



the Skyscraper

vol. 40 no. 12
December 2013

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

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active place is out-
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Saturday, December 14

at North Scituate Community Center

5:30 Pot Luck Dinner

Contact Kathy Siok (kathys5@cox.net) to report what food you plan to bring. (Beverages and paper goods will be provided)

Bring your Astronomical Photos to Display

7:00 Program Presentations Include:



The Central Falls Train Wreck of 1853 and the Institution of Time Zones

by Francine Jackson

Examination of an 1855 Star Atlas

by Steve Siok



Highlights from the Stellafane Symposium of August, 2012:
"Boston Chapter of the Antique Telescope Society" presented by David Sliski
from the Video Lending Library of Skyscrapers





President's Message

Ed Haskell

I hope you enjoyed Thanksgiving and will have a happy holiday season.

From time to time I have mentioned favorably our website, <http://theskyscrapers.org>, and the fine work that Jim Hendrickson has done in designing, building, and maintaining it. Surely most if not all of you have looked at the site, but do you realize that it changes continuously? What you saw last year, or last month, is different from what you will see today or next month.

The home page that displays as I write this hints at the depth and breadth of information contained on the site. The rotating display highlights three articles: Dave Huestis' updated report on what to expect from Comet ISON; a pictorial review of the restoration of our Alvan Clark telescope; and a really good reminiscence by Matt White on the dawning of his interest in astronomy and a forty year odyssey that brought him back to amateur astronomy.

Hidden below the bottom of the screen (you have to remember to scroll down) are links to more than a dozen good articles by members and contributors covering a broad spectrum of topics. These range from observing related reports and articles to a really good remembrance of Carl Sagan by Mark Sweberg. All of these pieces make for good reading and most of them could have found space in published magazines.

At the top of the home page are two horizontal menus that lead to hundreds of articles. Examples are:

- Midland Mall Remembrance (what has this to do with Skyscrapers?)
- How I became an Amateur Astronomer.
- What is the connection between Skyscrapers and Cinco de Mayo?

A veritable cornucopia of information on observing, history, upcoming events, etc., may be found on the site.

To download the newsletter you have to go to the site monthly. Why not resolve to look around each month when you do your download?

Late in November the Board, Trustees, and some other members were invited to participate in an all day session to imagine Skyscrapers a decade from now. The meeting was well attended and a large number of ideas relating to where we might be in 10 years and how we might get there were put forth. Subsequent meetings will hone these ideas and a plan will be prepared and presented to the membership.

Our annual holiday dinner is on the 14th at the Community Center. This meeting is less formal and provides a good opportunity to get to know your fellow members. I hope to see you there.

Thanks for all you do for Skyscrapers.



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.

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Directions

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

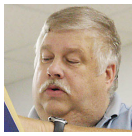
Submissions

Submissions to *The Skyscraper* are always welcome. Please submit items for the newsletter no later than **December 20** 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.





December Astronomical Highlights

Dave Huestis

In order to meet mid-November deadlines, this column is being written several weeks before comet ISON's close encounter with the Sun. The comet was still around 8th magnitude, which is two to three magnitudes fainter than what the naked-eye can see, especially here in the light-polluted skies of the Northeast. Will it become visible without optical aid before passing within 700,000 miles of the Sun's surface on Thanksgiving Day? Will it survive that close approach and be visible during the first week or two in December?

With comets anything is possible. I can only hope something dramatic happens that will cause ISON to brighten substantially to become an easy target for even a casual stargazer to observe. Visit the Skyscrapers website for sky diagrams showing where to find ISON.

Venus will be the brilliant beacon in the southwestern sky after sunset all month. Should you need a clue to its position in the sky, the waxing crescent Moon will be above and to the right of our closest planetary neighbor on December 5th. The following evening Venus will be at its brightest, shining at magnitude -4.9 .

This night would be a good time to focus a telescope on both of these beautiful worlds. A telescopic view of Venus will show its crescent phase, appearing slightly more illuminated than the Moon's phase. While a slim portion of the Moon will be sunlit, the entire surface facing us will be illuminated by Earthshine. Why? If you were on the Moon and looking back at the Earth, the Earth's phase would be waning gibbous—just past Full. It's so bright that the lunar surface will be bathed in the reflected sunlight off our planet.

Next up will be the Geminid meteor shower on the night of December 13-14. The good news is that this date occurs on a Friday night through to Saturday morning. Unfortunately a now bright waxing gibbous Moon will hamper observing the normal peak rate of 60+ meteors per hour that the Geminid shower can consistently produce.

Though the Geminids can be observed before midnight, the Moon will most certainly wash out all but the brightest shooting stars. Under moonless skies last year I observed a total of 36 Geminids in two

hours. Unfortunately this year the Moon will be present all night and won't set until around 4:21 a.m. EST. This timing only provides an observing window of about 1 ½ hours to observe as many meteors as possible without moonlight interfering.

These shooting stars will appear to radiate from a point in the sky near Gemini's brightest stars, Castor and Pollux. After moonset, Gemini will be from 40 to 50 degrees above the western horizon. To observe, face that direction and scan around. It's going to be cold, so keep warm and stay awake!

The Geminids are fairly bright and moderate in speed, hitting our atmosphere at 21.75 miles per second. They are characterized by their multicolored display (65% being white, 26% yellow, and the remaining 9% blue, red and green). Geminids also have a reputation for producing exploding meteors called fireballs.

In addition, on December 21 at 12:11p.m., the northern hemisphere celebrates the Winter Solstice—the beginning of winter. Notice the low arc the Sun “travels” across the sky. At least the days begin to get longer after this important astronomical event. Which long-range winter forecast will Mother Nature follow? The mild to average one issued by the National Weather Service, or the cold and snowy one predicted by the Old Farmer's Almanac? Regardless, we have no control over either one! Just go with the snow...errrr, go with

the flow!

And finally, as we count off the days in December, get ready to say goodbye to some of our favorite constellations, like Hercules, Lyra and Cygnus in that order. And say hello to Taurus, Orion and Gemini.

Don't forget to visit the local Rhode Island observatories even during the winter months when clear skies often prevail. However, be sure to check all the websites for the open night schedules and times before visiting these magnificent facilities. Wintry conditions can force unexpected closures.

