the Skyscraper

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

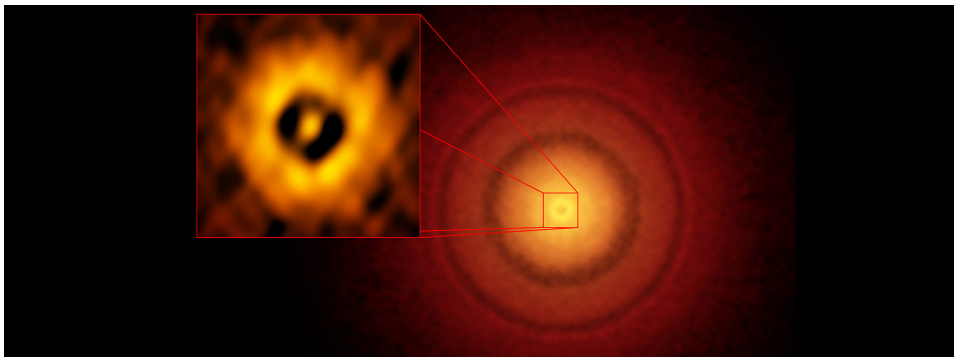
In This Issue:

Saturday, March 3, 7pm
at North Scituate Community Center

Planet Formation Through Radio Eyes

Although planets are always forming, this often occurs in disks of gas and dust so dense that light can't penetrate through to observe them, but radio wavelengths can. Radio telescopes, such as ALMA, possibly the most powerful one ever built, can show us incredible views of these planet-forming disks, giving us new knowledge of the possible origins of our own solar system. Meredith Hughes will lead us into the world of planet formation, using the most recent and spectacular information from the ALMA facility.

Meredith Hughes is an assistant professor of astronomy at Wesleyan University. She earned a BS degree in physics and astronomy from Yale University and AM and PhD degrees in astronomy from Harvard University. Before arriving at Wesleyan, she also held Carl Sagan's old job as a Miller Fellow at UC Berkeley. She was recently awarded the Harvard Astronomy department's Bok Prize for research excellence by a PhD graduate under the age of 35.



Upcoming Meetings & Presentations:

Friday, April 6: Cara Battersby from University of Connecticut

Monday, April 23: Robert Reeves from Texas Star Party

Skyscrapers Board Meetings
Third Monday of the Month
All Members Welcome

Phases of the Moon

Full Worm Moon
March 2 0:51

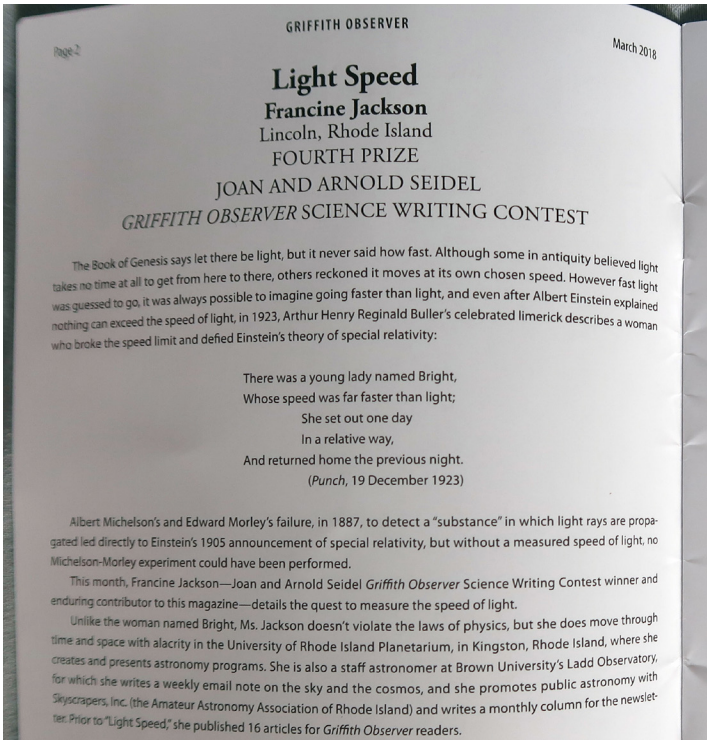
Last Quarter Moon
March 9 11:20

New Moon
March 17 13:12

First Quarter Moon
March 24 15:35

Full Blue Moon
March 31 12:37

Congratulations to **Lloyd Merrill** for recently completing his 8-inch f/6 Newtonian telescope mirror.



