



the Skyscraper

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AMATEUR ASTRONOMICAL SOCIETY OF RHODE ISLAND * 47 PEEPTOAD ROAD * NORTH SCITUATE, RHODE ISLAND 02857 * WWW.THESKYSCRAPERS.ORG

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Phases of the Moon

Last Quarter Moon
January 2 05:30

New Moon
January 10 01:31

First Quarter Moon
January 16 23:26

Full Wolf Moon
January 24 01:46

Friday, January 15, 7:00pm at North Scituate Community House

Beauty of the Southern Sky by Steve Hubbard

Our speaker this month is long time Skyscraper member Steve Hubbard.

Do you ever get tired of the same old night sky? Don't get me wrong, we have some nice things to see up here in the Northern Hemisphere and having Polaris point the way to the North Pole makes it SO easy to line up a telescope.

For years, I've both read and heard about the wonders of the Southern Hemisphere objects. Super bright nebulas, superior globular clusters, a vivid Milky Way and oh ya... a couple of small, close galaxies called the Magellanic Clouds that people in the Southern Hemisphere seem to get all excited about. I mean really, how much better could the southern sky be?

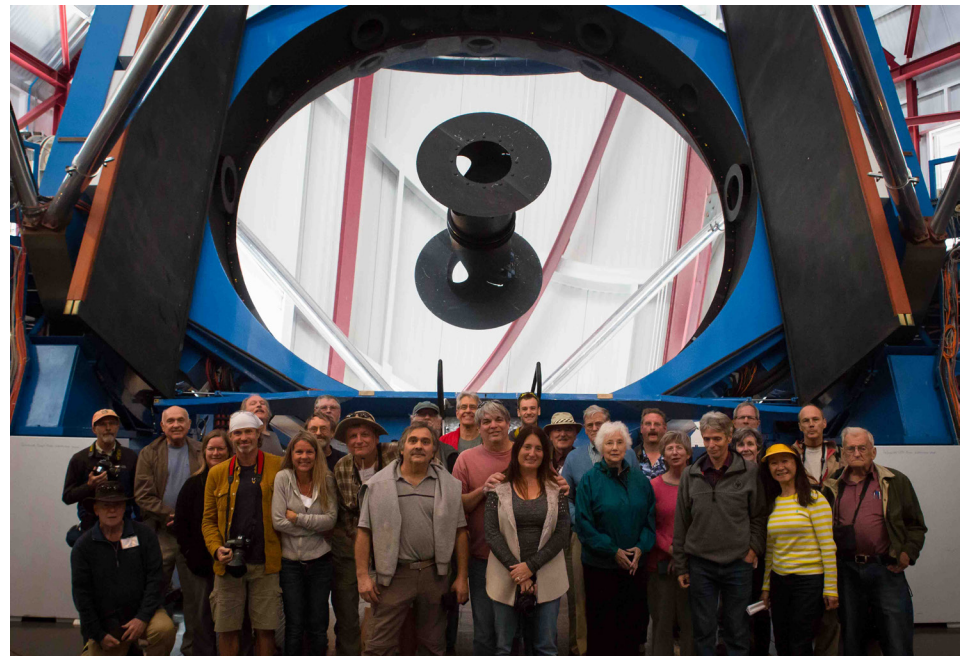
After decades wondering, I finally got the chance to find out. Last November, I was very fortunate to join Astronomy Magazine columnist Bob Berman and 25

other amateur astronomers on a fantastic trip to Chile. We spent a week touring the country, learning the culture and yes, we even did some astronomy. Regretfully, we didn't have a lot of time for observing and I couldn't bring a lot of equipment to document the trip, but it was still one of the best trips I've gone on.

How were the Southern skies as compared to what we can see? Well, to find out, you're just going to have to come to our meeting and find out!

Steve has been an active member of The Skyscrapers since 1973 and does visual observing and light imaging as often as he can from his backyard observatory in Auburn Mass.

While he still greatly enjoys The Skyscrapers, Steve can't get over the fact that so much time has passed (over 40 years!) since he first joined. Where did the time go?



President's Message

by Bob Horton

Happy New Year to all of you!

The winter months can present a challenge for any plans we make for activities at Skyscrapers. Hopefully this winter will be mild enough so we can continue to enjoy a variety of events at the observatory, rather than closing down until spring as we had to do last year. This past fall we enjoyed another series of astronomy workshops, star parties and membership observing opportunities, all of which were well attended. I would like to see that level of enthusiasm continue now through the coming winter months.

Over the past year, the Board of Directors has been looking into the possibility of having Skyscrapers collaborate with local universities and colleges to install a fully automated, large aperture telescope on our property. The telescope under consideration is a 27" Planewave Cassegrain which could be used remotely by both students and our own membership. I am happy to report that progress has been made on this effort and grant proposals have been drafted. We will be hearing more about this at our next board meeting.

Our regular monthly meetings are an opportunity for us to get together to enjoy a talk by an invited guest speaker, socializing with one another, and to do some stargazing after the evening's program. Business

matters are intentionally kept to a minimum during our regular meetings, and then it is largely limited to introducing new members. Monthly meetings are to be enjoyed as a fun, educational experience.

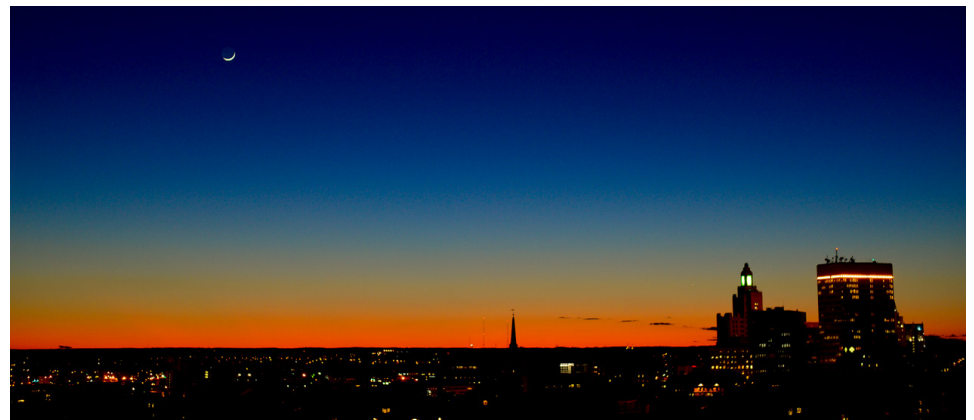
However, as a non-profit organization, Skyscrapers does indeed need to deal with its business matters, membership activities and long range planning. This is the focus of discussion by the officers at our monthly board meetings. Such planning requires enough time for discussion, and that is the reason for having board meetings.

