



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. 21, No. 11 December 2009

This Month's Meeting...

Thursday, December 10th, 2009 at 8:00 PM
Phillips Auditorium
Harvard-Smithsonian Center for Astrophysics
Parking at CfA is allowed for duration of meeting

WorldWide Telescope Ambassadors Program
Patricia Udomprasert



WorldWide Telescope (WWT) www.worldwidetelescope.org is a rich visualization environment that functions as a virtual telescope, allowing anyone to make use of professional astronomical data to explore and understand the universe. Patricia will demonstrate WWT's breathtaking features, including the ability to visualize and explore in 3-dimensions our solar system, nearby stars in the Milky Way galaxy, and large-scale structure in the universe out to hundreds of Mpc. She will discuss how to create engaging interactive presentations called "tours" that will not only allow users to display beautiful astronomical images in their proper context in the night sky, but also to demonstrate the physical principles at work in those images.

WWT has the potential to dramatically impact educational outreach work done by amateur astronomers. We plan to recruit and train astronomically-literate volunteers to serve as

Ambassadors in schools, neighborhood libraries, and community centers by giving presentations that demonstrate WWT's power to help laypeople visualize and understand our universe. Users will be able to link WWT tours to highly vetted multimedia content from NOVA, the renowned PBS multi-platform series produced by WGBH. Virtual tours will be freely available and centrally managed in order to form a comprehensive astronomy curriculum for both formal and informal educational use. WWT Ambassadors will help to increase science literacy in the general public and to improve science learning in the next generation while forming intergenerational connections within their communities. Patricia will discuss ways to become involved.

Patricia Udomprasert holds a Ph.D. in astronomy from Caltech, where she studied the interaction between galaxy clusters and the Cosmic Microwave Background Radiation. Although she values the thrill of discovery that comes from observing on a remote Chilean mountaintop and looking to the furthest reaches of our universe, she most enjoys working closely with students and explaining why our universe is as it is and how we know what we know. She taught high school astronomy, physics, and math at Concord Academy for 5 years and is now helping to launch the WorldWide Telescope Ambassadors Program. She particularly relishes sharing the joys of the night sky with her preschooler and is looking forward to taking him and his little sister on their first trip to Stellafane

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...

Have you had a chance to get out and look towards the East at around 11:00pm? If so, then you've probably seen Mars shining at magnitude 0.0 in Cancer the Crab. In the next few months, Mars' apparent diameter will grow from its current ten arc seconds to a little over fourteen arc seconds on January 27th, 2010 when it makes its closest approach to Earth during this apparition.

The club is fortunate enough to have a number of seasoned Mars observers as members. Mike Mattei and John Boudreau are two that come immediately to mind. Mike, a long time member of the Association of Lunar and Planetary Observers, has been making drawings of the red planet since the sixties and has had some of his drawings published in books and magazines. He has expert knowledge on the names and locations of the features of Mars and the best techniques of how to identify and observe them. Mike has also embraced today's modern technology of webcam astro-imaging of Mars and most recently, daylight observations of Venus and Mercury.

John started out with film and has since moved on to webcam photography. His work is outstanding in both image capture and the back-end processing of the raw data resulting in some of the finest images of Mars that you'll ever see. Of course,

what he really does well involves tenacity. John is out imaging whenever possible in order to catch the rare moments of good seeing in our New England skies. John also has some outstanding videos of the motions of Mars' moons (Phobos and Deimos) as they travel in their orbits around the planet.

I'm intending to try my hand at imaging Mars in the coming months and will be pulling on both John and Mike for help on the subject. This is one of the great things about the club – knowledgeable people willing to share what they know with others. Whether it be advice in optics, telescope mechanics, deep-sky astro-imaging or just plain finding one's way around the sky. We have quite a cache of knowledge that is available for all members.

Couple this with the physical (telescopes) resources we have at the clubhouse. You can really have a blast during the winter observing season.

Clear Skies

~ *Stephen Beckwith, President* ~

November Meeting Minutes . . .