GRIFFITH OBSERVER

Page 2 March 2018

Light Speed

Francine Jackson
Lincoln, Rhode Island
FOURTH PRIZE
JOAN AND ARNOLD SEIDEL
GRIFFITH OBSERVER SCIENCE WRITING CONTEST

The Book of Genesis says let there be light, but it never said how fast. Although some in antiquity believed light takes no time at all to get from here to there, others reckoned it moves at its own chosen speed. However fast light was guessed to go, it was always possible to imagine going faster than light, and even after Albert Einstein explained nothing can exceed the speed of light, in 1923, Arthur Henry Reginald Buller's celebrated limerick describes a woman who broke the speed limit and defied Einstein's theory of special relativity:

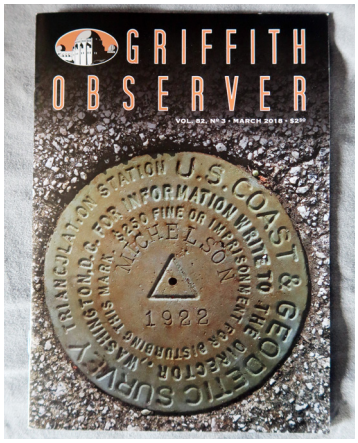
There was a young lady named Bright,
Whose speed was far faster than light;
She set out one day
In a relative way,
And returned home the previous night.
(*Punch*, 19 December 1923)

Albert Michelson's and Edward Morley's failure, in 1887, to detect a "substance" in which light rays are propagated led directly to Einstein's 1905 announcement of special relativity, but without a measured speed of light, no Michelson-Morley experiment could have been performed.

This month, Francine Jackson—Joan and Arnold Seidel *Griffith Observer* Science Writing Contest winner and enduring contributor to this magazine—details the quest to measure the speed of light.

Unlike the woman named Bright, Ms. Jackson doesn't violate the laws of physics, but she does move through time and space with alacrity in the University of Rhode Island Planetarium, in Kingston, Rhode Island, where she creates and presents astronomy programs. She is also a staff astronomer at Brown University's Ladd Observatory, for which she writes a weekly email note on the sky and the cosmos, and she promotes public astronomy with Skyscrapers, Inc. (the Amateur Astronomy Association of Rhode Island) and writes a monthly column for the newsletter. Prior to "Light Speed," she published 16 articles for *Griffith Observer* readers.

Congratulations to **Francine Jackson** for being awarded fourth price in the Joan and Arnold Siedel *Griffith Observer* Science Writing Contest and had her article "Light Speed" published in the March, 2018 issue.



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 **March 15** 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.

The Sun, Moon & Planets in March

This table contains the ephemeris of the objects in the Solar System for each Saturday night in March 2018. Times in Eastern Standard Time (UTC-5) before March 11 and Eastern Daylight Time (UTC-4) from March 11. Ephemeris times are for Seagrave Observatory (41.845N, 71.590W).