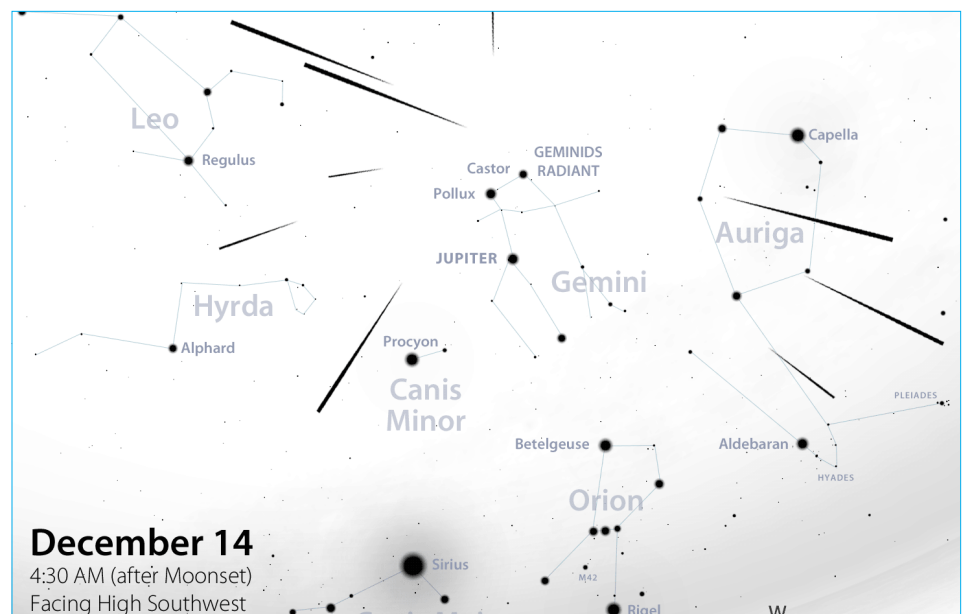
Seagrave Memorial Observatory (<http://www.theskyscrapers.org>) in North Scituate is open to the public every clear Saturday night, although it will be closed on December 14.

Ladd Observatory (<http://www.brown.edu/Departments/Physics/Ladd/>) in Providence is open every clear Tuesday night.

Frosty Drew Observatory (<http://www.frostydrew.org/>) in Charlestown is open every clear Friday night year-round.

Happy holidays and clear skies to all.

PS. Just a day before my column deadline, Comet ISON suddenly brightened by two magnitudes (6.3 times brighter). Possibly a new crack or vent on the comet's surface opened up to allow the release of “fresh” material from below. Or perhaps the comet started rotating (some early research had suggested it wasn't). The onset of rotation could allow portions of the comet that had not yet been subjected to the Sun's heating or solar wind to now react to either of those influences. Time will tell if the brightening is a short-lived effect or one that could still provide some outstanding naked-eye views.