Keep in mind that board meetings are not limited to our elected officers. As a member of Skyscrapers, your involvement in these discussions is more important than you may realize. If you have some ideas

you would like to share, please attend our next board meeting scheduled for January 16, 2pm at Seagrave Observatory. I will send out an e-mail reminder a few days before the meeting.

And speaking of officers, we are quickly approaching the time when we will nominate new officers, two members-at-large and a trustee. Nominations will be presented in March and we will hold an election at our Annual Meeting in April.

I have appointed Ed Haskell as chair of the Nominating Committee. The task of this committee is to get qualified members to run for office. If you are interested in taking on an active role in Skyscrapers and would like to be considered as a candidate, please see Ed at our next meeting.



The *Skyscraper* is published monthly by Skyscrapers, Inc. Meetings are held monthly, usually on the first or second Friday or Saturday of the month. Seagrave Memorial Observatory is open every Saturday night, weather permitting.

Directions

Directions to Seagrave Memorial Observatory are located on the back page of this newsletter.

Submissions

Submissions to The Skyscraper are always welcome. Please submit items for the newsletter no later than **January 18** to Jim Hendrickson, 1 Sunflower Circle, North Providence, RI 02911 or e-mail to jim@distantgalaxy.com.

E-mail subscriptions

To receive The Skyscraper by e-mail, send e-mail with your name and address to jim@distantgalaxy.com. Note that you will no longer receive the newsletter by postal mail.

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Seagrave Memorial Observatory Open Nights

Saturdays at 7:00 pm
weather permitting

Upcoming Meetings

Contact Steve Siok for more information: ssiok@cox.net

**January 15 at North Scituate
Community Center**
**Holiday Party & An Astronomical Vacation in
Chile** by Steve Hubbard (Skyscrapers, Inc.)

**February 5 at North Scituate
Community Center**
Cosmic Rays by Dr. Wallace Arthur (Farleigh Dickinson
University)

March 4 at North Scituate Community Center
Cosmology and the Decay of Dark Matter by
Gordon Blackadder (Brown University)

**April 1 at North Scituate
Community Center (if needed)**

May 6 at Seagrave Observatory

June 3 at Seagrave Observatory

**AstroAssembly: September 30/October
1 at Seagrave Observatory/North
Scituate Community Center Reserved**

Friday, January 8: Two Small Pieces of Glass at the University of Rhode Island Planetarium

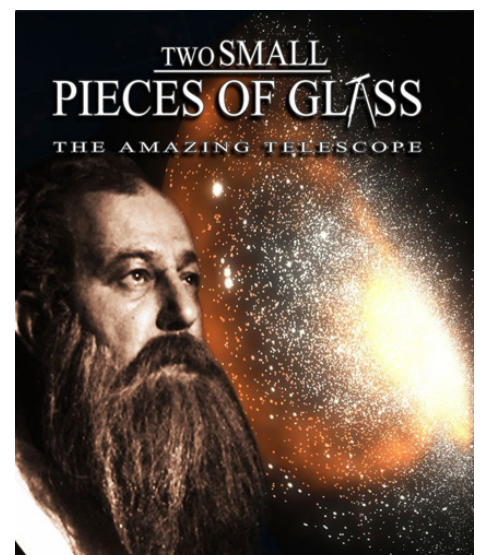
University of Rhode Island Planetarium
Upper College Road, Kingston, RI
Friday, December 11, 2015
6:00 P.M.

Contact: Francine Jackson: 401-527-5558

The telescope introduced the sky as had never been seen. It showed that some objects were not point sources, but actual bodies: planets, star clusters, and, eventually, independent galaxies. Join the URI Planetarium as we learn the history of this very important tool that opened our eyes to new worlds of our celestial sphere.

This program, for the general audience, will be preceded by a short program, Losing the Dark on light trespass, and then will be followed by a live presentation on the Sky above the URI Campus. Admission is just \$5.00, to benefit the URI Planetarium Fund.

The University of Rhode Island Planetarium is available for programs of many varied topics of astronomical interest for all age levels. For more information, please call 401-527-5558.



Meteor Shower Prospects for 2016 and Other Astronomical Highlights

by Dave Huestis

I can't believe I'm writing about astronomical prospects for the year 2016. I can remember a time when I thought 2001 was far into the future. That future turned out a bit different than the one portrayed in the movie "2001: A Space Odyssey" (though my computer often behaves like HAL). However, our conquest of space is inevitable. Unmanned spacecraft have explored many of the distant worlds in our solar system. NASA's recent call for the next generation of astronauts will prepare mankind for the eventual permanent settlement on Mars.

Unfortunately our "colonization" of Mars is still several decades into the future. But for the next 12 months you can explore our solar system, the Milky Way Galaxy, and countless island universes from your backyard and from the local Rhode Island observatories. The following are some of the astronomical highlights we can expect to see in 2016 if the skies remain clear and transparent.

One event that we do not see occurs on January 2, which is when the Earth is closest (perihelion) to the Sun at 91,403,808 miles. You may have thought otherwise. However, winter in the northern hemisphere is not attributable to the Earth's distance from the Sun. It occurs because the northern hemisphere is tilted away from the Sun during that time in Earth's orbit.

Despite the often very cold nights at the onset of January, I look forward to the annual Quadrantid meteor shower. This year these blue meteors blaze across the sky at 25.5 miles per second during the night of January 3-4. While the shower will peak between midnight and dawn, a waning crescent Moon (last quarter on the 2nd) will brighten the sky somewhat and reduce the number of meteors that can be seen. Still, an observer situated away from city lights can expect to observe perhaps 30-50 meteors per hour. I've seen many Quadrantids shoot more than halfway across the sky!

While you can see these meteors anywhere in the sky, their radiant point (the area of sky from where the meteors appear to originate) is not far from the end star, Alkaid, of the Big Dipper's handle. From midnight till dawn, this area of sky will rise higher and higher above the northeast

horizon, and by 4:00 a.m. it will be almost at zenith (directly overhead). You'll know you've spotted a Quadrantid meteor if its dust train through the sky points back to the radiant point. Be sure to dress warmly and do not fall asleep out there under the shooting stars.

During 2015, the Moon occulted (passed in front of) Taurus' bright star Aldebaran. These occultations will continue in 2016. While there is one every month except June, here in Southern New England we can only observe the following events: January 19, April 10, July 29, October 19 and December 13.

One quick note that is not entirely astronomical, we add a leap day to February during 2016 (February 29).

We make this adjustment every four years to keep our calendar in sync with the Earth's orbit around the Sun.

During the latter half of 2015, amateur astronomers had no naked-eye planets visible before midnight. Instead, they were all grouped together in the early pre-dawn sky. As we begin the new year, Jupiter will finally rise before midnight. Each night it will rise earlier, allowing casual stargazers to marvel at its beauty at a reasonable evening hour. On March 8, Jupiter will be at opposition (opposite the Sun in our sky) and will rise at sunset. On that date the planet will be at its closest distance to the Earth for 2016, approximately 412,296,186 miles.