Object	Date	RA	Dec	Const	Mag	Size	Elong	Phase(%)	Dist(S)	Dist(E)	Rise	Transit	Set
Sun	**3**	22 54.9	-6 55.6	Aqr	-26.8	1936.2	-	-	-	0.99	06:17	11:58	17:39
	10	23 20.9	-4 12.8	Aqr	-26.8	1932.7	-	-	-	0.99	06:06	11:56	17:47
	17	23 46.6	-1 27.4	Psc	-26.8	1929	-	-	-	0.99	06:54	12:54	18:55
	24	0 12.1	1 18.6	Psc	-26.8	1925.3	-	-	-	1	06:42	12:52	19:03
	31	0 37.6	4 02.8	Psc	-26.8	1921.5	-	-	-	1	06:30	12:50	19:11
Moon	**3**	11 50.4	4 24.1	Vir	-12.7	1933.2	167° W	99	-	-	19:40	01:53	07:56
	10	17 39.9	-19 43.8	Oph	-11.7	1753.8	84° W	45	-	-	01:43	06:37	11:30
	17	23 24.7	-7 22.3	Aqr	-6.6	1827.1	7° W	0	-	-	07:14	13:07	19:09
	24	5 36.6	19 03.3	Tau	-11.8	1962.4	82° E	43	-	-	11:39	19:12	02:46
	31	12 21.9	1 32.6	Vir	-12.7	1916	172° E	100	-	-	19:27	01:30	07:24
Mercury	**3**	23 38.8	-2 52.0	Psc	-1.1	5.5	12° E	89	0.32	1.23	06:49	12:44	18:40
	10	0 20.9	3 14.2	Psc	-0.8	6.3	17° E	68	0.31	1.06	06:41	12:57	19:15
	17	0 49.5	7 55.3	Psc	0.1	7.7	18° E	39	0.32	0.87	07:24	13:56	20:29
	24	0 56.9	9 43.3	Psc	2	9.5	14° E	13	0.35	0.71	06:57	13:34	20:11
	31	0 44.2	8 08.2	Psc	5	11.1	4° E	1	0.4	0.61	06:22	12:52	19:21
Venus	**3**	23 43.9	-3 12.2	Psc	-3.8	10.2	13° E	98	0.73	1.66	06:55	12:47	18:41
	10	0 15.6	0 23.2	Psc	-3.8	10.3	14° E	97	0.72	1.64	06:46	12:51	18:58
	17	0 47.3	3 58.8	Psc	-3.8	10.4	16° E	96	0.72	1.62	07:37	13:56	20:15
	24	1 19.2	7 30.4	Psc	-3.8	10.5	18° E	95	0.72	1.6	07:29	14:00	20:32
	31	1 51.4	10 53.7	Ari	-3.8	10.7	20° E	94	0.72	1.58	07:21	14:05	20:49
Mars	**3**	17 22.8	-22 54.5	Oph	0.8	6.8	81° W	89	1.57	1.38	01:51	06:25	10:59
	10	17 40.6	-23 13.8	Oph	0.7	7.1	84° W	89	1.56	1.32	01:43	06:15	10:48
	17	17 58.3	-23 26.4	Sgr	0.6	7.5	87° W	88	1.55	1.25	02:34	07:05	11:37
	24	18 15.7	-23 32.4	Sgr	0.4	7.9	90° W	88	1.54	1.18	02:24	06:55	11:27
	31	18 32.7	-23 32.6	Sgr	0.3	8.4	93° W	88	1.53	1.12	02:13	06:45	11:16
1 Ceres	**3**	8 49.0	31 59.9	Cnc	7.4	0.7	141° E	99	2.56	1.71	13:28	21:47	06:06
	10	8 45.8	31 58.5	Cnc	7.5	0.7	134° E	98	2.56	1.77	12:58	21:17	06:35
	17	8 44.2	31 48.0	Cnc	7.7	0.7	127° E	98	2.56	1.83	13:30	21:48	06:05
	24	8 44.0	31 29.5	Cnc	7.8	0.7	121° E	97	2.56	1.9	13:04	21:20	05:36
	31	8 45.4	31 04.2	Cnc	7.9	0.6	115° E	97	2.56	1.98	12:41	20:54	05:07
Jupiter	**3**	15 24.3	-17 24.7	Lib	-2	39.2	109° W	99	5.42	5.02	23:29	04:26	09:23
	10	15 24.6	-17 24.5	Lib	-2.1	40.1	116° W	99	5.42	4.91	23:01	03:58	08:56
	17	15 24.2	-17 22.1	Lib	-2.1	40.9	123° W	99	5.42	4.81	23:33	04:31	09:28
	24	15 23.2	-17 17.5	Lib	-2.2	41.7	130° W	100	5.42	4.72	23:04	04:02	09:00
	31	15 21.7	-17 10.7	Lib	-2.2	42.4	138° W	100	5.42	4.64	22:35	03:33	08:31
Saturn	**3**	18 32.3	-22 21.0	Sgr	0.6	15.9	65° W	100	10.07	10.45	02:57	07:33	12:10
	10	18 34.3	-22 19.4	Sgr	0.6	16	71° W	100	10.07	10.34	02:31	07:08	11:44
	17	18 36.0	-22 17.9	Sgr	0.5	16.2	78° W	100	10.07	10.22	03:05	07:42	12:19
	24	18 37.3	-22 16.6	Sgr	0.5	16.4	85° W	100	10.07	10.11	02:39	07:16	11:52
	31	18 38.4	-22 15.5	Sgr	0.5	16.6	91° W	100	10.07	9.99	02:13	06:49	11:26
Uranus	**3**	1 37.3	9 32.6	Psc	5.9	3.4	44° E	100	19.9	20.6	08:00	14:37	21:14
	10	1 38.5	9 39.8	Psc	5.9	3.4	37° E	100	19.9	20.68	07:34	14:11	20:48
	17	1 39.8	9 47.5	Psc	5.9	3.4	30° E	100	19.89	20.75	08:07	14:45	21:22
	24	1 41.2	9 55.5	Psc	5.9	3.4	24° E	100	19.89	20.8	07:40	14:19	20:57
	31	1 42.6	10 03.9	Psc	5.9	3.4	17° E	100	19.89	20.84	07:14	13:52	20:31
Neptune	**3**	23 02.0	-7 10.7	Aqr	8	2.2	2° E	100	29.94	30.93	06:26	12:02	17:39
	10	23 03.0	-7 04.7	Aqr	8	2.2	5° W	100	29.94	30.93	05:59	11:36	17:12
	17	23 03.9	-6 58.6	Aqr	8	2.2	12° W	100	29.94	30.92	06:32	12:09	17:46
	24	23 04.9	-6 52.8	Aqr	8	2.2	19° W	100	29.94	30.89	06:05	11:43	17:20
	31	23 05.8	-6 47.1	Aqr	8	2.2	25° W	100	29.94	30.84	05:38	11:16	16:54
Pluto	**3**	19 29.2	-21 29.3	Sgr	14.3	0.2	52° W	100	33.52	34.12	03:50	08:30	13:10
	10	19 29.8	-21 28.4	Sgr	14.3	0.2	59° W	100	33.52	34.03	03:23	08:03	12:43
	17	19 30.4	-21 27.8	Sgr	14.3	0.2	65° W	100	33.52	33.93	03:56	08:36	13:16
	24	19 30.9	-21 27.3	Sgr	14.3	0.2	72° W	100	33.53	33.82	03:29	08:09	12:49
	31	19 31.3	-21 27.1	Sgr	14.3	0.2	79° W	100	33.53	33.71	03:02	07:42	12:22