Kuiper Belt 55636 Occultation Group (L-R) Bernie Volz, Gary Jacobson, Paul Valleli, Mike Person, Bruce Berger and John Briggs.

The November meeting of the Amateur Telescope Makers of Boston featured reports from Mike Person of MIT and 5 ATMoB members who attempted to capture data from the occultation of the Kuiper Belt asteroid KB55636 on October 9, 2009. These members volunteered for the assignment when Dr. James Elliot, co-chair of the joint project of the MIT-Williams Occultation Consortium, spoke to our group in June and asked for amateurs to collaborate with his group at MIT. At the November meeting, Bruce Berger, John Briggs, Gary Jacobson, Paul Valleli and Bernie Volz reported on their experiences.

Mike Person of the MIT's Planetary Astronomy Laboratory and coordinator for the ATMoB groups gave a brief overview of the Kuiper Belt research project. He explained that Kuiper Belt occultations occur when small asteroids cross in front of a star. When that event is timed and the light intensity measured, one can measure that body's size. Other properties can also be

deduced from the light curve generated. The brightness can also determine the objects albedo and guesses can be made about its surface composition.

One of the problems experienced in Kuiper Belt occultation work is the infrequency of transits. Asteroids may have an occultation every week and if you can observe using fainter stars, several during a week. Kuiper Belt objects are far away and therefore move much more slowly and cover less sky. You may only get a couple of occultations a year and may be limited to 10th magnitude stars if you are lucky. Usually the occultation occurs with 12th to 14th magnitude stars. Person did one "on a 16th magnitude star with a big telescope".

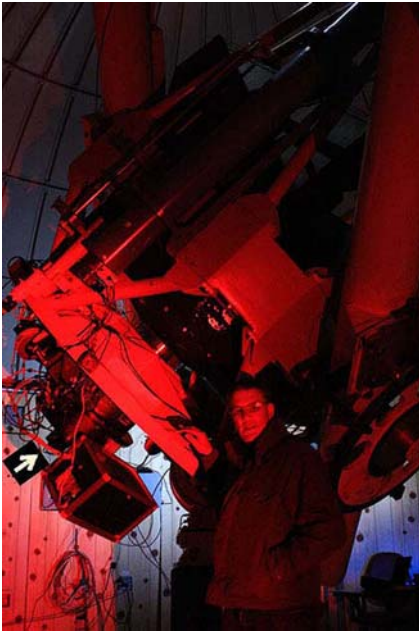
Another problem is predicting the path of the Kuiper Belt object. To observe occultations you need to know the position of the star, the position of the object and the position of the observer to within 2 milli-arcseconds. Star catalogs are getting better such as the U-Keck-2 catalog which is good to 10 – 20 milli-arcseconds. "To accurately predict an occultation takes a lot of preparatory work." Once they get the errors minimized they can send teams, such as the ATMoB group, out into the field. There were 25 stations throughout the world. The Consortium used their astronomers, the ATMoB group, guest observers and others that were just sent instructions.

Mike Person noted that a couple of stations do have data and that they are going over the data and will be putting out a paper soon. He was quite pleased with the collaboration and hope that it continues into the future. If anyone is interested in volunteering in future events or has any suggestions, contact Mike at mjperson@mit.edu.

Before Bruce Berger gave his occultation report, he explained to the group why he volunteered and dispelled some myths about collaboration. Essentially he noted that there is little exotic travel due to tight budgets, there is no pay to do this work, sometimes equipment is unavailable and must be supplied by the observer and observing can be a lonely pursuit. On the other hand you do get the benefit of collaborating with a professional to do real science, some travel expenses can be deducted and depending on the group you can have your name as a co-author in a scientific journal.

Bruce was sent to San Pedro Martir Observatory, Baja California in Mexico. The telescope was a 1.5-meter scope and was the largest scope used by the ATMoB team. The observatory is located in the San Pedro Martir National Park at 9100 feet in altitude. He mentioned that there was very little light pollution present. He exclaimed that "We were dark. We were really dark."