The highlight of 2016 is the transit of Mercury on May 9. Since Mercury orbits between the Sun and the Earth, it infrequently passes in front of the solar disk due to the planet's orbital inclination to that of the Earth. The last one occurred on November 8, 2006, and the next one after this one will be on November 11, 2019. While the transit is a fantastic event to observe, only astronomers with special solar filters will be able to follow its progress. (I'm sure it will be broadcast on the web.) For those of you who can view the event safely, the transit will begin locally at 7:13 a.m. and end at 2:41 p.m. Details will be provided in my May 2016 column.

Mars has been one of those planets grouped together in the pre-dawn sky at year's end. And due to the configuration

of our two orbits, Mars has not been easily observable for some time. While you could get out of bed early in the morning during January and February, it won't be until around March 1st that Mars will rise before midnight. Since the Earth is closer to the sun than Mars, our planet will be catching up to Mars in our respective orbits. On May 22, Mars will be at opposition, and our two worlds will be at their closest on May 30. This close encounter will be the nearest the two have been since November 2005, at 46,780,000 miles. Also at this time Mars will be at its biggest and brightest. Telescopes are likely to show a wealth of detail. The north polar cap will be tilted slightly towards us. The cap will be small, but noticeable. Mars' summer solstice is on January 3, so a lot of polar melting will have occurred by May. Dusky surface markings should be apparent under medium telescopic magnification.

While Saturn can be observed between midnight and dawn during the first few months of 2016, it isn't until about March 22 that this magnificent ringed world rises around midnight. On June 3 Saturn will be at opposition and at its closest to the Earth, about 838 million miles. Saturn will then be at its brightest in more than a decade. Contributing to this dazzling appearance will be Saturn's rings, the north face of the ring system tilted about 26 degrees towards us. The view will be spectacular. They will be at their maximum tilt of almost 27 degrees in 2017.

On July 4 Earth is at aphelion (farthest from the Sun) at 94,512,900 miles.

The Moon occults bright stars often (reference all the Aldebaran occultations for this year), and once in a while it will occult a planet. On July 23 at around 12:06 a.m., a waning gibbous Moon will occult Neptune, the eighth planet in our solar system. This interesting event will begin with the two objects about 21 degrees above the southeastern horizon. Neptune will disappear behind the Moon's bright limb (edge). The occultation will end at approximately 1:00 a.m. when Neptune will reappear along the Moon's dark limb.

While I absolutely hate the often coined word "Supermoon," it has come into wide-

spread use over the last few years. Well, the Moon's nearest perigee (that's the astronomical term for close approach) since January 26, 1948, will occur on November 14. At that time the Moon will be only 221,526 miles from the Earth. The next closest perigee won't happen until November 25, 2034. I'm sure everyone will be talking about it, so I thought I'd alert you well ahead of time.

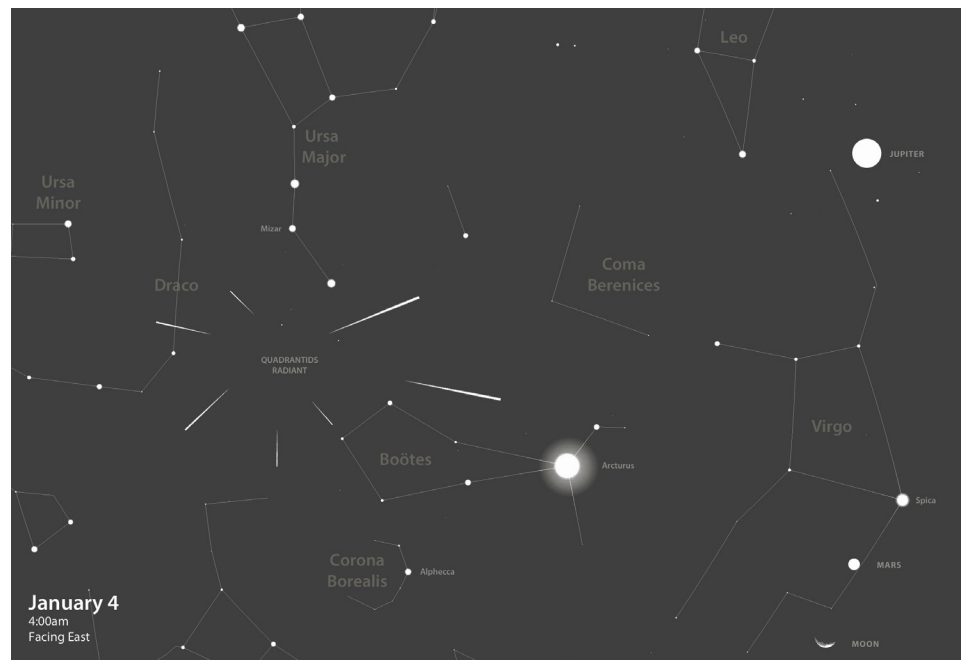
On December 6 the Moon will once again occult Neptune. This event will be more challenging to observe, as Neptune will disappear along the dark limb of a First Quarter Moon at approximately 4:15 p.m. locally. That's the same time the Sun sets, so the sky will be very bright. Neptune is so dim that I doubt it will be visible through a telescope before it disappears behind the Moon. However, by the time Neptune emerges from behind the bright lunar limb at approximately 5:35 p.m., the sky will have darkened enough for Neptune's reappearance to be viewed. Throughout this event the Moon will be well placed in the sky for all to observe.

So there you have it. The above astronomical events are merely the highlights for 2016. But please don't simply wait for these calendar dates to arrive to enjoy the heavens. While I hope for clear skies for all of the highlighted events, experience has proven that clouds will unfortunately spoil a percentage of them. Reserve some time to venture outdoors a couple of times a week to observe the heavens. Scan the sky for meteors, learn a few constellations, or if you are located away from severe light pollution and the Milky Way is visible, grab a pair of binoculars and discover the star clusters and nebulae within our home galaxy.