"March"-ing into Spring
Saying Goodbye to the Winter Sky

by Dave Huestis

March begins with a Full Moon on the 1st and ends with a Full Moon on the 31st. Therefore, like January, the second one is called a Blue Moon. Regrettably there is no lunar eclipse this time.

While we are still a couple of months away from the return of Jupiter to the early evening sky during public observing sessions at the local observatories, March does provide us an opportunity to observe our solar system's two innermost planets to the Sun. I'm talking about Venus and Mercury.

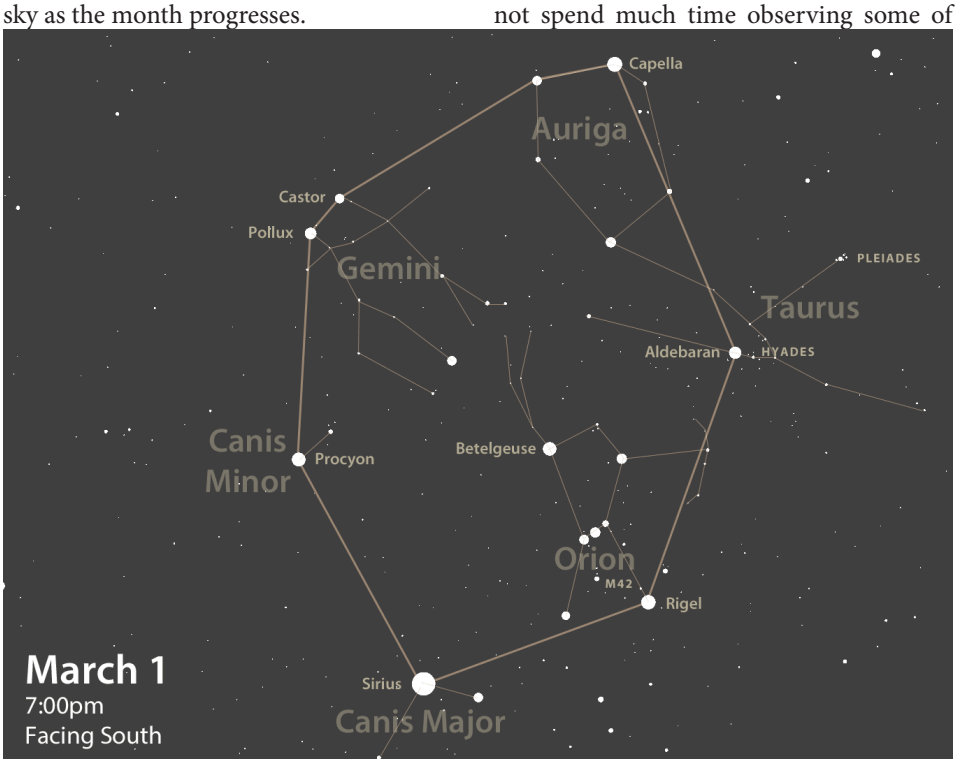
At the beginning of March these planets will be visible in evening twilight just above the western horizon after sunset. Venus will be the brighter of the two objects. On the 3rd Mercury will be about one degree (two full moon diameters) to the right of Venus. Each evening they will rise higher into the sky, though Mercury will very noticeably increase its separation from Venus rather quickly as they do so. On the evenings of the 16th and 17th Mercury will be at its highest elevation above the horizon. Then on the 18th a waxing crescent Moon will complement the Venus and Mercury sky scene. Each evening thereafter Mercury will begin descending the sky towards the horizon and will soon be lost in bright twilight. Venus will continue its ascent into the sky as the month progresses.