Knowing that Bruce would have 2 days of access on the 1.5-meter scope, the International Occultation Timing Association (IOTA) alerted him to the occultation of the asteroid Pulcova (762). He was able to collect 1200 images at a size of 256x256 pixels, binning the exposure at 2x2. The data was then passed on to IOTA.



Bruce Berger next to the 1.5-meter San Pedro Martir Observatory scope.

During the morning of the occultation the weather was perfect and he collected 2,500 images at 1.5 second intervals. Unfortunately he was too far north of the updated prediction and missed the occultation.

Bruce thanked his host and telescope operator, Dr. Raul Michel, for locating the targets and for giving him a lot of good advice.



Gary Jacobson and the tabletop telescope setup. Image by Bernie Volz.

The 2nd ATMoB group to present consisted of Gary Jacobson and Bernie Volz. They were originally supposed to go to California but were re-assigned to Acapulco, Mexico.

Using a loaner 10-inch Meade Schmidt Cassegrain telescope provided by John Briggs, they had to disassemble the telescope's fork mount and carry it as luggage due to Continental's stringent luggage requirement. The tripod was also left at home because they ran out of room in their luggage.

In Acapulco they rented a house and located the nearest Home Depot to acquire some clamps and other equipment to

secure the reassembled telescope to a table which served as a makeshift tripod.

The weather at that time of year was warm but also cloudy, and it was raining a lot. It was raining on the evening before the occultation. At about 3 a.m. it had stopped raining but it was still cloudy. Gary mentioned that there was a "sucker hole" an hour before the event which allowed for a one star alignment, but the clouds returned and no data was collected.



John Briggs and the Neil Butterworth loaner C-8. Image: John Briggs

Our third presenter, John Briggs noted that "Australia is a dreadfully long way to go." However, before traveled, John contacted the local meteorological office in Townsville, Australia for assistance on the weather and to get some backup in case his telescope had problems. Doug Fraser at the meteorological station was eager to help, since, as it turned out, Doug is working on a Masters degree in Astronomy

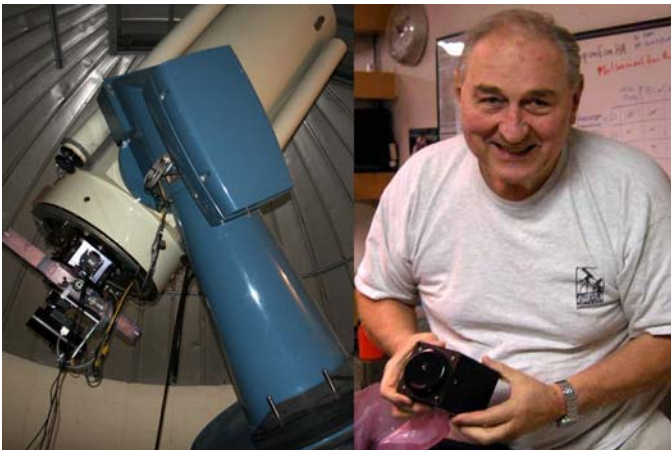
When John arrived in Townsville, his telescope had not. The scope was diverted to Singapore and he didn't see it again until after he was going through customs back in the United States. Using Paul Valleli's advice to check on local AAVSO members in Australia, John was able to contact Neil Butterworth who loaned him a Meade 8-inch Schmidt Cassegrain. Mike Person stated that an occultation measurement was possible with an 8-inch but that it would be difficult.

John and company were able to find a suitable spot at a horse farm outside of town and were able to get images though the 8-inch. As it turned out, nothing happened because the shadow went north of their position. The observer in Cairns also had no data due to the weather.



PICO system. Image by Bruce Berger.

Paul Valleli described the PICO system (Portable Instrument for Capturing Occultations), which fits into a ruggedized carry-on case system that the ATMoB teams used. The camera, made by Finger Lakes Instruments, has a 512x512 CCD chip with a 3-stage Peltier cooling that can lower the chip to 70 degrees Celsius below the ambient temperature. There is essentially no electronic dark noise. The camera can take a $2/10^{\text{th}}$ of a second exposure. The computer is a Lenovo netbook with a lot of RAM memory and running on Windows XP. The GPS unit is designed to send pulses through the computer to the camera. The camera is designed to receive them and that is what sets the cadence and exposure time. The camera and computer can take up to $8/10^{\text{ths}}$ second so data can be acquired every second.



