



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. 29, No. 5 May 2017

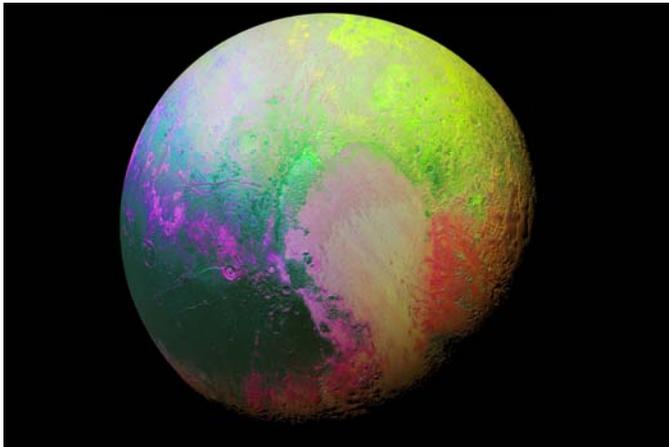
This Month's Meeting . . .

Thursday, May 11th, 2017 at 8:00 PM

Phillips Auditorium

Harvard-Smithsonian Center for Astrophysics

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



Pluto in False Colors. Copyright NASA/JHUAPL/SwRI

Update: New Horizons Mission to Pluto

On July 14, 2015, the New Horizons space probe made a historic flyby of the planet Pluto. At our November meeting that year, Kelly Beatty summed up preliminary results from that mission. Data from New Horizons continued to be received until last October. At our meeting Kelly will summarize what New Horizons has taught us about Pluto.

Kelly Beatty, a *Sky and Telescope* Senior Editor, writes many of the feature articles and news items for the magazine and its website. He joined the staff of Sky Publishing in 1974 and served as the editor of *Night Sky*, a magazine for beginning stargazers, from 2004 to 2007. Specializing in planetary science and space exploration, Kelly conceived and edited *The New Solar System*,

considered a standard reference among planetary scientists. He also taught astronomy for six years at the Dexter Southfield School in Brookline, Massachusetts. He has been an ATMoB member since 2004.

Besides being honored twice by the Division for Planetary Sciences of the American Astronomical Society, Kelly has also received the [Harold Masursky Award](#) for meritorious service, the [Astronomical League Award](#) for his contributions to the science of astronomy, and in 2009 the inaugural [Jonathan Eberhart Journalism Award](#) and the American Geophysical Union's [Cowen Award](#) for Sustained Achievement in Science Journalism.

Kelly hails from Madera, California. He holds a bachelor's degree in geology from the California Institute of Technology and a master's degree in science journalism from Boston University. During the 1980s he was among the first Western journalists to gain firsthand access to the Soviet space program. Asteroid 2925 Beatty was named on the occasion of his marriage in 1983, and in 1986 he was chosen as one of the 100 semifinalists for NASA's Journalist in Space program.

Please join us for a pre-meeting dinner discussion at [House of Chang, 282 Concord Ave, Cambridge, MA](#) at 6:00 pm before the meeting.

President's Message . . .

As stated in our bylaws, one of the purposes of ATMoB is to "promote interest in amateur observational astronomy and in the instruments used therefore." At the April meeting three such projects were brought to our attention.

The first came from Acton-Boxborough 7th-grader Arianna Roberts, who is President of the astronomy club at her school. Arianna has become involved with the citizen science CATE (Continental American Telescopic Eclipse) Project. She will join one of some 60 teams spread across the path of the August 21st total solar eclipse to study the structure of the corona during totality. ATMoB members Tom McDonagh and Bruce Berger have taken Arianna under their wings and have eagerly promoted her project to the membership. A GoFundMe site has been set up to help Arianna raise the \$3645 needed to purchase necessary equipment (which will be donated to ATMoB after the eclipse). As of the end of April, \$2480 – two-thirds of the total – have been donated. Donations can be given through her GoFundMe site (www.gofundme.com/citizen-cate-solar-eclipse-phase-2) or handed over to Tom or Bruce at our May meeting. For more info on Citizen Project CATE go to www.citizensciencecenter.com/link-chain-citizen-cate-experiment/.

Another citizen science project was presented by member James Synge. Project PANOPTES (Panoptic Astronomical Networked Observatories for a Public Transiting Exoplanets Survey) essentially involves the use of home-built wide-field instruments to monitor stars for transiting planets. James has expressed an interest in constructing such an instrument and welcomes help from any interested ATMoB member. You can

contact James at james.syng@gmail.com. Find out more about Project PANOPTES at www.projectpanoptes.org/.