Through a telescope Venus will appear almost fully illuminated like a full moon for the entire month. While Mercury will start out nearly in full phase as March begins, its phase will quickly change as it dips back towards the horizon and the Sun. By the 22nd, when Mercury will once again be to the right of Venus, his phase will look like that of a waxing crescent Moon.

An important date to remember is Sunday, March 11. This day is when most of the United States set clocks ahead one hour to Eastern Daylight Time (EDT) at 2:00 a.m. This annual ritual is known as Daylight Saving Time. Don't forget to do so or you'll be late for any Sunday morning function.

Another important day is March 20. At 12:15 p.m. the vernal equinox (equal day and night) occurs. Spring begins in the northern hemisphere. Since the Winter Solstice observance back on December 21 the Sun has been steadily moving northward in our sky. On the vernal equinox if you were standing at a location on the Earth's equator the Sun would be directly overhead (zenith) at local noon. We look forward to longer daylight hours and warmer temperatures.

However, it is not too late to say goodbye to the winter constellations. It was so cold and windy this past winter that I did not spend much time observing some of the brightest and most recognizable star patterns in the sky. In fact, the winter sky contains seven of the 23 brightest stars we can see from the Earth.



There is a huge winter sky asterism formed by combining some of the brightest stars of six constellations. It's called the Winter Circle or Winter Hexagon. Please reference the accompanying star map. Betelgeuse, though inside either pattern, is still considered part of the asterism.

Before we examine each of the stars in the Winter Circle, let's review three important terms. First, the brightness of any celestial object is called its magnitude. The basic idea is that the more negative the magnitude, the brighter the object. The more positive the magnitude, the dimmer the object is. So the Sun is -26.74, the Full Moon -12.92, Venus -4.89, Saturn approximately 0, well known Polaris (the North Star) is magnitude +2, and the naked-eye limit with no light pollution is magnitude +6. Pluto is about +13.65. (Usually the plus sign (+) is assumed and not used, but I do so in this column for clarity.)

Second, a star's distance is measured in light years. One light year is equal to just less than six trillion miles. Third, the spectral classification of a star is defined using the following letters: O, B, A, F, G, K, or M, and often followed by additional numbers and letters to further refine the classification. "O" stars are the hottest while "M" stars are the coolest.

Let's start our tour of the Winter Circle with the brightest star we can see in the sky (besides the Sun of course) — Sirius. Sirius is in Canis Major, the Big Dog. Sirius shines at magnitude -1.44 and it is 8.7 light years away. Do the math and this fairly close neighbor to our Sun is 52.2 trillion miles from us. For you Rhode Islanders that's much farther than Woonsocket or Westerly! Sirius is a hot, blue-white star (spectral class A0) about 1.7 times the diameter of our Sun.

Next we move northward and clockwise in the sky to locate Procyon in Canis Minor, the Little Dog. Procyon is a white star (F5) shining at magnitude +0.40 and is 11 light years distant. It's about twice the diameter of our Sun. Moving farther northward we encounter the Gemini twins, Pollux and

Castor. Pollux is 34 light years distant, while Castor is 18 light years farther away at 52. Pollux is a cool, orange giant (K0) ten times the Sun's diameter, while Castor is a hot, blue-white star (A1) only twice the diameter of the Sun. Pollux and Castor shine at +1.16 and +1.93 magnitude respectively.

Now we swing up and over to a constellation almost directly overhead — Auriga, where we find +1.93 magnitude Capella. While Capella (G6) is a class "G"-type yellow star like the Sun (G2), it has three times more mass and is just over seven times the Sun's diameter. Next we proceed south to encounter the orange giant (K5) Aldebaran in Taurus. Aldebaran represents the bull's eye in the star pattern known as the Hyades star cluster (shaped like a "V"). Aldebaran, 65 light years away, is a cool star which has expanded to be just over 44 times the diameter of the Sun with only 2.5 times our Sun's mass.

