonagh  
48 Mohawk Drive  
Acton, MA 01720

**Don't delay, renew today!**

The Amateur Telescope Makers of Boston, Inc. is a 501(c)3 organization. Donations are gladly accepted and are tax deductible to the fullest extent allowed by law. Consider making a contribution to the club during your estate and tax planning this year. Many companies make matching contributions at an

employee's request. This is a simple way to make your donation go twice as far.

Please take the time to seek out and welcome our new and returning club members:

Dean Shaddock	Courtenay Smith	Jack Whipple
Edward Burke	David McCurdy	David Long
Rex Gallagher	John Harrington	Fred Cadieu
Micah Lillrose	Jeremy McLeod	Karen Paik
Juan Jimenez		

*~ Tom McDonagh – Membership Secretary ~*

## Sky Object of the Month . . . July 2013 - M80 – Globular Cluster in Scorpius



M80 – Image by Mario Motta M.D.

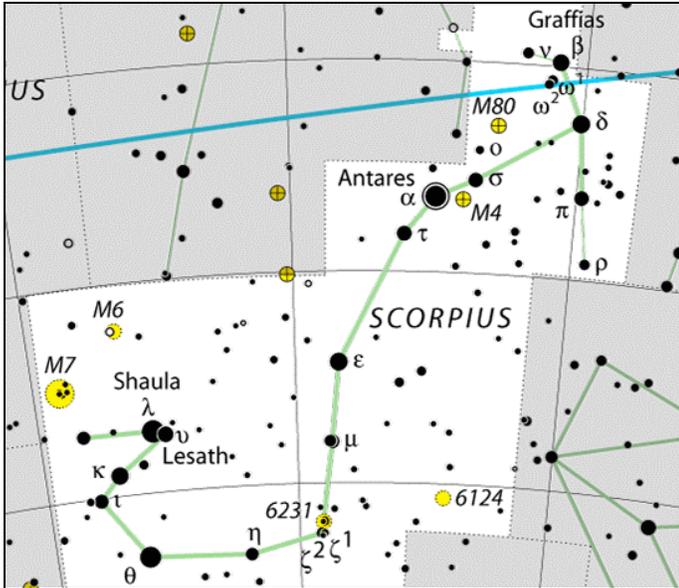
From last month's featured object, the challenging double-double nu ( $\nu$ ) Scorpii, we dip 4 arcminutes south and slightly east to a point roughly midway between Antares ( $\alpha$  Scorpii) and Graffias ( $\beta$  Scorpii). The small 7th magnitude fuzball we encounter when viewing this area with binoculars or low-power rich-field scope is the globular cluster M80.

M80 was discovered on January 4, 1781, by Charles Messier, who wrote, "The nebula is round, the center brilliant, and it resembles the nucleus of a little comet, surrounded with nebulosity." William Herschel observed M80 four years later and called it "one of the richest and most compressed clusters of small stars I remember to have seen."

This compression is obvious, even when M80 is viewed with small telescopes. In the spring of 1971, despite being an inexperienced backyard astronomer and using a modest 3-inch reflecting telescope and magnification of just 30X, I easily noted its "small and condensed" appearance. More recently, I returned to M80 with a 4.5-inch f/8 reflector and a boost in magnification to 150X. Despite this jump in aperture and magnifying power, I was still unable to resolve any cluster members. No surprise, because M80 – at least its core – is all but impossible to resolve.

The outer region appears grainy when viewed with medium to large aperture scopes.

Most sources cite a distance to M80 of between 28,000 and 36,000 LY. Crammed within its 95 LY diameter are several hundred thousand stars. Herschel was right. M80 is truly one of the densest globular clusters in the Galaxy.



[www.constellation-guide.com](http://www.constellation-guide.com)

Your comments on this column are welcome. E-mail me at [gchaple@hotmail.com](mailto:gchaple@hotmail.com).

~ Glenn Chaple – Member at Large ~

## Annual Club Picnic . . .



September 7 at 3PM at the Clubhouse  
All members and their families are invited.

Saturday, September 7th is the day of this year's Annual Club Picnic at the clubhouse in Westford. It will start at 3:00 P.M. Enjoy a day with good food and lots of astronomy talk with other ATMoB members.

Please bring something tasty to share - salad, main dish, dessert, soup, appetizer, fancy bread,... A serving utensil would be helpful. We will provide hamburgers, drinks, potato chips, ketchup, mustard, coffee, paper goods and plastic cutlery.

Share your astronomy stories and experiences. Bring any astrophotography you would like to show. There will be daytime H-alpha and white light solar viewing and night sky observing after sunset (all weather permitting). The picnic is on rain or shine. Bring lawn chairs or blankets to sit on. Bring your favorite suntan lotion and mosquito repellent. Observing will continue until Midnight if the sky is clear, so bring your telescope and your observing clothing and gear. The club's scopes will be open too.

Club members, their families and friends are invited. Do bring the kids and grandchildren. There will be a tour of the clubhouse facilities and a demonstration of mirror grinding. There will be opportunities for kids to take part in astronomy activities. We also plan to walk "up the hill", stopping along the way to talk about the MIT Haystack Observatory facility.

Directions to the clubhouse can be found on the last page of Star Fields and at the club website [www.atmob.org](http://www.atmob.org).