In conclusion, please remember that the local observatories do remain open year-round to provide incredible views of the heavens with their wonderful telescopes. These facilities are unheated, so dress warmly. Seagrave Memorial Observatory (<http://www.theskyscrapers.org>) in North Scituate is open every clear Saturday night. Ladd Observatory (<http://www.brown.edu/Departments/Physics/Ladd/>) in Providence is open every Tuesday night. The Margaret M. Jacoby Observatory at the CCRI Knight Campus in Warwick (<http://www.ccri.edu/physics/observatory.htm>) is open every clear Wednesday night. Frosty Drew Observatory (<http://www.frostydrew.org/>) in Charlestown is open every clear Friday night. Snow or ice can force closures, so please check the respective websites for any cancellation notices before venturing

Meteor Shower Prospects for 2016

Month	Shower	Date	Moon Phase
January	Quadrantids	3-4	Waning Crescent (Last Qtr on 2nd)
April	Lyrids	21-22	Full Moon
May	Eta Aquarids	5-6	New Moon
July	Delta Aquarids	28-30	Waning Crescent (Last Qtr on 26th)
July	Capricornids	29-30	Waning Crescent (Last Qtr on 26th)
August	Perseids	12-13	Waxing Gibbous (First Qtr on 10th)
October	Orionids	20-21	Last Quarter
November	Leonids	16-17	Waning Gibbous (Full Moon on 14th)
December	Geminids	13-14	Full Moon



out for a visit. Currently the winter hours for Seagrave and Ladd are 7:00-9:00 p.m., while Frosty Drew begins at 6:00 p.m. with no set end time.

Some of the topics highlighted in this column may be covered in depth as an event date approaches.

Please clip and save the following chart showing the observing prospects for the 2016 meteor showers. These displays of shooting stars only require your eyes, dark

skies, and patience to enjoy.

Keep your eyes to the skies for 2016 and always.

Happy New Year!



Dave Huestis is Skyscrapers Historian and has been contributing monthly columns to local newspapers for nearly 40 years. See more at <http://theskyscrapers.org/dave-huestis>

In Memory: Roger Menard and Minka Wescott

by Francine Jackson

It's very hard to lose a friend, but to become aware of two in one day is very difficult. This week the Rhode Island astronomical community lost two of its most staunch lovers of astronomy.

The first was a long time member of Skyscrapers, Inc., **Roger Menard**. Roger was also known for his patience and endurance running the 12-inch refractor at Ladd Observatory for many decades. He would come to Ladd each open night with a brown paper bag covered with that night's information on the objects he would concentrate on observing. If planets, the name and position of each satellite belonging to it; if the Moon, the relevant features you would be able to see; if a comet, its distance, brightness, position with respect to the Sun, and how much longer we would be able to view it in the sky.

Roger was also involved with the planetarium facility at Brown. Not many can recall that a planetarium was set up within the cupola of a fraternity house in the late '60s, early '70s. Roger was one of the lecturers during its time.

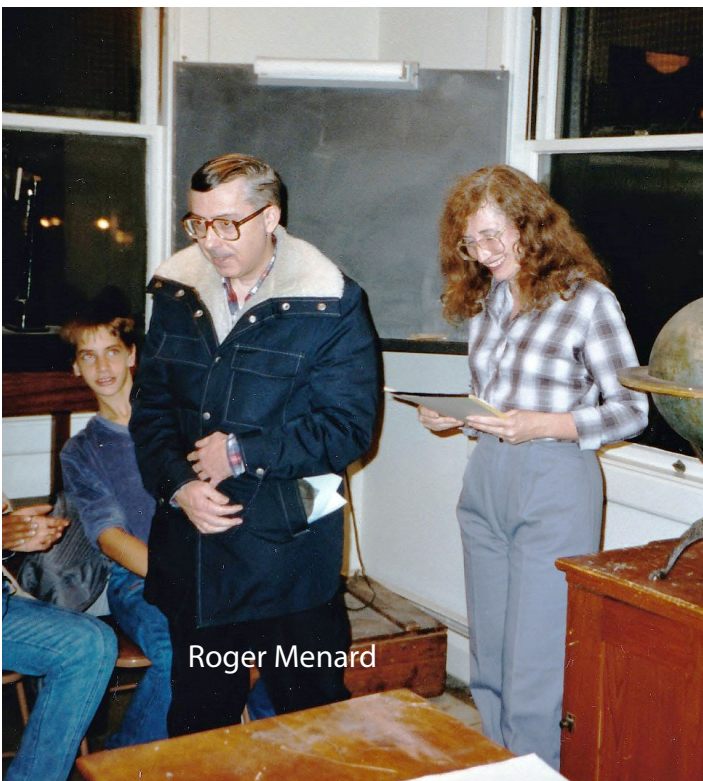
Roger had been ill the past several years, and had been living in a nursing home, but he still remained in contact. His work with the

public will be very sorely missed.

Also, although not a Skyscraper member, many of you will recall **Minka Wescott**. She and I were first introduced when she started coming to the Roger Williams Park Planetarium every weekend, because of her love of astronomy; however, once Minka learned about Ladd Observatory, she realized this was her "home." She would spend virtually the entire night up in the dome, often discussing the universe with Roger. Her wonderment of the sky didn't diminish even when she moved to Texas, where her skies were not to her liking, and every October she would come back for our open Ladd nights, becoming once again a part of our family, if only for that one night.

One of her surprising skills was woodworking, and Minka surprised us one evening by bringing to Ladd two of her creations: Saturn, and Jupiter with its Galilean moons. They are still a part of our library collection.

The last time Minka came to Ladd, in October 2014, she mentioned that she hadn't been feeling very well, but she still had to come, and the night was one of the clearest we had had in many months. When Bob brought her up to the deck, she was greeted with the cheers she deserved, as she had come back "home" with her sky friends. We hadn't realized then that that night would be the last time we would all be together.



Roger Menard



Francine Jackson is Skyscrapers Public Relations Spokesperson, writes the weekly newsletter for Ladd Observatory and serves as planetarian at the University of Rhode Island. See more at <http://theskyscrapers.org/francine-jackson>



Minka Wescott

Centennial of the Discovery of the Proper Motion of Barnard's Star

by Francine Jackson

2016, in addition to being the 125th anniversary of Ladd Observatory, is also the 100th anniversary of the discovery of a star moving the fastest in our sky. In 1916, Edward Emerson Barnard, working at the Yerkes Observatory's 40" refractor, discovered that a very tiny red dwarf star's proper motion had the incredible rate of 10.3" per year. Although to us this may sound like watching fingernails grow, on the celestial sphere this is incredible. It is the equivalent of traveling the diameter of our Moon in under two centuries.

Proper motion is the change in position of a star on the celestial sphere from our perspective. This change is normally

exceedingly small, often seconds of arc per century. It is believed the first person who realized this motion was Edmund Halley, who in 1718 noticed that some of our closer stars' positions differed from that of Hipparchus's charts two millennia previous.

Besides moving very quickly, Barnard's star is the fourth closest to us, only about 6 light years. Only the Alpha Centauri system of three stars, at 4 ¼ light years, is closer.

Unfortunately, Barnard's star isn't in our evening sky right now, as it is within the constellation Ophiuchus, the Doctor, which belongs to our spring/summer set of stars. It also, at approximately 9th apparent

magnitude, is close to 15 times dimmer than the sharpest eyes can locate, but, it is rather easy to find with a small telescope; however, don't expect to be enthralled, as this star is not very significant, even with the best instruments. But, remember: whenever you are able to look at it, it will never be in the same position again.