Continue to swing southward in the sky until we arrive at the bottom right star representing Orion's left foot. (Please note: Orion is facing us.) This star is +0.18 magnitude Rigel, a blue supergiant (B8) 800 light years away — the most distant of the Winter Circle stars. Rigel is 62 times the diameter of our Sun and contains 17 times more mass. We now complete the tour of the Winter Circle by swinging back to Sirius.

But wait. No, I didn't forget about Betelgeuse. Betelgeuse is the red supergiant (M2) star that marks the top right shoulder of Orion. It shines at magnitude +0.45 and resides at a distance of 520 light years. Betelgeuse is also a very large star, measuring in at a conservative 950 solar diameters. If you replaced our Sun with Betelgeuse it would extend out to the asteroid belt between Mars and Jupiter.

As you can see by this small sampling of stars that comprise the Winter Circle, stars are quite a lot like people. They are all different, but their differences make them unique and important.

The next time you have an opportunity to observe the Winter Circle, you will have a better understanding and appreciation of the scale and diversity of our stellar neighbors in this region of the Milky Way Galaxy.

While you do not require a telescope to appreciate the magnificence of the bright stars comprising the Winter Circle, when Jupiter, Mars and Saturn return to the mid-evening sky the views of these planets from the local observatories and their fine instruments will reward you with incredible images. 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 clear 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 Thursday night. Frosty Drew Observatory (http://www.frostydrew.org/) in Charlestown is open every clear Friday night.

Keep your eyes to the skies.

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

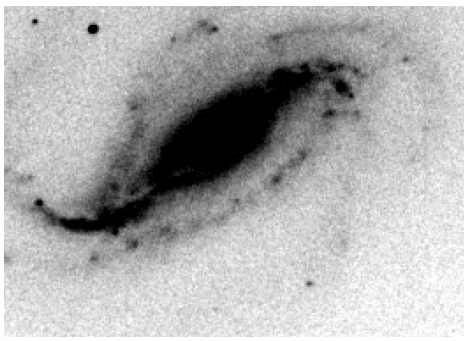
Amateur Astronomer Makes First-of-its-Kind Supernova Discovery

by Francine Jackson

Although several of us are professional astronomers, all members of Skyscrapers, Inc., are there because of a love of the sky. Whether it's spending time at a telescope, or just enjoying the beauty of the night, we all share the love of the night – and often day – sky. There is also a unique bond that amateur astronomers have that isn't as notable in other science disciplines: The possibility to make a significant discovery.

Such is the case of self-taught amateur Victor Buso, of Argentina. Using a 40-centimeter telescope on his rooftop observatory, Buso became the first person ever to observe the "shock breakout" phase of a supernova, when a wave of energy seems to roll from a star's core to its outer portion just before the actual explosion. Previously, astronomers had to depend on computer models to assume the occurrence. Buso, testing a new camera on his telescope, aimed his instrument at NGC 613, a galaxy in Sculptor, and caught what no one had ever found: the light at the birth of a supernova.

Like many of us, Buso just fell in love with the science at a very early age, but took up locksmithing, keeping astronomy as a late-night enjoyment. It was the night of September 20th, 2016 when he saw a point of light that didn't appear on any of his star charts. He wanted to show this to professionals in his country, but, as can happen, they were all away at a conference. After showing his work to another amateur friend of his, who confirmed the discovery, Buso did soon inform scientists from his country, who quickly set about training professional equipment on the galactic find.



NGC 613 with Type IIb Supernova (bottom right) image by Victor Buso & Gaston Folatelli.

Buso is a true example of a person who fell in love with astronomy but kept it at the amateur level; however, he made a discovery incredibly important in the study of supernova birth. Although not a common happening, discoveries of this type have been known before. By just enjoying the beauty of the sky, Buso increased its knowledge. And, although it might not be something that could happen to any of us, there is always the possibility that someone at Skyscrapers, Inc., can also add to the richness of the science we all love best.

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

February Reports

Minutes of the Skyscraper meeting February 2 2018

Meeting opened at 7:15pm with a combined welcome by President Steve Siok and numerous clicking noises and flashes from Tracy Prell and her camera.

Steve asked for a moment of silence for Skyscraper member Kent Cameron who passed away recently.

Steve asked for an additional moment of silence for fellow amateur and friend of Skyscrapers, John Davis who also recently passed away.

New members, Michael and son Weston Ambrose were introduced for membership. They will be voted into the society with a family membership at our next meeting.

Ian Dell'Antonio provided a recap of speakers for upcoming meetings.

Treasure Lloyd Merrill provided a brief overview of our finances. We have a modest shortfall. We have received $545 in donations so far in Kent Cameron's name.