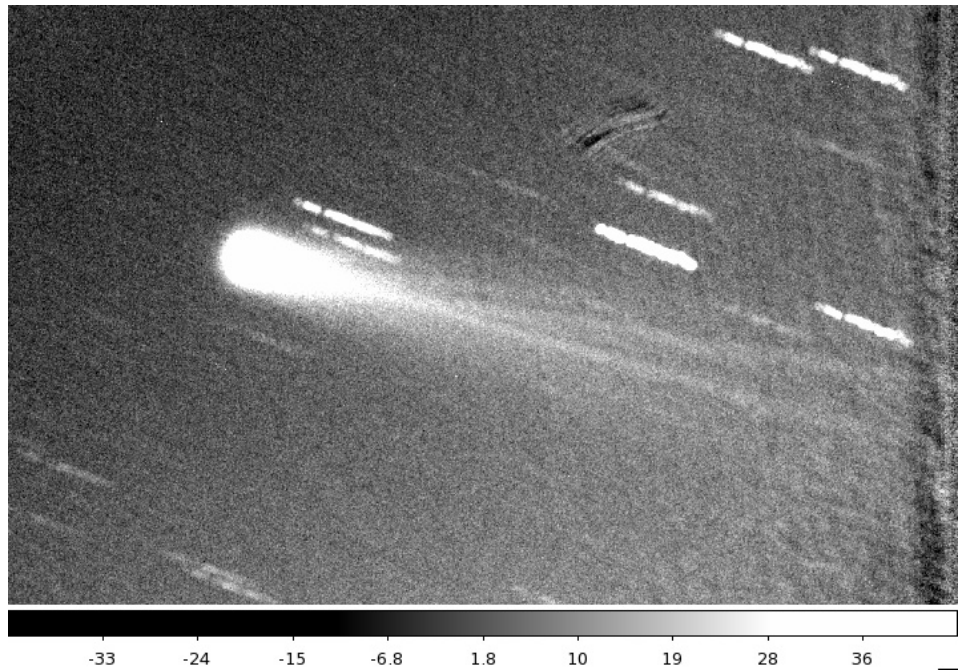
A Glimpse of Comet ISON

Craig Cortis

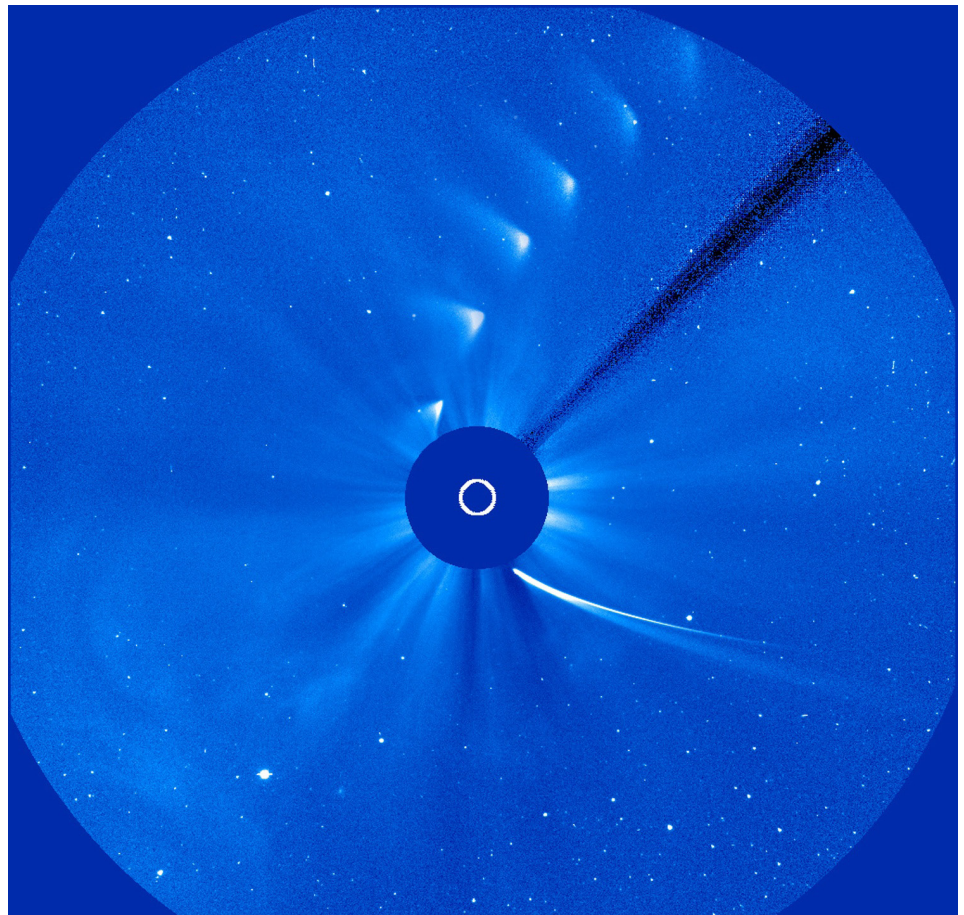
Like most of us, I developed an interest in viewing ISON in early November, weeks before perihelion. I seldom keep careful records of observing sessions and can't be certain (as I write this) of the precise date, but I'm fairly sure it would have been the morning of Monday, 11/11/13. If so, the comet's position would have been about 2 degrees due south of Eta Virginis, according to an ephemeris obtained online about a week prior. A few times before 11/11, using 10 X 70 Fujinon Polaris binoculars, I'd tried to spot ISON after studying its projected positions on a detailed star atlas. Despite a few clear mornings in the first week of November, I simply could not discern the comet in 70mm aperture and regretted not trying my 4.2 inch Astroscan rich-field scope for the hunt. (Even the Astroscan can seem like too much work to take outside at 4:30 or 5:00 a.m. when it's cold and you must leave for work by 5:30.)

Just 2 or 3 days before that Monday, I accidentally came across news and detailed information on a fairly recent comet discovery that was touted as being easily bright enough to see in a 50mm binocular, C/2013 R1 (Lovejoy). Its position was to be readily found just a few degrees WNW of the northernmost star in the "Sickle" asterism in Leo on the morning of 11/11, so I got up early and checked the sky. Mainly cloudy and hopeless at 4:35, naturally enough considering the usual weather curse that seems to accompany attempts to see transient sky objects. At least the Moon cooperated; it would've been First Quarter the day before and had set just after midnight, but the onset of morning astronomical twilight during my observing time window was a factor to work around, especially considering a viewing direction east.

I went outside a second time at 5:00 and beheld a timely "gift" – the sky had cleared, nearly thoroughly! This inspired me to grab a 10 X 50 binocular and head out for a look at Lovejoy, all the while thinking of the beginning of astronomical twilight and my brief time for observing. Just for the fun of it, I first trained the bino on ISON's position in Virgo where I'd memorized the specific starfield, but saw no faint smudge. This was no surprise, of course,



here's the black and white Jpeg of the ISON observation from Nov. 19. I used the 4" telescope piggybacked on our 16", took 20 exposures (ranging from 30 to 60 seconds) over the course of about an hour (from about 4:50 to 5:40 or so). The images were individually processed, then shifted to align the center of the coma and coadded. Ian Dell'Antonio



Composite image from NASA/ESA Solar and Heliospheric Observatory showing comet ISON just before (below) and up to two days after perihelion on November 28.

but it seemed worthy of a quick attempt. (Maybe ISON had brightened?) I then put the bino on the predicted spot for Lovejoy in Leo and was delighted to almost immediately see a bright, easily conspicuous, large snowball-like object exactly where predicted. This was so good in appearance that I decided it was time for more aperture and got out the Astroscan, which is what I commonly use to show people wide-field, low power views on public nights at Ladd Observatory. Lovejoy was an easy treat in the scope and I determined to follow it for as many days as possible thereafter, weather permitting.

Just before wrapping things up at around 5:10 to 5:15 a.m., I thought I'd give ISON another try; it'd be my first attempt with anything larger than 70mm aperture and the comet evidently had not brightened sufficiently by 11/11 to be viewable in instruments of a certain size or smaller. Besides, I already had the Astroscan set up, so why waste the chance? I pointed the scope over to the exact spot in Virgo and double-checked star patterns to assure a "fix" with respect to certain stars. Within a few seconds there seemed to be a mere suggestion of a ghostly, nearly invisible and elongated wisp of grayish-white at the correct position, but was I just imagining it because I so much wanted something to be there? After a few back-and-forth visual checks using averted vision, then direct vision, I became at least 95 percent sure that a nonstellar smudge of light was there; the Astroscan had done the trick. I'm writing this on the evening of 12/1/13 and will hope we'll have a chance to see ISON post-perihelion, provided there'll be anything much to see.



Comet ISON on November 19th by Bob Horton



The Sword of Orion by Jim Hendrickson. 200mm f/4, 4 minutes @ ISO400.