(L-R) Boller & Chivens 30-inch and Paul Valleli holding the FLI camera.
Images by Paul Valleli

Following the ATMoB presenters who went to Mexico and Australia, Paul explained, “And I drew the short straw, and traveled to the Behlen Observatory, which is 35 miles northeast of Lincoln, Nebraska.” The observatory houses a Boller & Chivens 30-inch, f/13.5 telescope. He was assisted by Dr. Ed Schmidt who studies long period variables and Dr. Melissa Brucker who is interested in Kuiper Belt Objects.

On the morning of the event it stopped raining and at 3 a.m. it did start to clear. The telescope was slewed to the target star but they only viewed a “saturated star and horrible noise.”

Paul did not even have enough clear time to focus properly. The PICO camera had been programmed to start 20 minutes before the event but only one star would pop out occasionally as the thick clouds passed by. Paul was certain that he had negative results.



Kelly Beatty gave a short NASA report on the Spirit rover on Mars. The rover has been stuck in a sand dune for over 6 months and NASA will be trying to free it shortly.

Kelly also mentioned that NASA will be holding an LCROSS briefing on Nov. 13th. Data from the LCROSS spectrometers and its other instruments that monitored the booster impact is to be released. NASA also reported that the poles of the Moon are around 35 Kelvin, making it one of the coldest regions in the solar system. Temperatures in this range can freeze out ammonia, carbon dioxide, carbon monoxide and anything else that can be seen in a comet.

Bruce Berger solicited donations for sponsorship of the Ed Knight Observatory Clear Sky Clock site. He raised \$184 from the membership.

The Secretary’s report was given by Al Takeda.

The Treasurer was absent and the report was given by Steve Beckwith

The Membership Secretary report was given by Tom McDonagh. He reminded us that the annual membership dues were due on September 1 and that the deadline for renewing is on Dec. 1.

Steve Beckwith gave the Observing Committee report. John Maher will be canceling the DVD Cosmology course this Friday, November 13th.

Steve Clougherty gave the Clubhouse report. There were 2 good work sessions in October with a lot of members helping out. There are no work parties in November, but there is one scheduled for Saturday, December 5th.

Bruce Berger reported that the Paramount upgrade conversion is complete. The mount is polar aligned within 45 arc seconds and all that is left on the electronics is the error correction on the Sky mapping. The system was used to do some real occultation work last week.

Gary Walker announced that John Reed, Vladimir Vudler and himself will be traveling up to Bailey Hill for the Leonid Meteor shower.

Gary Jacobson is trying to get a count of how many people are interested in getting the RASC *Observer’s Handbook 2010*. He will order copies based on the amount of requests he receives.

Paul Valleli reminded the membership that the International Space Station (ISS) will be visible in the sky in the next few weeks.

Kelly Beatty is hopeful that the Light Pollution bill will be brought out of the Energy Committee in the State House. Kelly reminded everyone to send a note to the co-chairs of the energy committee to get this pushed out of committee.

November Announcements:

- Leonid Meteor Shower – Peaks on the evenings of Nov. 16 and 17th.

November Star Parties:

- Acton Town Wide Star Party – Nov. 13th Canceled
- Lexington Christian Academy Star Party – Postponed
- Swallow Union Elementary School – Nov. 17
- Dr. An Wang School, Lowell - Nov

New Announcements:

- Clubhouse Work Party – Dec 5th
- Bernie Volz is organizing the Australian 2012 Total Solar Eclipse trip. See the Events section at the ATMob website for information.

New Star Parties:

- Lexington Christian Academy Star Party – Dec. 7th

~ Al Takeda, Secretary ~

Clubhouse Report . . .

October 2009

October provided two full moon work sessions at our clubhouse on October 10th and October 31st.