Our third project takes us back to the past via a request from Jim and Rhoda Morris, makers of replica scientific instruments. They plan to construct reproductions of historical telescopes (Galileo's, Newton's, and one of Herschel's) for a planetarium being constructed in China. They are particularly interested in a 6½-inch f/13 mirror to be used with a replica of Herschel's 7-foot scope. Jim and Rhoda do some amazing work! You can contact them by email (klugm@comcast.net) or phone (781-245-2897). Check out their website (www.scitechantiques.com).

If you were unable to attend the April meeting, you can access the recording made by Chris Elledge and posted on the internet (youtu.be/4hKMvWOSqHI).

Clear Skies,

~ Glenn Chaple – President ~

March Meeting Minutes . . .



Kevin Collins *

Minutes of the monthly ATMoB meeting held April 13, 2017, in the Phillips Auditorium at the Harvard Smithsonian Center for Astrophysics. President Glenn Chaple called the meeting to order at 8:00 pm.

Glenn updated the membership on his current health status, indicating his condition, while serious, is manageable.

Glenn introduced Arianna Roberts, president of the Acton-Boxborough Student Astronomy Club. Arianna gave the membership an overview of the National Solar Observatory Citizen CATE Project (Continental American Telescope Eclipse). Citizen CATE will be positioning astronomers and students geographically along the line of the August 2017 total solar eclipse, to collect information and then create a 90 minute video. Focus of the project will be to collect data on the solar corona and solar wind. ATMoB is providing training assistance during May-June at the Westford Clubhouse, where CATE Project personnel will practice using equipment in preparation for the solar eclipse.

ATMoB members Tom McDonagh and Bruce Berger are facilitating the collaboration with CATE Project personnel. Please see Tom or Bruce for further details.

After the eclipse, the equipment will be donated for use at the ATMoB Clubhouse, for club and local astronomy outreach use. The equipment includes a Daystar 80mm ED80 APO OTA, a Celestron CG4 equatorial mount with motor drive and tripod, an 80mm image quality white light filter, an Imaging Source Grasshopper 3 digital camera with a SONY Pregius IMX250 chip, associated hardware, cables, laptop and Matlab processing software. <http://eclipse2017.nso.edu/>

Members interested in donating to help support the CATE Project, please see the following link:

<http://www.gofundme.com/citizen-cate-solar-eclipse-phase-2>

Glenn Chaple brought his old 13.1-inch Coulter, Odyssey Dobsonian telescope to be auctioned off during the meeting. The winning bid was from Bruce Berger whose funds will be donated to the club.

- Phil Levine read the Secretary's Report.
- Eileen Myers read the Treasurer's Report.
- Chris Elledge read the Membership Report.
- Glenn congratulated new member Ben Rubel, for completing a 110 double star marathon using two telescopes in one night.
- Glenn Chaple presented the Observing Report:

Glenn mentioned four comets are currently visible:

PanSTARRS (C/2015 ER61).

Lovejoy (C/2017 E4).

45P/Honda/Mrkos/Pajdusakova.

41P/Tuttle/Giacobini/Kresak.

Steve Clougherty mentioned observing comet 41P Tuttle at the Westford Clubhouse.

Glenn indicated that the Lyrid meteor shower might be visible on April 22 in the early morning.

On Thursday, May 11 from 9:59 - 10:06 pm there will be a double shadow transit on Jupiter of the moons Io and Europa. John Sheff indicated it might be possible to view the double transit using the Clark telescope on the roof of the CfA. Observing will be weather dependent.

The Sue French Fan Club Pick for April: M105, and elliptical galaxy in Leo, and nearby galaxy NGC 3384.

The Las Vegas Astronomical Society Observer Challenge for April: NGC 3395/96, interacting galaxies in Leo Minor.

Roger Ivester's member observing picks for April:
Galaxy compact cluster in Leo (NGC 3185, NGC 3187, NGC 3190, NGC 3193), and M84/86, a galaxy group in Virgo.

- The Clubhouse Report was given by Steve Clougherty.
- Announcements:
The ATMoB monthly pre-lecture dinner will no longer be held at the Changsho Restaurant. The parking lot is no longer available due to construction of a new building on the site. The pre-lecture dinner will now be held at the House of Chang at 282 Concord Ave, a short walk from the CfA.