Kathy Siok talked about Astroassembly 2018. The date set for this year's gala event will be September 28 and 29. The community center and caterer have been confirmed for that date.

Jim Crawford represented the trustees and discussed a recent donation we received of between 10 to 12 telescopes. Half are in great shape and there is a mix of reflectors and refractors. An inventory of all items is being put together and eyepieces, finders and so forth are being combined. Tom Thibault has put a design together for an all sky camera mount location. Ian Dell'Antonio has submitted an application to NASA for an all sky camera so that we can be a part of their fireball monitoring network. There will be a wait of a couple of months for a decision. There would be no financial obligation to the society, the camera and download computer would be loaned.

Steve Hubbard submitted a proposed addition to the society bylaws to be added under Article IV, Board of Trustees section:

"The board of trustees shall not discard, sell or otherwise dispose of any item of non-maintenance related property listed within the society's inventory list(s) without first bringing a list of such property under consideration to the board of directors for review and approval. Final permission to discard, sell or otherwise dispose of such listed property will require a majority vote of the board of directors."

Motion to be discussed and voted on at the next meeting of the society.

Steve Siok made the following Presidential Announcements:

A nominating and election committee have been appointed. Bob Horton and Tracy Prell are the members on the nominating committee. Bob made a plea for members to run for offices. All of the offices this year will be open as the current slate is barred from running again for the same positions due to term limits.

On 2/8/2018, there will be a lecture "Tim Mutch lecture series" at Brown University at 4pm in McMillan Hall. The speaker will be Sara Seager from M.I.T.

At 7:30pm, the business meeting concluded and our featured speaker, Jonathan Pober of Brown University gave his talk.

Respectfully submitted, your humble society secretary, Steve Hubbard


Jonathan Pober

Dual Lobed Planetary Nebula in Gemini

NGC 2371-2

by Glenn Chaple for LVAS

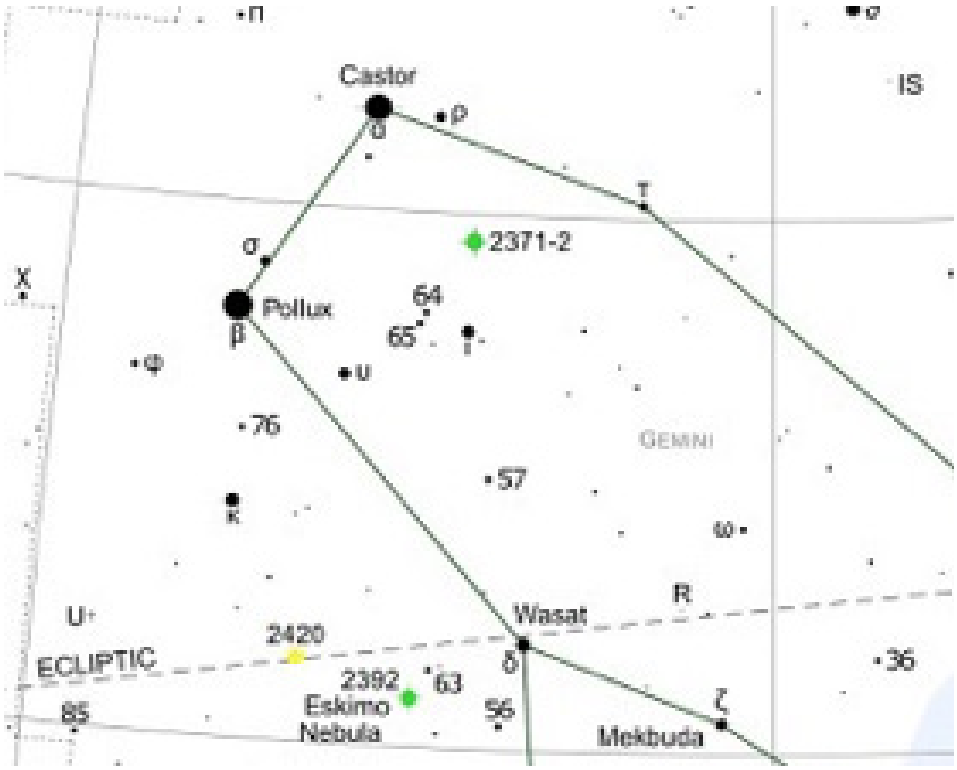
(Mag. 11.2; Size 55")

Our March, 2018, LVAS Observer's Challenge takes us to a planetary nebula in Gemini – not the well-known Eskimo Nebula (NGC 2392), but the fainter and more difficult dual lobed planetary NGC 2371-2. It was discovered by William Herschel in 1785. Herschel saw it as two separate entities, which led to its ultimately receiving two listings in the NGC Catalog as 2371 and 2372.