Here are some Lovejoy images from November 30. The first is taken through a newly acquired Orion 80ED. The second is through my Antares 152mm. Both shots are single unprocessed images taken with a Canon T3i @ 50seconds. Afocal using a 40mm EP. Nov. 30 was my third session with this beauty. I also captured a plume of dust emanating from the false nucleus on the 13th (left). Bill Guca

See Rocket Launches & Space Stations From Your Backyard



Francine Jackson

A surprising perk to living on the East Coast lately has been the opportunity to witness resultant launches from Wallops Island, Virginia. Within the past several months, two such craft, LADEE, a lunar orbiter attempting to understand the possibility of an atmosphere surrounding our nearest neighbor, and Minotaur, crammed with over two dozen mini-satellites – Cubesats – were both observed by many of us willing to stay up late (LADEE went up at 11:27 P.M) or brave the cold (the night Minotaur was launched, temperatures were near freezing). But, for those of us who do spend some time outside, launches such as this are great ways to have our public looking for something unique.

Of course, the sky is full of many man-made objects. The International Space Station is a great sight for anyone just observing outside; also, it is easily found, as web sites such as Heavens-Above, or your facility's Sky Chart, quickly gives not only the times these appear in the sky, but how long and how bright they will be. In addition, Iridium flares, the set of communication satellites that suddenly appear, sometimes brightening to magnitudes to rival Venus –

or, in some cases, even more – there have been flares reach magnitude -8.

Introducing some of our brighter satellites is a great way to introduce these elusive bodies to the audience. All you need is a couple minutes to determine the brighter ones visible during a night. By having them able to witness “Your tax dollars at work,” you are giving your audience another reason to go outside and enjoy the night sky. And, by directing them to a web site containing a very clear path in the sky, or by making a quick chart, our audiences are now on their way to not only looking up – reinforcing what they learned from us – but also subliminally identifying the celestial objects that the satellites are both appearing near to and passing by on their paths across the sky. It's very seldom that at least one artificial satellite can't be seen. And, keep checking Wallops Island. There's always a chance there will be another launch waiting for us.



Bob Horton captured this image of the International Space Station with an SLR camera on his 12-inch telescope from Foster, Rhode Island at 5:12 on the morning of November 13.

Jim Hendrickson and Francine Jackson observed the Minotaur I/ORS-3 launch from Alton Jones Campus with URI Physics Professor Amer Hodzic and a group of his astronomy students on the evening of November 19.





Remembering Carl Sagan

Mark Sweberg

As a young man on a cross country road trip/relocation to San Francisco, I stood on the North Rim of the Grand Canyon, mesmerized and lost in the sublime. "I can't believe she dragged me 2,000 miles to look at a hole in the ground," a harried, sweating, middle-aged man confided in his best colloquialism. Bemused, I could only smile politely. Later that evening, camped out under the great expanse and canopy of the unsurpassed beauty of the sky, I reflected on the twinkling distant points of light and on holes in the ground.

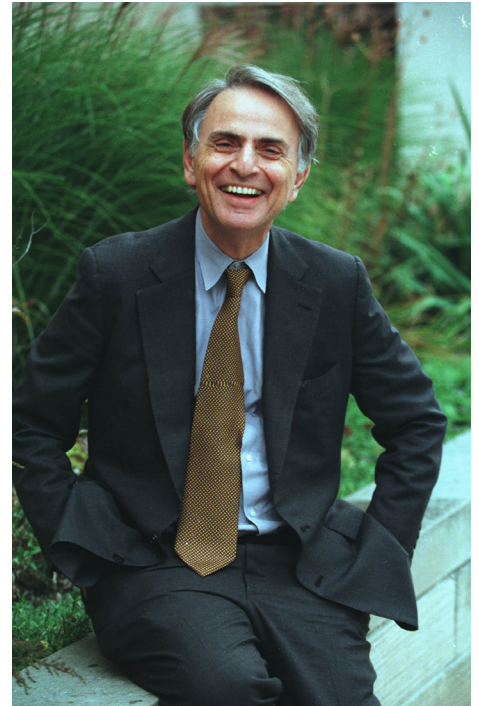
It was the mid 1970's, and an up-and-coming astronomer by the name of Carl Sagan (1934-1996) was literally introducing millions of people to the wonders of the Universe in his inimitable way. Expressing admiration at the vastness of space and time was his forte. He would say, "The total number of stars in the Universe is larger than all the grains of sand on all the beaches of the planet Earth," and we would struggle to wrap our minds around the concept. His award-winning 1980 television series *Cosmos: A Personal Voyage* would further fascinate spellbound viewers and challenge us to fabricate a personal connection and relationship with the Universe.

Noted for his sense of childlike wonder in the Universe, Sagan captured the interest of millions of people for whom science was a closed book. Sporting a strong inquisitiveness about nature, he frequented the New York Public Library and the American Museum of Natural History and Hayden Planetarium from an early age.

With his imagination nurtured and encouraged by his parents, Sagan graduated from the University of Chicago and taught and researched at Harvard before being granted a full professorship at Cornell University in 1971. His professional research, writing, and scholarly contributions were prodigious, wide-ranging and important. However, it was his ability to convey ideas which allowed many people to understand the cosmos better, for which he is perhaps most remembered and appreciated.

Eminently quotable, Sagan penned: "The nitrogen in our DNA, the calcium in our teeth, the iron in our blood, the carbon in our apple pies were made in the interiors of collapsing stars. We are made of star stuff." In his distinct style, Sagan conveyed the idea that the raw materials that constitute our physical bodies were forged in the bellies of distant, long-extinguished stars. The interrelatedness and connection of all things, living and inanimate, logically follows, and is quite profound. One can scarcely observe a bird soaring through the air, a cascading waterfall, or a rolling rock coming to rest in a mountain's scree field without the recognition that their common origin stems from the same source: stellar furnaces of eons ago.

Carl Sagan introduced a generation of people to the wonders of the Universe, and engaged our imaginations. He taught us to think in ways both grand and expansive. He taught us to recognize patterns of kinship, and to appreciate all that you see, wherever you are. And, for this, he was



loved and most admired.

The magnificent grandeur of the Grand Canyon takes one's breath away. To experience it for oneself amidst a clear view of the infinite Universe is nature's prescription for natural mind expansion. To feel the chill of the evening air, to know the stillness of the night, and to hear a symphony echoing from all around is akin to coming to know one's place in the Universe, and to coming home.

Carl Sagan would have told me to look gently upon the cantankerous stranger who earlier had annoyed me with his view that the Grand Canyon was a mere hole in the ground, for Sagan would have said the man and I were kin.