Francine Jackson is Skyscrapers Public Relations Spokesperson, writes the weekly newsletter for Ladd Observatory and serves as planetarian at the University of Rhode Island. See more at <http://theskyscrapers.org/francine-jackson>

Diffuse Reflection Nebula in Orion

Messier 78

by Las Vegas Astronomical Society

M78, Orion's "other" Messier nebula, has the distinction of being brightest diffuse reflection nebula (one whose light comes from nearby or embedded stars) in the sky. M42 and similar bright luminaries like M8, M17, and M20 are basically diffuse emission nebulas that give off their own light.

To find M78, make a low-power scan of the area 3 degrees northeast of Alnitak (the zeta [ζ] star in Orion's belt – see the finder chart below). M78 was discovered by Pierre Mechain in early 1780 and included by Messier in his Catalog later that year. At an approximate distance of 1600 light years, it spans an area some 10 light years across.

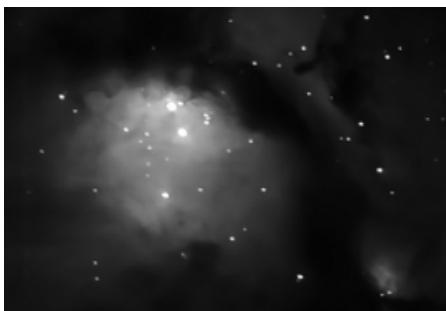
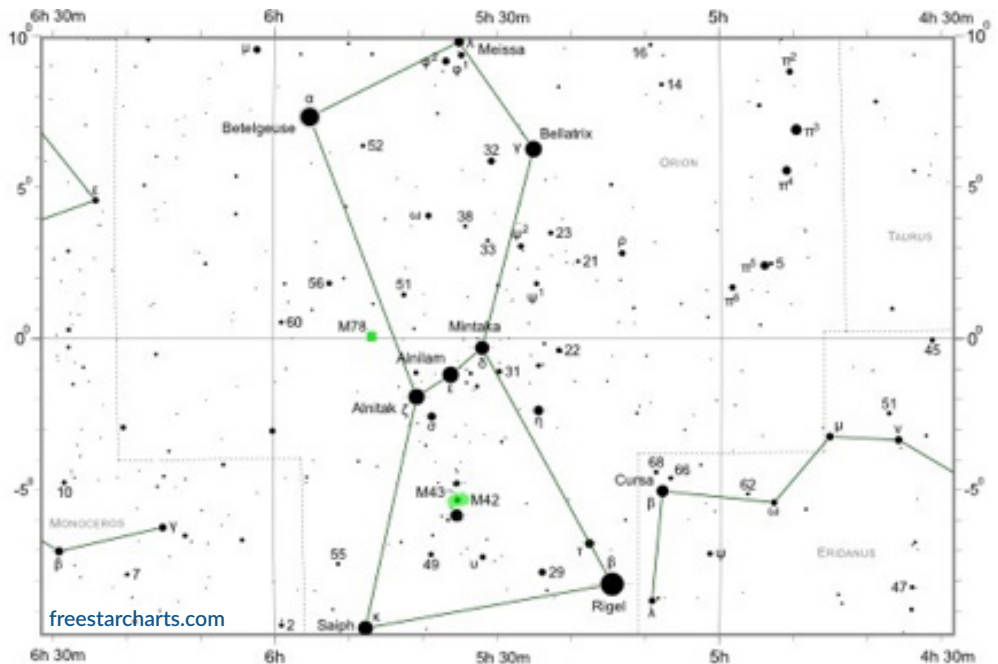


Image by Mario Motta, M.D.

The purpose of the LVAS Observer's Challenge is to encourage the pursuit of visual observing. It is open to everyone that is interested, and if you are able to contribute notes, drawings, or photographs, the LVAS will be happy to include them in our monthly summary. If you would like to contribute material, submit your observing notes, sketches, and/or images to either Roger Ivester (rogerivester@me.com) or Fred Rayworth (queex@embarqmail.com).

To find out more about the LVAS Observer's Challenge or access past reports, log on to lvastronomy.com/observing-challenge.

The Sun, Moon & Planets in January

This table contains the ephemeris of the objects in the Solar System for each Saturday night in January. Times are in Eastern Standard Time calculated for Seagrave Observatory (41.845N, 71.590W).