Glenn informed the membership of an astronomy organization at M.I.T. called Astronomy on Tap, "Learn about astronomy over a pint. Short, free talks about astronomy, with a side of astronomy related news, trivia and games". For details see astronomyontap.org.

Glenn mentioned that members may want to check out the website Surplus Shed for interesting astronomical sale items.

John Sheff gave an overview of upcoming Cambridge Science Festival events, which will include lectures, exhibits and museum tours. Telescopes and volunteers are needed for day and night observing events.

A presentation was given by ATMoB member James Syngé on Project PANOPTES, a citizen amateur astronomer exoplanet project focusing on building low cost robotic telescopes. For more information please contact James at james.syngé@gmail.com or see the following link: <http://www.projectpanoptes.org/>

A point of order regarding election of club board member positions was brought up by Dick Koolish. He indicated that a nominating committee needs to be formed to propose a slate of candidates for the ATMoB board elections held at the annual meeting in June. A vote was conducted and the results for the nominating committee are: James Syngé (Chair), Mike Hill and Eileen Myers.

Jim and Rhoda Morris gave a presentation regarding the building of telescope replicas to be exhibited at the world's largest planetarium to be built in China. Three telescope replicas will be constructed, a Newtonian, a Herschel, and a Galilean. Jim and Rhoda would welcome ATMoB member expertise on construction of these replicas. Please visit their very interesting website for contact information and to view extensive technical information on historic telescopes and other notable scientific instrumentation information.
www.scitechantiques.com/resume/index.htm
www.scitechantiques.com/Adler/

- Old Business:
Bernie Volz indicated in an ATMoB Announce email that Chris Elledge has uploaded public outreach material provided by March speaker Dr. Douglas Arion to the ATMoB website, under **Members>Documents>Resources>AMC-Carthage**. Materials may be used by members during public outreach, as

long as the authors of the material are given proper acknowledgement.

- New Business:
Julie Kaufman mentioned that a march to support the sciences will be held on the Boston Common on Earth Day. Julie indicated the importance of showing public support for the funding of scientific research.

One of the attendees at the meeting requested assistance from the club on how to use her telescope. Glenn suggested she stay after the meeting, and help would be arranged.

Glenn introduced the guest speaker for the evening, Kevin Collins, a member of the Amherst Area Amateur Astronomers Association. Kevin detailed his project to utilize a mirror from an old 13.1-inch Coulter Odyssey Dobsonian reflector and make it into a much more compact Obsession style truss tube design. Kevin contrasted the size and weight of the original Odyssey design to his compact, light weight design which he assembled at the meeting. To show the difference, Glenn Chaple had his old, original Odyssey 13.1-inch next to Kevin's scope.

Optical specifications:
Focal length: 57.5" (1460.5 mm).
Theoretical limiting magnitude: 14.4.
Dawes limit: 0.35 arc seconds.
Central obstruction: 21%.
Min. / max. power: 47X / 655X.
Mirror cell: 18 point flotation with a sling.

Kevin stepped through the 85 hours of forming the wood components, positioning the metal hardware, constructing the rocker and mirror boxes, applying the ebony star composite onto the bearing surfaces, and attaching the lead counter weights.

When he finished he had an ultra light scope that can now entirely fit into the back of his vehicle.

Refreshments for the evening provided by Bruce Tinkler.

Glenn Chaple adjourned the meeting at 10:12 pm.

~ *Phil Levine - Secretary* ~

Meeting Recordings . . .

The recording of ATMoB meeting #897 is available on YouTube: <https://youtu.be/4hKMvWOSqHI>.

I would like to thank Kevin Collins for allowing us to record his presentation "13-Inch Coulter Odyssey I Turned Ultra Compact".

From now on, I will be providing the link to the publicly available cut of the meeting recordings in Star Fields. To view the original version of the meetings, please see the Announce Forum on the ATMoB Website <http://www.atmob.org>.

~ *Chris Elledge - Membership Secretary* ~

Nominations for 2017-2018 . . .

By popular vote at the April meeting, the 2017 Nominating Committee was selected. The results are: Chairperson: James Synge and members: Mike Hill and Eileen Myers.