The atoms in each of us were born of the same place.

Our star stuff was our common bond.

Phases of the Moon

New Moon

December 3 00:22

First Quarter Moon

December 9 15:12

Full Long Night Moon

December 17 09:28

Last Quarter Moon

December 25 13:48



Conrad Cardano

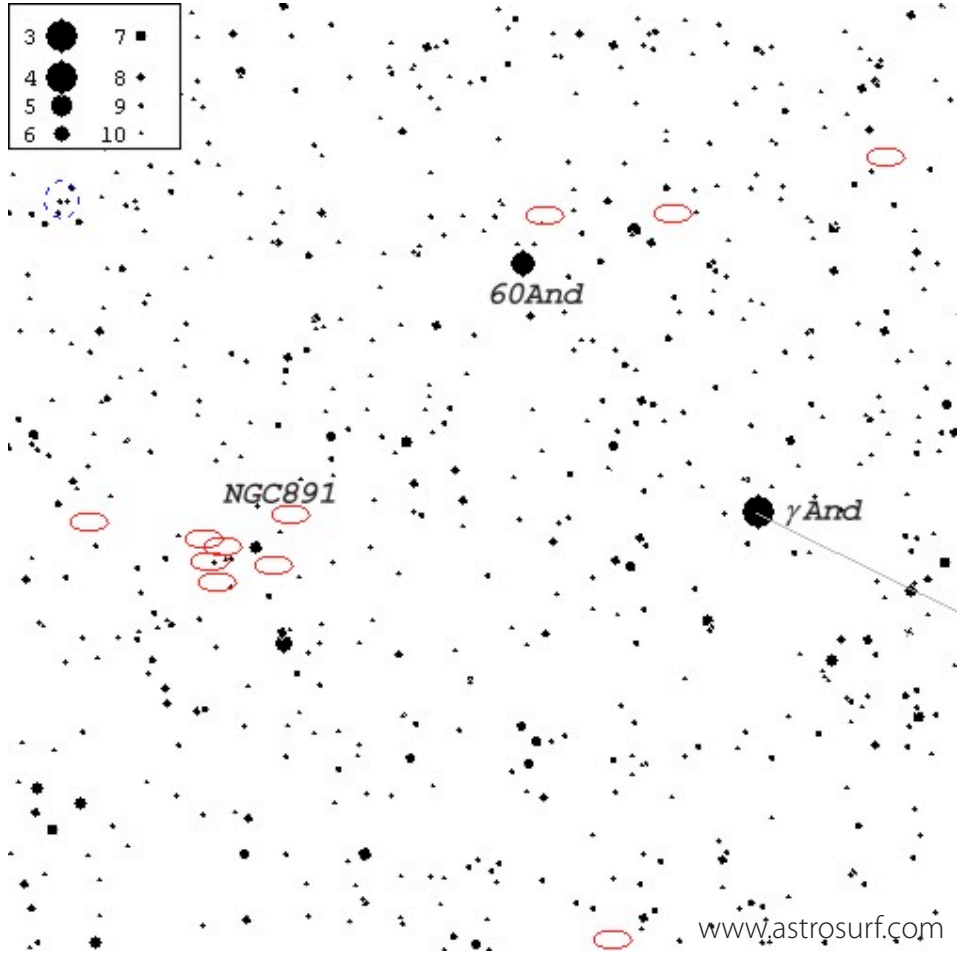


**Spiral Galaxy
in Andromeda
NGC 891**
Glenn Chaple

Last month, we turned our attention to the spiral galaxy NGC 7331 to get an idea what the Andromeda Galaxy (which is similar in size and structure) might look like were it 20 times more distant. From its new location, this naked eye object would now be a 9th magnitude “faint fuzzy,” visible only with the aid of telescope or large binocular.

How might our Milky Way Galaxy appear to eyes gazing our way from an extragalactic perspective? From a distance of 30 million light years and angled edge-on to the observer’s line of sight, it would appear very much like NGC 891 in Andromeda. Discovered by William Herschel’s sister Caroline in 1784 and located 3½ degrees east of the colorful double star Almach (gamma [γ] Andromedae), NGC 891 is essentially a twin to the Milky Way.

A 10th magnitude sliver 13 arcminutes long and 3 arc-minutes wide, NGC 891 is an elusive target. A dark dust lane that runs its length greatly diminishes its overall brightness. Just to glimpse NGC 891 with small aperture telescope is a challenging task. The dust lane doesn’t really come into view until an 8 to 10 inch scope is used. The real grandeur of NGC 891 begins to unfold under the scrutiny of large Dobsonian-mounted reflectors. Whatever telescope you use, your quest for NGC 891 should be made from a dark-sky location with a magnification in excess of 100x. Its dim appearance is a sobering reminder that our mighty Milky Way isn’t so mighty in the cosmic scheme of things.



Left: Steve Hubbard captured this image of Jupiter and Io on the evening of December 4 with his newly installed 14-inch Meade SCT. Right: 11/2/13 Sun, shot with a CanonT3i though a AstroTech 65. ISO100 at 1/800 by Tom Thibault.



NOVEMBER REPORTS



Secretary

Tom Thibault

Skyscrapers November Meeting Minutes – November 1, 2013

2nd Vice President Bob Horton called the Skyscrapers November Members Meeting to Order at 7:30PM.

2nd Vice President, Bob Horton: Bob Horton on Ed Haskell's behalf began the evenings meeting.

Prof. Ian Dell Antonio displayed a photo taken with a new large format CCD camera (567 megapixels) at the Blanco telescope at the Cerro Tololo Inter-American Observatory in Chile. The photos were taken with the so named Dark Energy Camera as part of the Dark Energy Survey. The photo was of the southern galaxy cluster Abell 3128 at a distance of 600 million light years. Within the image an example of gravitational lensing could be seen as well as star forming and interacting galaxies. It was a great photo to see and enjoy.

Bob informed the group of the upcoming partial solar eclipse to occur on Sunday at sunrise. It will be from 6:21 till 7:11 if the weather and clear skies allow.