Object	Date	RA	Dec	Const	Mag	Size	Elong	Phase(%)	Dist(S)	Dist(E)	Rise	Transit	Set
Sun	2	18 47.8	-22 58.8	Sgr	-26.8	1951.8	-	-	-	0.98	07:13	11:50	16:26
	9	19 18.6	-22 12.4	Sgr	-26.8	1951.6	-	-	-	0.98	07:13	11:53	16:33
	16	19 48.9	-21 04.8	Sgr	-26.8	1951.1	-	-	-	0.98	07:10	11:56	16:41
	23	20 18.7	-19 37.4	Cap	-26.8	1950.1	-	-	-	0.98	07:06	11:58	16:49
	30	20 47.8	-17 52.2	Cap	-26.8	1948.5	-	-	-	0.98	07:00	11:59	16:58
Moon	2	12 34.2	-2 50.8	Vir	-11.8	1756.1	92° W	52	-	-	23:54	05:53	11:46
	9	18 18.1	-18 52.0	Sgr	-8.1	1852.7	14° W	2	-	-	06:28	11:31	16:35
	16	0 47.0	2 46.4	Psc	-11.7	1963.5	77° E	39	-	-	11:06	17:42	00:27
	23	7 23.7	17 00.1	Gem	-12.6	1887.2	166° E	99	-	-	16:47	00:01	07:09
	30	13 05.1	-5 01.8	Vir	-12.1	1757.6	113° W	70	-	-	22:39	04:31	10:16
Mercury	2	20 09.0	-20 41.0	Cap	0.0	7.5	19° E	44	0.32	0.89	08:24	13:09	17:54
	9	20 06.9	-18 41.9	Sgr	2.3	9.2	12° E	12	0.31	0.73	07:44	12:35	17:27
	16	19 32.7	-18 25.9	Sgr	6.0	10.1	5° W	2	0.32	0.67	06:41	11:33	16:24
	23	19 05.7	-19 19.5	Sgr	1.5	9.2	17° W	21	0.36	0.73	05:52	10:41	15:29
	30	19 08.0	-20 21.8	Sgr	0.4	7.9	24° W	43	0.4	0.85	05:33	10:18	15:03
Venus	2	16 06.5	-18 52.8	Sco	-3.9	14.4	38° W	77	0.72	1.17	04:17	09:09	14:00
	9	16 42.1	-20 29.2	Oph	-3.9	13.9	36° W	79	0.72	1.22	04:32	09:17	14:02
	16	17 18.5	-21 38.8	Oph	-3.9	13.4	35° W	81	0.72	1.26	04:45	09:26	14:06
	23	17 55.5	-22 18.4	Sgr	-3.9	13	33° W	83	0.72	1.3	04:58	09:35	14:12
	30	18 32.7	-22 26.1	Sgr	-3.9	12.6	32° W	85	0.72	1.34	05:08	09:45	14:22
Mars	2	13 50.4	-9 45.3	Vir	1.2	5.6	72° W	91	1.66	1.67	01:24	06:51	12:18
	9	14 05.1	-11 05.2	Vir	1.2	5.8	75° W	91	1.65	1.61	01:16	06:38	12:00
	16	14 19.6	-12 20.7	Vir	1.1	6.1	79° W	91	1.65	1.53	01:08	06:25	11:42
	23	14 33.8	-13 31.5	Lib	1.0	6.4	82° W	90	1.65	1.46	00:59	06:12	11:24
	30	14 47.8	-14 37.3	Lib	0.9	6.7	86° W	90	1.64	1.39	00:50	05:58	11:06
1 Ceres	2	21 40.6	-22 32.7	Cap	9.3	0.3	40° E	99	2.98	3.67	10:04	14:40	19:16
	9	21 50.8	-21 37.7	Cap	9.3	0.3	35° E	99	2.98	3.73	09:43	14:23	19:03
	16	22 01.1	-20 40.9	Aqr	9.3	0.3	31° E	99	2.98	3.78	09:21	14:06	18:50
	23	22 11.5	-19 42.4	Aqr	9.2	0.3	27° E	99	2.98	3.82	09:00	13:48	18:37
	30	22 21.9	-18 42.6	Aqr	9.2	0.3	22° E	100	2.98	3.86	08:39	13:31	18:24
Jupiter	2	11 36.9	3 51.1	Leo	-2.0	39.1	108° W	99	5.42	5.03	22:21	04:37	10:53
	9	11 37.2	3 51.4	Leo	-2.1	39.9	115° W	99	5.42	4.93	21:54	04:10	10:26
	16	11 36.9	3 55.5	Leo	-2.1	40.7	122° W	99	5.42	4.83	21:26	03:42	09:58
	23	11 36.0	4 03.3	Leo	-2.2	41.5	130° W	100	5.42	4.74	20:57	03:13	09:30
	30	11 34.6	4 14.5	Leo	-2.2	42.2	137° W	100	5.42	4.66	20:27	02:44	09:02
Saturn	2	16 39.8	-20 30.5	Oph	0.5	15.3	30° W	100	10.01	10.85	04:55	09:39	14:24
	9	16 42.9	-20 36.2	Oph	0.5	15.3	36° W	100	10.01	10.79	04:31	09:15	13:59
	16	16 45.9	-20 41.3	Oph	0.5	15.5	43° W	100	10.01	10.71	04:07	08:50	13:34
	23	16 48.7	-20 45.8	Oph	0.5	15.6	49° W	100	10.01	10.63	03:42	08:25	13:09
	30	16 51.3	-20 49.7	Oph	0.5	15.7	56° W	100	10.01	10.54	03:17	08:00	12:43
Uranus	2	1 02.1	5 55.8	Psc	5.8	3.5	96° E	100	19.98	19.86	11:37	18:00	00:23
	9	1 02.3	5 57.5	Psc	5.8	3.5	88° E	100	19.97	19.98	11:09	17:33	23:56
	16	1 02.7	6 00.1	Psc	5.8	3.5	81° E	100	19.97	20.1	10:42	17:05	23:29
	23	1 03.2	6 03.7	Psc	5.8	3.5	74° E	100	19.97	20.21	10:15	16:39	23:02
	30	1 03.9	6 08.2	Psc	5.9	3.5	68° E	100	19.97	20.33	09:48	16:12	22:36
Neptune	2	22 38.2	-9 27.9	Aqr	7.9	2.2	57° E	100	29.96	30.49	10:09	15:36	21:04
	9	22 38.9	-9 23.8	Aqr	7.9	2.2	50° E	100	29.96	30.59	09:41	15:10	20:38
	16	22 39.6	-9 19.3	Aqr	8.0	2.2	43° E	100	29.96	30.67	09:14	14:43	20:11
	23	22 40.5	-9 14.4	Aqr	8.0	2.2	36° E	100	29.96	30.75	08:47	14:16	19:45
	30	22 41.3	-9 09.1	Aqr	8.0	2.2	29° E	100	29.96	30.82	08:20	13:49	19:19
Pluto	2	19 04.7	-21 00.4	Sgr	14.2	0.2	4° E	100	33.01	34	07:21	12:04	16:46
	9	19 05.7	-20 59.4	Sgr	14.2	0.2	3° W	100	33.02	34	06:55	11:37	16:19
	16	19 06.8	-20 58.4	Sgr	14.3	0.2	10° W	100	33.02	33.99	06:28	11:11	15:53
	23	19 07.8	-20 57.3	Sgr	14.3	0.2	17° W	100	33.03	33.97	06:02	10:44	15:26
	30	19 08.8	-20 56.3	Sgr	14.3	0.2	24° W	100	33.03	33.93	05:35	10:18	15:00

How will we finally image the event horizon of a black hole?

by Ethan Siegel

One hundred years ago, Albert Einstein first put forth his theory of General Relativity, which laid out the relationship between spacetime and the matter and energy present within it. While it successfully recovered Newtonian gravity and predicted the additional precession of Mercury's orbit, the only exact solution that Einstein himself discovered was the trivial one: that for completely empty space. Less than two months after releasing his theory, however, the German scientist Karl Schwarzschild provided a true exact solution, that of a massive, infinitely dense

object, a black hole.

One of the curious things that popped out of Schwarzschild's solution was the existence of an event horizon, or a region of space that was so severely curved that nothing, not even light, could escape from it. The size of this event horizon would be directly proportional to the mass of the black hole. A black hole the mass of Earth would have an event horizon less than a centimeter in radius; a black hole the mass of the sun would have an event horizon just a few kilometers in radius; and a supermassive black hole would have an event horizon the

size of a planetary orbit.

Our galaxy has since been discovered to house a black hole about four million solar masses in size, with an event horizon about 23.6 million kilometers across, or about 40 percent the size of Mercury's orbit around the sun. At a distance of 26,000 light years, it's the largest event horizon in angular size visible from Earth, but at just 19 micro-arc-seconds, it would take a telescope the size of Earth to resolve it – a practical impossibility.