The 2017 Nominating Committee has proposed a slate of nominations to be voted on at the Annual Meeting in June. The nominees are:

President: Glenn Chaple
Vice President: Tom McDonagh
Secretary: Phil Levine
Membership Secretary: Chris Elledge
Treasurer: Eileen Myers
Member at Large: Maria Batista
Member at Large: Al Takeda
Member at Large: Bruce Tinkler

~ 2017 Nominating Committee ~
James Synge (Chair)
Mike Hill
Eileen Myers

Per Articles IX of the ATMob Bylaws: "Members shall have the right to offer additional nominations from the floor of the annual meeting, provided only that a suitable written notice, containing the name or names of the person or persons to be nominated from the floor at the annual meeting, and the signatures of at least Seven members, is filed with the Secretary not less than ten (10) days prior to the date of the annual meeting."

Clubhouse Report . . .



Repairing the damaged observing field. (L-R) Marsha Bowman, Brian Rusch, Steve Clougherty, Chris Elledge and Dave Prowten *

April 2017 Clubhouse Report

During the month of April we had a total of 21 volunteers help out at our Saturday work party which was held on the 15th of the month. Our efforts were focused on outdoor post-Winter cleanup and repair tasks.

Several members helped shovel gravel into the depressions along the driveway while others raked gravel from the lawn which had been deposited by the snow plow earlier in the season. The plow had, unfortunately, torn up a large swath of grass and topsoil on the South side of the Clubhouse. A team of helpers spent 3 hours re-grading the damaged area, and by afternoon new topsoil and grass seed was applied. The area is nearly back to its original condition as of this writing. The snow posts were dismantled and stored in the upper barn for the season.

Work was done on the 17-inch Dob at the work session after mice were discovered nesting inside the warm tube over the Winter months! The mirror and cell were pulled out and washed down while the inside of the tube was cleaned with damp towels. A new mesh screen was stapled to the open end of the mirror cell to prevent this from happening again. This telescope is fully operational and members are encouraged to be checked out on the opening/closing procedure; see Sai Vallabha or Steve Clougherty if you are interested in using this telescope.

The Schupman telescope power cables for the laser pointer and heaters were rerouted by Eric Johansson to prevent them from being tangled when people use the scope. The AC outlet box was found to be damaged and will need to be replaced.

One the two clamshell motors failed last week and the observatory is closed until needed repairs are made during the next work party in May.

Thanks to Paul Cicchetti, Phil Levine and Vladislav Mlch for setting up their solar scopes for viewing during the work party.

Our grill had its igniter and feeder tubes replaced and has been cleaned and readied for another season of service. Many thanks to the lunch crew volunteers who do a fantastic job in meal prep and cleanup!

Our next work party will be held on Saturday, May 13. Hope to see you there!

Thanks to the following members and friends of the ATMob for their efforts during the month of April:

John Blomquist, Barbara Bosworth, Marsha Bowman, Paul Cicchetti, Steve Clougherty, Chris Elledge, Dick Koolish, Phil Levine, Lilah, John Maher, Karen Mercadante, Vladislav Mlch, Eileen Myers, Dave Prowten, John Stodieck, Art Swedlow, John Reed, Brian Rusch, Al Takeda, Bill Toomey, Sai Vallabha.

Important Notice: Due to changing work schedules and commuting times for our optical experts, the Clubhouse **WILL NOT** be open on Thursday evenings. Mirror making sessions will now take place on **Saturday evenings beginning at 7:00 pm. Other times may be scheduled. Check your email on the ATMob-ANNOUNCE list.** We hope that you will have patience with us as we transition to this new time period.

~ Clubhouse Committee Chairs ~
~ Steve Clougherty, John Reed and Dave Prowten ~

Clubhouse Saturday Schedule		
May 6	Nina Craven	Al Takeda
May 13	WORK PARTY # 5 Paul Cicchetti & Karl Dean	
May 20	Steve Clougherty	Jim Gettys
May 27	Paul Courtemanche	Eric Johansson
June 3	Tom McDonagh	Volunteer Needed
June 10	WORK PARTY # 6 John Reed & Sai Vallabha	
June 17	Dave Prowten	John Stodieck
June 24	Phil Rounseville	Joe Wolfe
July 1	Bruce Berger	Joe Henry
July 8	WORK PARTY # 7 George Paquin & John Small	

Clubhouse Evening Schedule	
Friday Night Educational Videos	7:00 pm - 10:30 pm #
Saturday Night Mirror Making	7:00 pm - ##
Saturday Night Observing	7:00 pm - ##
# Closing time is determined by the organizers	
## Closing time is determined by the "A" members on duty	
Note: The Clubhouse is closed on the 2nd Thursday of the month for our monthly meeting in Cambridge.	
Due to inclement weather conditions on Saturday evenings, the "A" members on duty may elect to close the Clubhouse. Please call the Clubhouse at (978) 692-8708 or check for messages posted to ATMOb-ANNOUNCE.	