We extend our thanks to John Blomquist, Steve Clougherty, Chuck Evans, Mike Hill, Sydney Johnston, Bern Kosicki, John Maher, Eileen Myers, Dave Prowten, Junichi Sano, Gerry Sussman, Art Swedlow, Al Takeda, Sai Vallabha, and Eric Johansson who prepared a delicious lunch on October 10th. And further thank you's are extended to John Blomquist, Barbara Bosworth., Steve Clougherty, Nina Craven, Anna Hillier, Mike Hill, Eric Johansson, Dick Koolish, John Maher, Mike Mattei, Eileen Myers, Dave Prowten, John Reed, Sergio Simunovic, John Small, Art Swedlow, Al Takeda, and Sai Vallabha for making the October 31st session possible. A Bailey Hill spaghetti sauce lunch was served on October 31st, welcoming the cooler weather.

While John B. and John M. tended the lawn mowing, the fall staining of the Ed Knight Observatory was tackled by Junichi S., Al T., Steve C., Eileen M., Dave P., and Mike H.

The 17" hutch was scraped, primed and doors stained by Barbara B., Eileen M., Nina C. and Steve C. Al T. did yeoman's work, tackling the staining of the full rear of the clubhouse, using multiple ladders, and holding on "by hook

and by crook". He was ably assisted by Eileen M. and Nina C. Meanwhile, in the near barn, the workshop wiring was extended by John S. assisted by Sergio S., and Mike H. Some tree trimming along the observing field was undertaken by Steve C. and John R.

Daylight is ending much sooner since the EST switch; even though it's tough getting to the clubhouse by 10 am, we can have six hours if we start on time. So I'll make a special effort the next few months to load the truck the night before.

The next work party/session will be held on December 5th. With crossed fingers we'll try to wrap up the outside chores, and tackle the inside chores that have been waiting in the wings. If you can spare a few hours, come up/down and help out, for it will be very much appreciated. The packages of Clamshell stairs parts that Steve C. trucked to the clubhouse are ready to assemble. Steve and Dave can use your help

~ Clubhouse Committee ~

~ John Reed, Steve Clougherty and Dave Prowten ~



John Small working on electrical wiring in the new Workshop. Image by Al T.

Clubhouse Saturday Schedule

Dec 5	Dave Prowten, John Reed- Work Party	
Dec 12	Steve Mock	TBD
Dec 19	John Small	Art Swedlow
Dec 26	John Maher	George Paquin
Dec 31	New Year's Party	
Jan 2	John Panaswich	John Small
Jan 9	Gary Jacobson	Eric Johansson
Jan 16	Brian Maerz	Glenn Meurer
Jan 23	Shilpa Lawande	Nitin Sonawane

Membership Report . . .

Membership as of 12/01/2009 - 291 members.

This membership count reflects the current membership in good standing on the 1st of December 2009. Members delinquent in dues payment will no longer have access to the website or ATMoB facilities on this day.

Navigate using the following link after logging in to renew your membership today!

<http://www.atmob.org/members/person.php?frid=renewals> then click on the red renewal tab to renew online!

Please contact the Membership Secretary if you have any problems logging into the ATMoB website or navigating through the renewal process, at Membership@ATMoB.org.

New members in 2009 are not required to renew till September 2010.

The Amateur Telescope Makers of Boston, Inc. is a 501(c)3 organization. Donations are gladly accepted and are tax deductible to the extent allowed by law. While the deadline for 2009 charitable donations is almost here, please consider making a tax-deductible contribution to the club when planning for 2010 and beyond.

All members are encouraged to seek out and welcome our new members:

Louis Roten Peter Burns Mark Henry Jason Trechok

membership@atmob.org

~ Tom McDonagh – Membership Secretary ~

Thoreau on Astronomy . . .

Long did it take to sink the Carlisle bridge. The reflections after sunset were distinct and glorious, the heaven into which we unceasingly rowed. I thought now that the angle of reflection was greater than the incidents. It cooler grew. The stars came out after we turned Ball's Hill, and it became difficult to distinguish our course. The boatman knows a river by reaches. We ran part way into several holts, or poke-logans. Got home in the dark, our feet and legs numb and cold with sitting and inactivity, having been about eight miles by river, etc. It was some time before we recovered full use of our cramped legs. I forgot to speak of the afterglows. The twilight, in fact, had several stages to it, and several times after it had grown dusky the twilight acquired a new transparency, and the trees on the hillside were lit up again.