But all hope isn't lost! If instead of a single telescope, we built an array of telescopes located all over Earth, we could simultaneously image the galactic center, and use the technique of VLBI (very long-baseline interferometry) to resolve the black hole's event horizon. The array would only have the light-gathering power of the individual telescopes, meaning the black hole (in the radio) will appear very faint, but they can obtain the resolution of a telescope that's the distance between the farthest telescopes in the array! The planned Event Horizon Telescope, spanning four different continents (including Antarctica), should be able to resolve under 10 micro-arc-seconds, imaging a black hole directly for the first time and answering the question of whether or not they truly contain an event horizon. What began as a mere mathematical solution is now just a few years away from being observed and known for certain!



NASA/CXC/Amherst College/D.Haggard et al., of the galactic center in X-rays. Sagittarius A* is the supermassive black hole at our Milky Way's center, which normally emits X-ray light of a particular brightness. However, 2013 saw a flare increase its luminosity by a factor of many hundreds, as the black hole devoured matter. The event horizon has yet to be revealed.

This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit spaceplace.nasa.gov to explore space and Earth science!

Skyscrapers December Meeting Minutes — 12/4/2015

Bob Horton called the Skyscrapers' December meeting to order at 7:30 p.m.

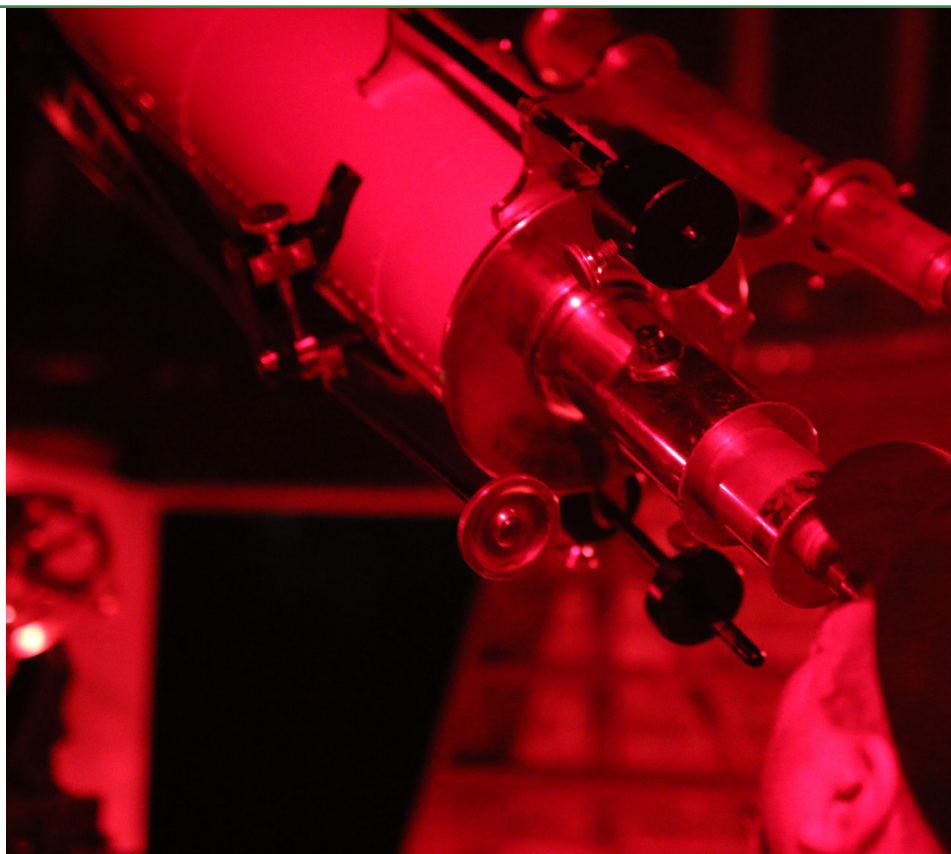
President, Bob Horton, welcomed everyone and said that, weather permitting, the Observatory would be open following the meeting.

Membership: It was noted that Terrence Turner and Steve and Maria Brown were present and were voted into membership. Also Jack Mertz and Bill Kaimer were introduced and will be voted on in the next meeting. • In November's monthly meeting, a motion was raised and seconded for a proposed change to the organization's Article IV: Membership, Section 2, Constitutional Amendment: "An applicant for Junior, Regular, Family, and Senior shall submit the standard form of Membership application together with noted dues, shall be proposed by an existing member at a regular meeting, and shall become a member upon receiving a favorable majority vote at a subsequent regular meeting of the Society." This motion was formally presented for a vote at December's meeting and was passed by the membership.

Announcements: Bob noted that tomorrow night's workshop, "Buying a Telescope for Christmas," is scheduled to run from 6:00 – 7:00 p.m. Since this workshop was advertised in the Providence Journal, it may attract more people than the usual number. If you can volunteer to help out, Bob asks that you bring your scope and set up in the courtyard at Seagrave at 5:00 p.m. • Steve Siok said that on Wednesday, December 16, there will be a star party at



Anna Frebel



Seagrave for the parents and children from the Trudeau Center. The start time is 7:00 p.m. and may draw 10–20 attendees. If you can assist, please see Steve to sign up to volunteer.

First Vice-President Report: Steve Siok noted that the next monthly meeting will be on Friday, January 15, and will be held at the Community Center. The January meeting will also be our holiday celebration and will feature a dessert party this year. If you plan on attending and want to contribute a dessert, Steve is circulating a sign-up sheet. Our January speaker will be member Steve Hubbard, who will talk about his astronomical vacation in Chile.

Good of the Organization: Joe Filocco noted that he compiled a CD on the Apollo 11 moon launch. If you would like a copy, please sign the sheet and he will provide one for you. Also, Joe created a poster display that he donated to Skyscrapers. • Bob noted that this is the time of year for the organization to begin thinking about nominations for the executive board positions. If anyone is interested in learning more about how the organization is run, you are invited to attend our board meetings. The next one will be scheduled for sometime in January. • Bob noted that on Monday afternoon at 12:44 the crescent moon will occult Venus. Check the society's newsletter on the web-

site for more details. Bob suggested that by locating the Moon first, you will be able to locate Venus through binoculars.

The meeting ended at 7:45. Submitted by Tina Huestis, Secretary.

Anna Frebel, professor at MIT, presented her program "Searching for the Oldest Stars." She explained that her goal is to offer realistic insight into the life of an astronomer, while also pairing it with the cutting edge results of the last ten years. Anna's scientific journey led her to remote mountaintop sites, such as Chile's two Magellan telescopes and Hawaii's Subaru telescope. By using ongoing sky surveys, her mission was to deduce the properties of the short-lived first stars by identifying metal-poor stars found in today's Milky Way galaxy. Anna took the audience through an overview of the synthesis of the chemical elements, spectroscopy, stellar archaeology, and age dating of the oldest stars. She explained that our Sun is a population "1" star, the minority group ("old stars") comprise population "2", whereas population "3" (hydrogen and helium) stars were formed in the initial 100 million years after the Big Bang and are metal-free. By searching the Milky Way for any of those remaining metal-poor stars, it would be possible to bridge the 13 million years separating us from the Big Bang event, which occurred 14 billion years ago.