Historian, Dave Huestis: The Centennial Seagrave Observatory Calendar is available for a \$20.00 donation.

Dave thanked Jim Hendrickson and Print Makers for the assistance in the creation and production of the calendar.

Trustee, Conrad Cardano: The following Star Parties are scheduled, an event at Seagrave on Nov. 6th, and a Star Party at Portsmouth Middle School on Nov. 15th

1st Vice President: Kathy Siok: Will be forming a Refreshment Committee to oversee refreshments at our monthly meetings.

Announce our December Meeting will be held at the Scituate Community Center on Dec. 14th and will feature a Pot Luck Dinner.

Member Presentations will occur that evening and anyone interested in sharing with the membership are urged to contact her.

Treasurer, Linda Bergemann: Requested a vote for membership of Robert Stahlbush, Vin Pasquale, Bernard Stack and Nancy and Thomas Curry, which were approved by the membership.

Announced the following individuals are pending vote at our December Meeting are Ian Dell `Antonio and Evan Fox.

Meeting adjourned at 9:15PM



Bob Horton brought some eclipse glasses in preparation for the Sunday, November 3 sunrise partial eclipse. Unfortunately we were clouded out and no one from our area was able to observe the eclipse.



Treasurer

Linda Bergemann

Submitted by Tom Thibault - Secretary

Cash Flow YTD as of November 15, 2013
(4/1/13 through 11/15/13)

INFLOWS

AstroAssembly	
Banquet	\$1,220.00
Grill	\$421.50
Misc	\$30.00
Raffle	\$506.00
Registration	\$1,540.00
TOTAL AstroAssembly	\$3,717.50
Centennial Calendar Donation	\$560.00
Misc Donation	\$263.00
Refreshment Donation	\$138.20
TOTAL Donation	\$401.20
Dues	
Contributing	\$154.05
Family	\$240.00
Junior	\$15.00
Regular	\$1,190.00
Senior	\$625.00
TOTAL Dues	\$2,224.05
Misc Income	
Sale of Items	\$630.00
TOTAL Misc Income	\$630.00
Star Party Donations	\$74.00
Subscription Income	
Astronomy	\$324.00
Sky & Telescope	\$230.65
TOTAL Subscription Income	\$554.65
FROM Preservation Fund (See note below)	\$96.30
TOTAL INFLOWS	\$8,257.70

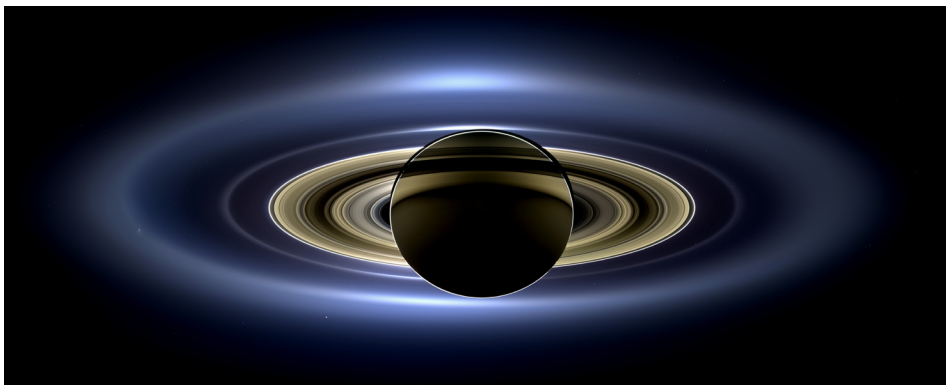
OUTFLOWS

Astro Assem Exp	
Caterer	\$1,000.00
Grill	\$244.13
Misc	\$68.90
Raffle	\$5.00
Reception	\$138.31
Tent Rental	\$670.00
TOTAL Astro Assem Exp	\$2,126.34
Centennial Calendar Production	\$299.60
Corporation, State Fee	\$30.00
Postage and Delivery	\$18.40
Refreshment Expense	\$138.59
Subscription Payments	
Astronomy	\$324.00
Sky & Telescope	\$230.65
TOTAL Subscription Payments	\$554.65
Trustee Expense	\$1,252.79
Utilities	
Electric	\$125.79
Porta-John	\$693.00
Propane	\$80.25
TOTAL Utilities	\$899.04
TO Preservation Fund (See note below)	\$96.30
TOTAL OUTFLOWS	\$5,415.71
OVERALL TOTAL	\$2,841.99

Note: Designated Preservation Fund monies used to digitize photos for archive.

Cash and Bank Accounts - As of 11/15/2013

Capital One Bank	\$12,323.17
Checking	\$13,507.08
TOTAL Bank Accounts	\$25,830.25





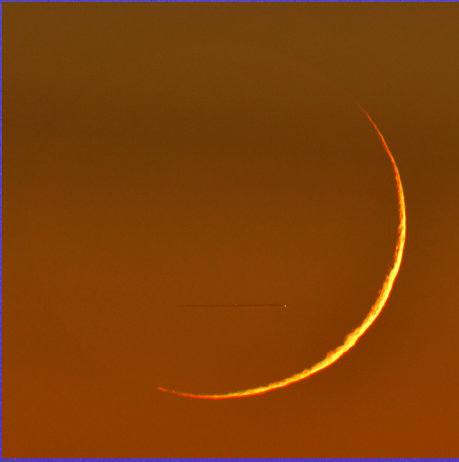
Kepler Asteroseismic Science Consortium (KASC) +500 members

Steering Comm.: J. Christensen-Dalsgaard, H. Kjeldsen, R. Gilliland, ...

Working Group	Chair
1. Solar-like oscillations	W. Chaplin (Birmingham, UK)
2. Oscillations in clusters	S. Basu (Yale, US)
3. Beta Cephei stars	G. Handler (Warsaw, PL)
4. Delta Scuti stars	D. Kurtz (Lancashire, UK)
5. Rapidly oscillating Ap stars	M. Cunha (Porto, PT)
6. Slowly pulsating B-stars (SPB)	P. De Cat (Brussels, B)
7. Cepheids	R. Szabó (Budapest, HU)
8. Red giants	J. de Ridder (KU Leuven, B)
9. Pulsation in binary stars	C. Aerts (KU Leuven, B)
10. Gamma Doradus stars	J. Guzik (Los Alamos, US)
11. Compact pulsators	S. Kawaler (Iowa, US)
12. Mira and semiregular stars	L. Kiss (Budapest, HU)
13. RR Lyrae stars	K. Kolenberg (CfA, US)

Katrien Kolenberg, during her presentation "Study of RR Lyrae Stars from Kepler Results" showed this slide listing the different types of variable stars being studied using the data from Kepler Space Telescope.