Citizen CATE Project . . .

For those of you that missed the presentation by Arianna Roberts, a seventh grader from the Acton-Boxborough School system, she presented a compelling imaging project including groups from across the country. Arianna and other students will participate in a coast-to-coast collaboration aiming to image the solar eclipse through totality. The resulting combined 90-minute effort will provide valuable scientific coronal data. At the same time, young scientists will learn to image and cooperate to generate something bigger than the sum of their efforts. Money raised through this GoFundMe effort will help to defray the cost of the telescope imaging system and the travel expenses for training and the eclipse itself. Below is the URL for the Citizen CATE GoFundMe website.

<https://www.gofundme.com/citizen-cate-solar-eclipse-phase-2>

The Amateur Telescope Makers of Boston stand to gain from the effort also. Upon completion of the project, the A-B team will donate the entire imaging system to ATMob for use in education outreach and by the general membership. Please join Bruce Burger and me in donating generously through the GoFundMe site listed above. This is a great cause supporting STEM efforts at a time when funding is becoming more scarce every day. Please feel free to contact Bruce or me with questions regarding this project.

~ Tom McDonagh - Vice President ~

Membership Report . . .

I am pleased to welcome our newest members: John Kwon and Kevin Collins.

As of April 24th, 2017 we have 331 memberships covering 403 members. This is broken down as follows:

- 188 Regular Members
- 94 Senior Members
- 7 Student Members
- 35 Family Membership covering 107 Members
- 7 Guest Members

~ Chris Elledge - Membership Secretary ~

Let's Hunt Exoplanets Together . . .

At NEAIC & NEAF this year I was captivated by Project PANOPTES. Josh Walawender (Keck Observatory) presented the project which aims to extend our ability to find transiting exoplanets by enlisting schools and clubs, amateur astronomers and citizen scientists.

Before the project had a name or a team, its founder, Olivier Guyon, had a question: can DSLRs, rising in ability and dropping in cost, be used for "real science"? He, and others working on Mauna Kea who joined him, experimented with a variety of Canon DSLRs (some modified to remove the IR cut filter) and lenses (some Canon, some less expensive 3rd party lenses). They found, given suitable algorithms for processing the RAW images, that the unmodified, low-end DSLRs cameras with less expensive lenses were almost as good for photometry as their more expensive, customized cousins -- good enough to find a Hot Jupiter with a modest number of these cameras working together, and to find Super Earths with a large network of these cameras.

Since 2010 they've designed, built and tested several prototypes of a small, automated telescope based on that camera. Their latest design is ready for beta testing -- a task I've signed up for, and am quite excited by. The design is based around 2 Canon DSLRs, each with an 85mm f/1.4 lens. These are enclosed in a plastic box atop an iOptron EQ mount, all of which are operated by a small computer, which also handles preliminary analysis. The computer gets instructions for where to aim from a central system, but those can be overridden easily by the owner of the scope.

If you'd like to learn more, contact me (james.synge@gmail.com), see my blog (<https://goo.gl/xPuk0Y>), or visit the project website: projectpanoptes.com.

~ Submitted by James Synge ~

Sky Object of the Month . . .

May 2017

Courtesy LVAS Observer's Challenge***

M98 (NGC 4192) – Galaxy in Coma Berenices

Mags. 12.1/12.2

Mag. 10.1; Size 9.8' X 2.8'

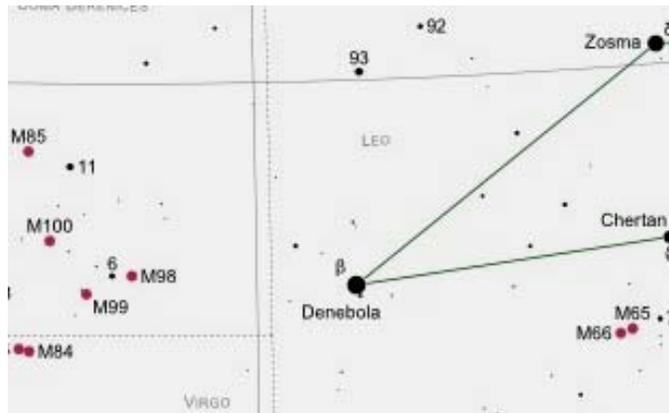


M98 (NGC 4192). Image by Mario Motta M.D.