Bob Horton captures this view of the waning crescent Moon with Saturn & Venus on the morning of January 7.



Cassiopeia & the Perseus Double Cluster, stack of 10 frames, 30s each using Canon 35mm f/4 lens on an iOptron Sky Tracker. Photo by Jim Hendrickson

Comet Catalina Update

I am able to see Catalina and tail, however light pollution keeps me from seeing it as it should be seen. In a darker sky such as Seagrave's it would show up better. The sky is partly cloudy and there seems to be a mist high up.

The tail seems to be directly behind the comet as if it was coming directly at us, so it does not have that elongated look, that I could discern. The color of the comet is a hint of blue.

While I wish I were somewhere else looking at it, it is still a nice sight.

I used Venus to find it. I followed a line toward the eleven o'clock direction until I could see it. I used a monopod and 12x60 binoculars. The monopod really helped to steady the picture.

As time went on it got more difficult to see. I went out again at 5:20 am and it was barely visible with handheld 10x50's.

I also looked at Jupiter and it's moons. What a great sight. The moons were lined up to the bottom left at about the seven o'clock position. Io was partially eclipsed

(as seen on Stellarium) and I could see it sticking out from behind Jupiter.

The moons were very bright and bigger than they usually are. This is the best view of the moons I have seen yet.

Reported by Jack Mertz on December 20

Caught Catalina Sunday (12/20) morning while dodging sheets of annoying clouds. The clouds really hampered observing as they were most plentiful during the darker part of the morning and twilight were fast increasing.

I was unable to accurately align my 6" Antares due to the fact Polaris was blocked by tree branches. Because of this, I ended up with slightly trailed image of the comet. I wasn't at my best due to lack of sleep and the 29 degree temperature. It was amazing I got one acceptable, though poor, shot.

The saving end of all this, is that even though the (now) 5th magnitude comet was barely visible in my finder scope due to the deteriorating sky, it was beautiful and bright in the 25x100 binoculars!

Catalina looked multiple due to its fuzz-ball countenance almost occulting a nearby 7th magnitude star. The comet's "atmosphere" had easily enveloped the star. I would send you the image, but I've had difficulty posting images anywhere lately because of an unknown glitch in my laptop.

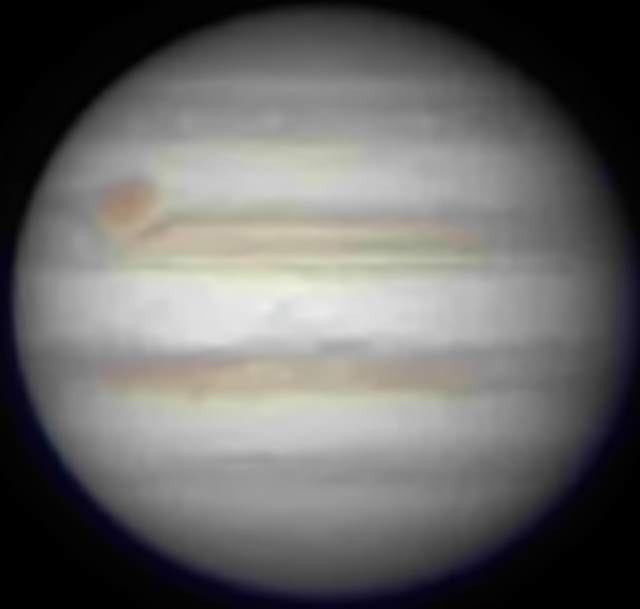
To make things even more interesting, I packed things up and was viewing my imaging results at the kitchen table when I heard a small "snap." It turned out to be one of my glasses lenses breaking in half when its 29 degree surface temp blended with my kitchen's 68 degree or so air temperature!!

Ya win some, ya lose some. I can't wait for New Years, when Catalina and Arcturus meet up!

Report by Bill Guca on December 20

Steve Hubbard took these images of Jupiter on the morning of Sunday, December 7 when Io and Europa were near and the Red Spot was coming around the limb.

Also included is a lightly processed image of spiral galaxy M74 in Pisces taken recently. It's an unstacked 2 minute exposure with a MallinCam and 14" SCT.





Glenn Jackson



Ed Turco



Kim Arcand



Kelly Beatty



Ian Dell'Antonio



Stephen Arthur

AstroAssembly Photo Gallery

Photos by Tracy Prell, Jim Hendrickson & Steve Hubbard



Andrew Vanderburg



Linda Bergemann and Tina Huestis at the registration desk



Skyscrapers Grill



AstroAssembly co-chairs Steve & Kathy Siok



Banquet dinner catered by Quik-Stop Deli



A composite image of the September lunar eclipse by Scott MacNeill was selected as the 1st place winner of the astrophoto contest.



Kelly Beatty, Tracy Prell & Jim Crawford

Directions to Seagrave Memorial Observatory

From the Providence area:

Take Rt. 6 West to Interstate 295 in Johnston and proceed west on Rt. 6 to Scituate. In Scituate bear right off Rt. 6 onto Rt. 101. Turn right onto Rt. 116 North. Peeptoad Road is the first left off Rt. 116.

From Coventry/West Warwick area:

Take Rt. 116 North. Peeptoad Road is the first left after crossing Rt. 101.

From Southern Rhode Island:

Take Interstate 95 North. Exit onto Interstate 295 North in Warwick (left exit.) Exit to Rt. 6 West in Johnston. Bear right off Rt. 6 onto Rt. 101. Turn right on Rt. 116. Peeptoad Road is the first left off Rt. 116.

From Northern Rhode Island:

Take Rt. 116 South. Follow Rt. 116 thru Greenville. Turn left at Knight's Farm intersection (Rt. 116 turns left) and follow Rt. 116. Watch for Peeptoad Road on the right.

From Connecticut:

- Take Rt. 44 East to Greenville and turn right on Rt. 116 South. Turn left at Knight's Farm intersection (Rt. 116 turn left) and follow Rt. 116. Watch for Peeptoad Road on the right.
- or • Take Rt. 6 East toward Rhode Island; bear left on Rt. 101 East and continue to intersection with Rt. 116. Turn left; Peeptoad Road is the first left off Rt. 116.

From Massachusetts:

Take Interstate 295 South (off Interstate 95 in Attleboro). Exit onto Rt. 6 West in Johnston. Bear right off Rt. 6 onto Rt. 101. Turn right on Rt. 116. Peeptoad Road is the first left off Rt. 116.



47 Peeptoad Road
North Scituate, Rhode Island 02857