~ Submitted by Tom Calderwood ~

Ditson Star Party Report . .

On November 2nd John Blomquist, Neil Fleming, Brewster LaMacchia, Scott Romanowski, Bruce Tinkler, and David Wallace helped at a star party at the Ditson School in Billerica. Despite clouds that moved in late in the afternoon the students were enthralled by the talk and the limited objects they could see through breaks in the clouds.

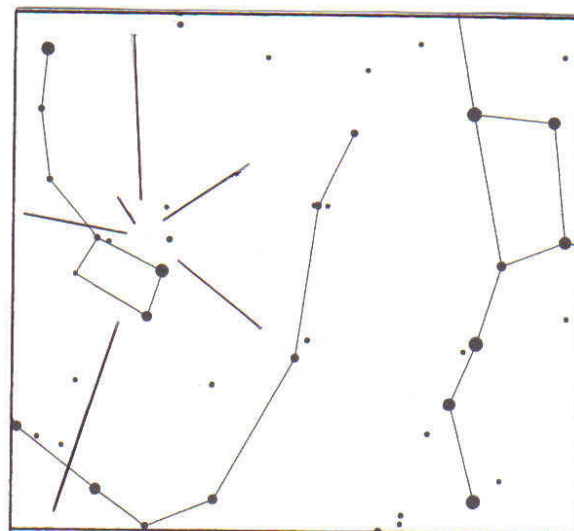
~ Scott Romanowski ~

Sky Object of the Month . . .

December 2009

Ursid Meteor

Shower



Radiant for Ursid Meteors
From Cartes du Ciel

You're quite likely familiar with the Geminid meteor shower. One of the year's most prolific, with hourly rates often exceeding 100 meteors, the Geminids reach peak activity on the evening of December 13-14. With the moon close to new phase, the 2009 Geminid display should be spectacular.

Less known is a meteor shower that occurs about a week later - the Ursids. Discovered a little over a century ago, the Ursids are associated with the comet P8/Tuttle. There are two reasons why this meteor shower is so little observed. For one thing, it's rather sparse. Although there have been reports of short outbursts of 100 Ursids per hour, the hourly rate rarely reaches double figures. Couple that with the fact that the Ursids climax near the peak of the Holiday season (predicted maximum activity is scheduled for the evening of December 21-22), and you have a meteor shower few backyard astronomers have ever observed.

That includes me. In years when I've made plans to view the Ursids, either clouds or a bright moon got in the way. Other times, I got so wrapped up in Holiday hysteria, I either forgot or was too tired to bother. On the one clear, moonless evening I

did give the Ursids a try, I saw virtually nothing for 15 minutes, got bored, and went back inside – behavior NOT worthy of a so-called avid amateur astronomer!

Here's my game plan for Ursids 2009 – one that I encourage you to try. Some time towards the middle of the night when the waxing crescent moon has set, I'll bundle up and go outside with a thermos of hot chocolate. Since the Ursids appear to radiate from the vicinity of the star Kochab (β Ursae Minoris) I'll set up a lawn chair in a part of my back yard that affords a clear view of the northern sky. Then I'll sit and wait. No copping out after a quarter hour! I'll watch for at least an hour, or until I've spotted 5 or 6 Ursids, which ever comes first. Who knows – I might be fortunate enough to catch one of those rare Ursid outbursts. It's the uncertainty of meteor showers that makes them so fascinating.

Want to know more about the Geminids and Ursids? Check out Gary Kronk's www.meteorshowersonline.com. And don't forget the section on meteor showers in Guy Ottewill's annual publication *Astronomical Calendar*.