Spring is galaxy season, with the Virgo Galaxy Cluster well-placed in the evening sky after sunset. The cluster is home to over a dozen Messier objects, including this month's LVAS Challenge, the nearly edge-on spiral M98 (NGC 4192). At magnitude 10.1, M98 is one of the faintest Messier objects, but it's relatively easy to locate as it lies just a little over 6° east of Regulus and $1/2^\circ$ west of 5th magnitude 6 Comae.

As faint as it is, M98 can be seen with a small-aperture scope. I first saw M98 on April 2, 1978, using a 3-inch f/10 reflector and a magnifying power of 30X. The galaxy required averted vision and a chart (an Astro Card) that pinpointed its precise location. I re-observed M98 on the evening of April 12, 2015, this time with a 4.5-inch f/8 reflector and a 16mm Nagler eyepiece that yielded 57X and a 1.4° field. M98 was extremely faint, once again visible only because I knew exactly where to look. Despite the dimness, its elongated form was unmistakable.

Along with nearby M99 and M100, M98 was discovered by Messier's comet-hunting contemporary Pierre Méchain on the evening of March 15, 1781. It lies approximately 60 million light years away and, unlike the vast majority of galaxies, is actually approaching the earth at a speed of about 80 miles/second. This "blue shift" behavior is due to its motion within the Virgo Galaxy Cluster.



Cambridge Explores the Universe Solar Party . . .



Virginia Renehan. Image by Dick Koolish.

Thank you all for another wonderful year of Cambridge Explores the Universe! Nanette Benoit, Dick Koolish, Phil Levine, Virginia Renehan and Phil Rounseville - each and every one of you were integral in making Cambridge Explores the Universe an incredible experience. From welcoming the public, to sharing your astronomy knowledge and expertise, you created a fun, exciting, and engaging atmosphere for visitors young and old.



Dick Koolish with his solar scope. Image by Virginia Renehan.

Based on the CfA tally sheets, and programs handed out, it was estimated that at least 800 ~1000 people came through the Observatory! If the smiling faces on those visitors were any indication, it's safe to say that they thoroughly enjoyed themselves. If that's not enough, over 3/4 of the visitors said they were leaving even more interested in astronomy than when they came, and intend to find out more about astronomy as a result of their time spent with you!

Thank you again for your time, and the positive impact you made on the community! It was a fun day!



Nanette Benoit showing a Hydrogen-alpha view. Image by Virginia Renehan.



Phil Levine with two solar scopes. Image by Virginia Renehan.



Phil Rounseville. Image by Virginia Renehan.

~ Virginia Renehan - Star Party Coordinator ~

Editor: * Photos by Al Takeda unless otherwise noted.

June Star Fields DEADLINE
Sunday, May 21st

Email articles to Al Takeda at
newsletter@atmob.org

Articles from members are always welcome.

POSTMASTER NOTE: First Class Postage Mailed May 5, 2017

Amateur Telescope Makers of Boston, Inc.
c/o Chris Elledge, Membership Secretary
99 College Ave
Arlington, MA 02474
FIRST CLASS

EXECUTIVE BOARD 2016-2017

PRESIDENT:	Glenn Chaple	(978) 597-8465
VICE PRES:	Tom McDonagh	(617) 966-5221
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NEWSLETTER	Al Takeda	newsletter@atmob.org

PUBLIC OUTREACH

STAR PARTY COORDINATOR:
Virginia Renehan starparty@atmob.org

How to Find Us...

Web Page 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 see www.atmob.org and check your email on the ATMOB-ANNOUNCE list.

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 Eastern Daylight Time (EST) from Universal Time (UT) subtract 4 from UT.

May 10 Full Moon
May 11 Double shadow transit on Jupiter, 21:59 - 22:05 EDT
May 17 Mercury at greatest western elongation, 26-deg. (morning)
May 18 Last Quarter Moon (Moonrise at midnight)
May 18 Double shadow transit on Jupiter, 23:54 - 00:42 EDT
May 25 New Moon
May 26 Double shadow transit on Jupiter, 01:47 - 03:19 EDT
Jun 1 First Quarter Moon (Moonset at midnight)
Jun 3 Venus at greatest western elongation, 46-deg. (morning)