Questions - Email Eileen Myers at [starleen@charter.net](mailto:starleen@charter.net)

Don't miss the fun!

~ Eileen Myers – Member at Large ~



**HMSC** HARVARD MUSEUMS OF SCIENCE & CULTURE

# Summer Solstice Event! . . .

Dear ATMoB Friends,

The Harvard Museums of Science and Culture Summer Solstice Festival on June 21 was a smashing success that exceeded all expectations and dreams. Thousands of people came, and many said it was for the astronomy.



Phil Levine showing a Hydrogen-alpha view of the Sun. Image by Al T

Your enthusiasm and patience in giving people an opportunity to see the Sun, Moon, and Saturn made the day for so many people who had never before looked through a telescope. The dedication of the team working the portable STARLAB planetarium was unmatched and gave young and old alike a fun way to explore the night sky. But you did not stop there! With your help, we laid out a human sundial that had more gnomons than one could shake a stick at, and several hundred people went away sporting their wristwatch sundials. I heard from one satisfied customer that her granddaughter showed it off to everyone on the bus ride home!



(L-R) Dick Koolish and Sara Schecner at the sundial table. Photo by Al T.

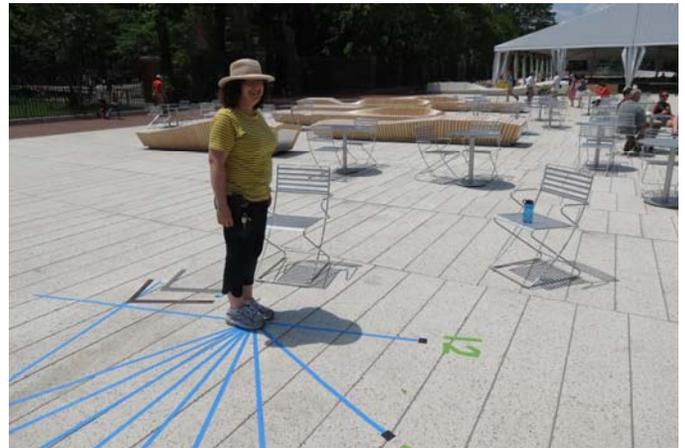
The Solstice Festival combined astronomy and culture in a glorious, most memorable day. We could not have done it without you!



Phil Rounseville showing the Sun in Hydrogen-alpha. Image by Al T.

~ Submitted by Sara Schecner, Curator: Historical Instruments Collection, Harvard University ~

*Editor: We would like to extend a big thank you to Virginia Renehan and Sara Schecner for organizing ATMoB's participation in the festival. Thanks to Virginia Renehan, Ross Barros-Smith and Nanette Benoit for demonstrating the STARLAB planetarium. Thanks to Nanette Benoit, Mike Hill, Julie Kaufmann, Ken Launie, Phil Levine, Eileen Myers, Bill Robinson, Phil Rounseville, John Sheff and Al Takeda for setting up their telescopes. Thanks to Dick Koolish and Sara Schecner for making the human sundial and producing wristwatch sundials for the audience.*



Sara Schecner demonstrates the human sundial. Image by Dick Koolish

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**September Star Fields DEADLINE**  
**Sunday, Aug 25<sup>th</sup>**

Email articles to Al Takeda at  
[newsletter@atmob.org](mailto:newsletter@atmob.org)

**Articles from members are always welcome.**

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**POSTMASTER NOTE:** First Class Postage Mailed July 7, 2013

Amateur Telescope Makers of Boston, Inc.  
c/o Tom McDonagh, Membership Secretary  
48 Mohawk Drive  
Acton, MA 01720  
**FIRST CLASS**

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Virginia Renehan [starparty@atmob.org](mailto:starparty@atmob.org)

**How to Find Us...  
Web Page [www.atmob.org](http://www.atmob.org)**

**MEETINGS:** Held the second Thursday of each month (September to July) at 8:00PM in the Phillips Auditorium, Harvard-Smithsonian Center for Astrophysics, 60 Garden St., Cambridge MA. For INCLEMENT WEATHER CANCELLATION listen to WBZ (1030 AM)

**CLUBHOUSE: Latitude 42° 36.5' N Longitude 71° 29.8' W**

The Tom Britton Clubhouse is open every Saturday from 7 p.m. to late evening. It is the white farmhouse on the grounds of MIT's Haystack Observatory in Westford, MA. Take Rt. 3 North from Rt. 128 or Rt. 495 to Exit 33 and proceed West on Rt. 40 for five miles. Turn right at the MIT Lincoln Lab, Haystack Observatory at the Groton town line. Proceed to the farmhouse on left side of the road. Clubhouse attendance varies with the weather. It is wise to call in advance: (978) 692-8708.

**Heads Up For The Month . . .**

*To calculate Daylight Saving Time (DST) from Universal Time (UT) subtract 4 hours from UT.*

- July 8 New Moon
- July 15 First Quarter Moon (Moonset at midnight)
- July 22 Full Moon
- July 29 Last Qtr Moon + S. Delta-Aquariid Meteor Shower peaks
- Aug 6 New Moon
- Aug 12 Perseid Meteor Shower peaks
- Aug 14 First Quarter Moon (Moonset at midnight)
- Aug 20 Full Moon
- Aug 28 Last Quarter Moon (Moonrise at midnight)