Bob Horton chases the young waxing crescent Moon. To the left are images of the Moon taken on November 4 & 5. Below is one taken on December 3, when the Moon was only 20 hours old.





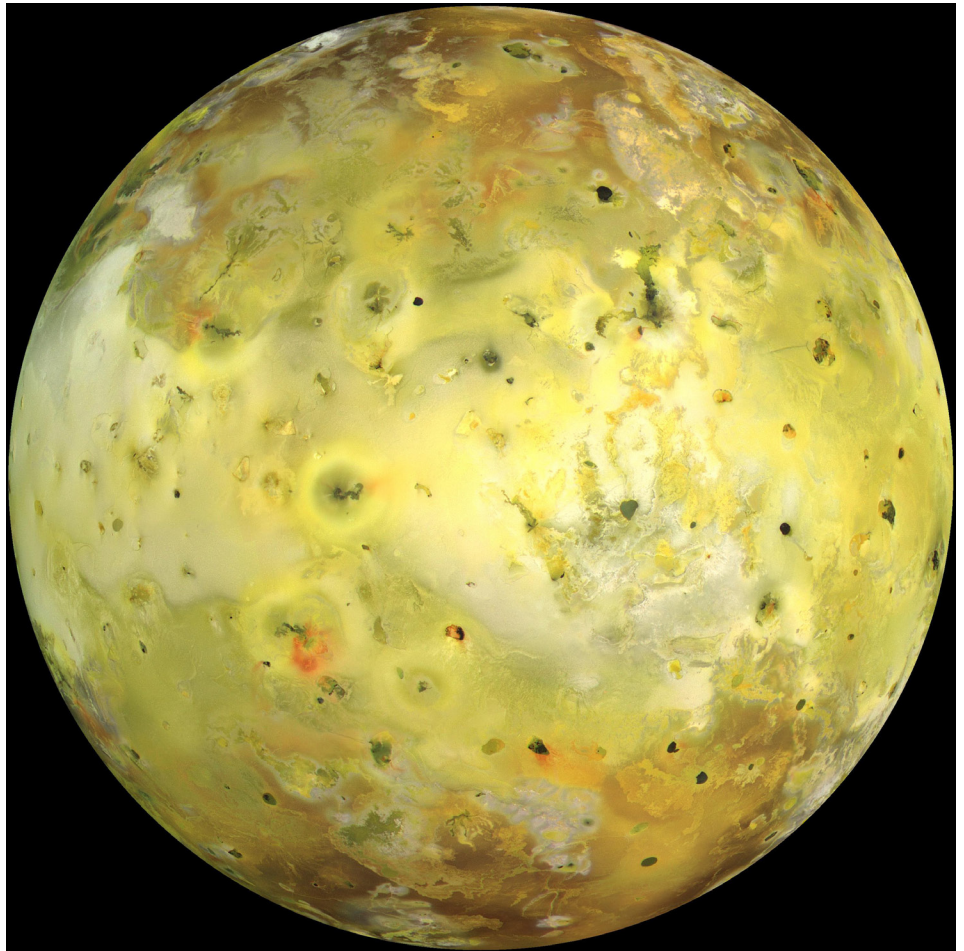
The most volcanically active place is out-of-this-world!

By Dr. Ethan Siegel

Volcanoes are some of the most powerful and destructive natural phenomena, yet they're a vital part of shaping the planetary landscape of worlds small and large. Here on Earth, the largest of the rocky bodies in our Solar System, there's a tremendous source of heat coming from our planet's interior, from a mix of gravitational contraction and heavy, radioactive elements decaying. Our planet consistently outputs a tremendous amount of energy from this process, nearly three times the global power production from all sources of fuel. Because the surface-area-to-mass ratio of our planet (like all large rocky worlds) is small, that energy has a hard time escaping, building-up and releasing sporadically in catastrophic events: volcanoes and earthquakes!

Yet volcanoes occur on worlds that you might never expect, like the tiny moon Io, orbiting Jupiter. With just 1.5% the mass of Earth despite being more than one quarter of the Earth's diameter, Io seems like an unlikely candidate for volcanoes, as 4.5 billion years is more than enough time for it to have cooled and become stable. Yet Io is anything but stable, as an abundance of volcanic eruptions were predicted before we ever got a chance to view it up close. When the Voyager 1 spacecraft visited, it found no impact craters on Io, but instead hundreds of volcanic calderas, including actual eruptions with plumes 300 kilometers high! Subsequently, Voyager 2, Galileo, and a myriad of telescope observations found that these eruptions change rapidly on Io's surface.

Where does the energy for all this come from? From the combined tidal forces exerted by Jupiter and the outer Jovian moons. On Earth, the gravity from the Sun and Moon causes the ocean tides to raise-and-lower by one-to-two meters, on average, far too small to cause any heating. Io has no oceans, yet the tidal forces acting on it cause the world itself to stretch and bend



Io. Image credit: NASA / JPL-Caltech, via the Galileo spacecraft.

by an astonishing 100 meters at a time! This causes not only cracking and fissures, but also heats up the interior of the planet, the same way that rapidly bending a piece of metal back-and-forth causes it to heat up internally. When a path to the surface opens up, that internal heat escapes through quiescent lava flows and catastrophic volcanic eruptions! The hottest spots on Io's surface reach 1,200 °C (2,000 °F); compared to the average surface temperature of 110 Kelvin (-163 °C / -261 °F), Io is home to the most extreme temperature differences from location-to-location outside of the Sun.

Just by orbiting where it does, Io gets

distorted, heats up, and erupts, making it the most volcanically active world in the entire Solar System! Other moons around gas giants have spectacular eruptions, too (like Enceladus around Saturn), but no world has its surface shaped by volcanic activity quite like Jupiter's innermost moon, Io!