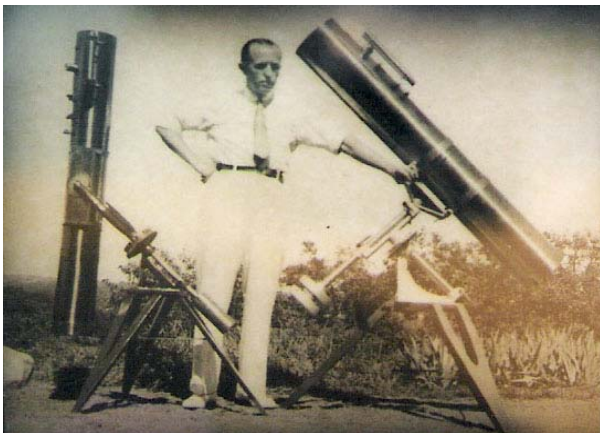
Your comments on this column are welcome. E-mail me at gchaple@hotmail.com.

~ Glenn Chaple ~

History publications . . .

For the 75th Anniversary Party I planned to have five copies of the *Club History* for sale. Unfortunately, the printer did not have hard covers for these special printings and had to order them, but the shipment arrived too late. As a result, I now have 5 copies, which will be the last batch printed as there are no more names on the waiting list. ALSO, the copy place ran off the Histories on the wrong machine and printed the last half of the Histories with the headings on the previous page. I think they wanted the book to look even nicer, so the pictures are now in color and on heavier paper. Since I don't plan to return them, anyone who wants a copy can have a *Club History* for the \$20.00 cost of printing. See Eileen Myers at club meetings to request a copy.

~ Anna Hillier ~



Wagn Hargbol: From the ATMob Archives

Blue Moon New Year's Eve Party at the Clubhouse . . .

Yes my friends, a New Year's Eve Blue Moon! Is the Blue Moon the second full moon in a calendar month or the third full moon in a season of four? Is January 1, 2010 the start of the new decade, or is January 1, 2011? Ignore the debate and stay up late. Stop by and celebrate as we welcome 2010!

The festivities will start at 6:30 PM on Thursday, December 31st and will continue past midnight. You can arrive at any time since the opportunity to shout "Happy New Year" will be every hour on the hour as the New Year crosses the time zones, starting with Greenwich Mean Time and continuing through Eastern Standard Time.

Stop by with your family and friends. Please bring something tasty to share. Entrée type dishes are always very welcome since folks arrive and leave all evening. The party seems to start again with each new group. There will be plenty of non-alcoholic beverages. The clubhouse will be warm and the party is on regardless of the weather. The full Blue Moon will be joining us (blue filters will be available) so don't forget your warm observing clothes and boots, and bring a telescope and camera if you like. There should be celebratory Moon gazing. We will also have indoor games, quizzes, songs, and PRIZES so do join us to welcome in 2010 together. Any party suggestions or questions, email Eileen at starleen@charter.net or 978-461-1454 (day) or 978-456-3937 (evening). Directions to the Tom Britton Clubhouse: see the last page of this newsletter, or find them at the club's website.

~ Co-Hosts, Clubhouse Committee Members Eileen Myers, John Reed, Art Swedlow, Al Takeda and Sai Vallabha ~



2009 New Years Day Party. (L-R) Dick Koolish, John Reed, Marcha Bowman, Art Swedlow and Steve Clougherty. Image by Al Takeda.

**January Star Fields DEADLINE
Wednesday, December 30th**

Email articles to Al Takeda at

secretary@atmob.org

POSTMASTER NOTE: First Class Postage Mailed Dec 2nd, 2009

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

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John Maher (978) 568-1253

OBSERVING AND 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 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 Eastern Standard Time (EST) from Universal Time (UT) subtract 5 from UT.

- Dec 8 Last Quarter Moon
- Dec 14 Geminid Meteor Shower peaks 5 UT (0 hr. EST)
- Dec 16 New Moon
- Dec 18 Mercury at Greatest Eastern Elongation (Evening).
- Dec 21 Winter Solstice
- Dec 24 First Quarter Moon
- Dec 31 Full Moon (Blue Moon), Partial Lunar Eclipse at Moonrise.