Learn more about Galileo's mission to Jupiter: <http://solarsystem.nasa.gov/galileo/>.

Kids can explore the many volcanoes of our solar system using the Space Place's Space Volcano Explorer: <http://spaceplace.nasa.gov/volcanoes>.



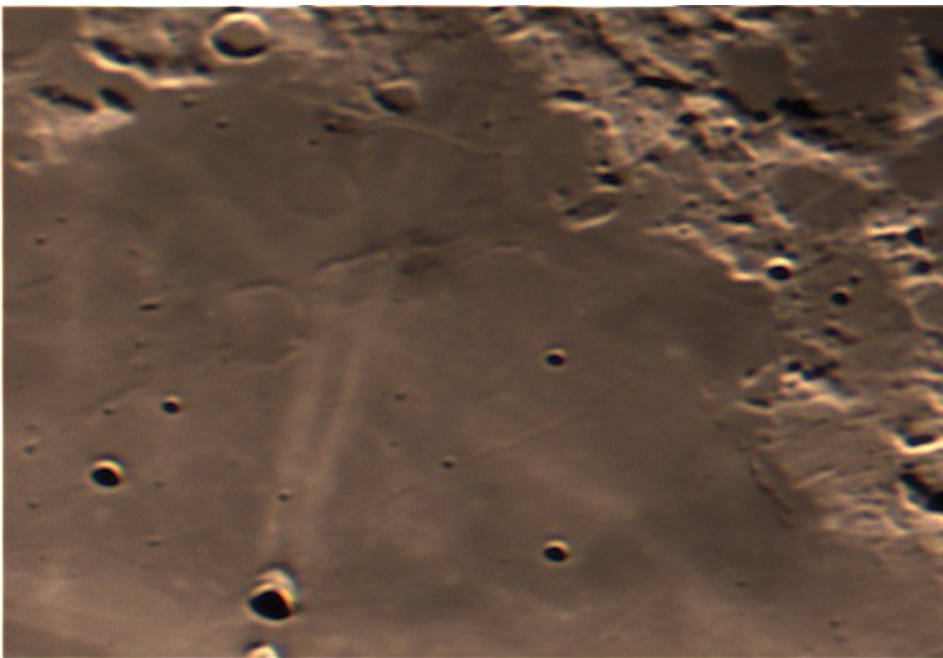
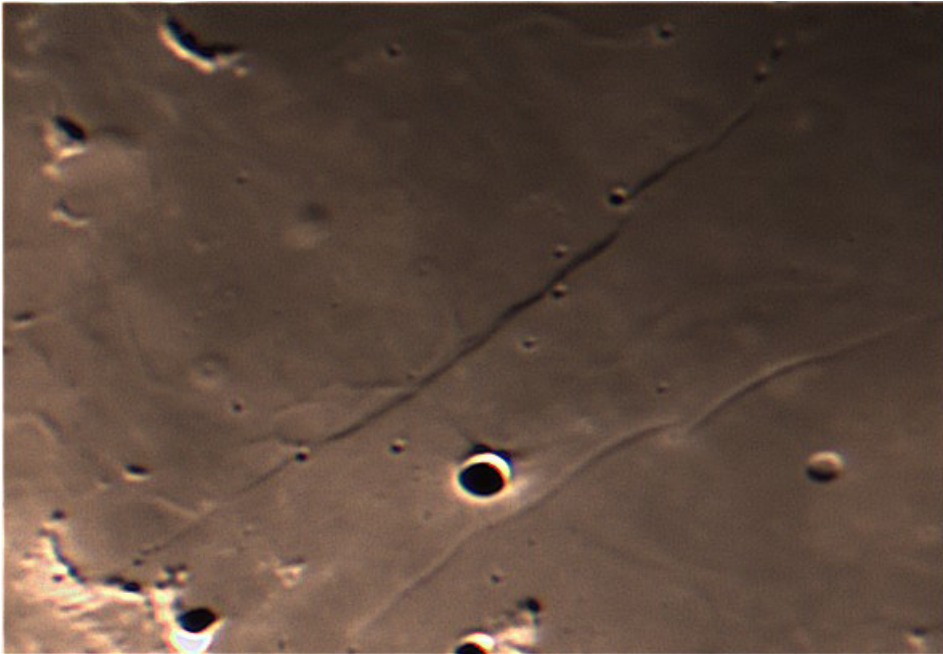
M31 Andromeda Galaxy. Night of 11/4/13 shot with a CanonT3i though a AstroTech 65. Stack of 8 shots at ISO 800 through 1000 with speeds of 45 – 75 seconds. Tom Thibault



M45 The Pleiades by Jim Hendrickson. 200mm f/4, 4seconds @ ISO400.

Venus & Moon on November 5 by Bob Horton.

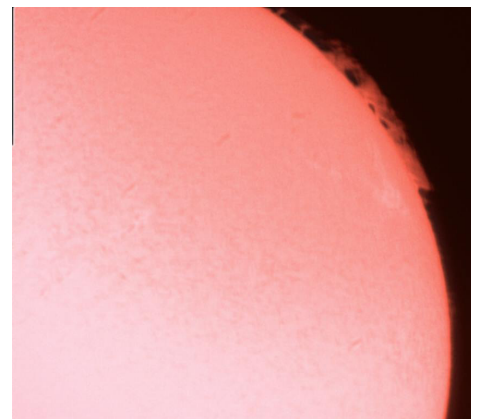




Straight Wall area and Messier A and B from Saturday night, December 7. I was off in the imaging of Messier A and B a bit and didn't get both in. Oh well, next time. Steve Hubbard



For sale: 60mm f/10 H Alpha scope for sale. Comes with custom foam and soft gym bag type carry case and alt azimuth mount. Has a large 10mm blocking filter. This is the PST modification done by Denkmeier and gives good, sharp images. Easy to use grab and go scope. This is a total new cost of around \$1200. To avoid shipping and help out a fellow skyscraper member, I'm offering this to any club member for just \$600. Steve Hubbard. cstahs@yahoo.com / 508-832-8746



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