Due to its telescopic appearance, NGC 2371-2 goes by the nick-names the Peanut Nebula, the Gemini Nebula (a two-part planetary whose home constellation is the Twins, get it?), and the Double Bubble Nebula. The latter is used by Stephen James O'Meara, who features NGC 2371-2 in his book The Secret Deep. It also appears on the list of 110 "Finest NGC Objects" in the annual RASC Observer's Handbook.

The Double Bubble Nebula presents a variety of challenges. First, you have to be able to see it – not an easy task in scopes with apertures under 10 inches. An OIII filter, if you have one, would help. If you're working with a larger telescope, look for a pair of arcs northwest and southeast of the main nebula and visible in the image below. These visual tests will require dark skies and high magnification. The third challenge is to pick out the magnitude 14.8 central star.

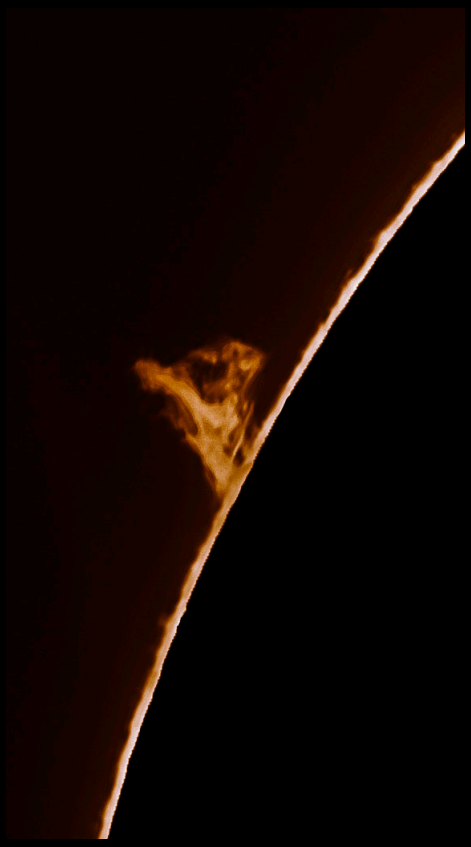
The distance to NGC 2371-2 is uncertain, but is likely on the order of 4400 light years. The main lobes span a distance slightly greater than a light year, while the outer arcs double that size.



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

Ladd Observatory Lens Cleaning

Bob Horton and Al Hall clean the objective of the 12-inch Brashear telescope at Ladd Observatory on December 27, 2017. In the seven years since its last cleaning, it had collected a film of grime both on the exterior and interior surfaces that significantly impacted contrast. Following cleaning, the waxing gibbous Moon was observed.



Solar prominence on February 24 by Jeff Padell.

Waxing gibbous Moon on February 28 by Tracy Prell.

Waning gibbous Moon showing Earthshine on February 13 by Bob Horton.

What Is the Ionosphere?

By Linda Hermans-Killiam

High above Earth is a very active part of our upper atmosphere called the ionosphere. The ionosphere gets its name from ions—tiny charged particles that blow around in this layer of the atmosphere.

How did all those ions get there? They were made by energy from the Sun!

Everything in the universe that takes up space is made up of matter, and matter is made of tiny particles called atoms. At the ionosphere, atoms from the Earth's atmosphere meet up with energy from the Sun. This energy, called radiation, strips away parts of the atom. What's left is a positively or negatively charged atom, called an ion.

The ionosphere is filled with ions. These particles move about in a giant wind. However, conditions in the ionosphere change all the time. Earth's seasons and weather can cause changes in the ionosphere, as well as radiation and particles from the Sun—called space weather.

These changes in the ionosphere can cause problems for humans. For example, they can interfere with radio signals between Earth and satellites. This could make it difficult to use many of the tools we take for granted here on Earth, such as GPS. Radio signals also allow us to communicate with astronauts on board the International Space Station, which orbits Earth within the ionosphere. Learning more about this region of our atmosphere may help us improve forecasts about when these radio signals could be distorted and help keep humans safe.

In 2018, NASA has plans to launch two missions that will work together to study the ionosphere. NASA's GOLD (Global-scale Observations of the Limb and Disk) mission launched in January 2018. GOLD will orbit 22,000 miles above Earth. From way up there, it will be able to create a map of the ionosphere over the Americas every half hour. It will measure the temperature and makeup of gases in the ionosphere. GOLD will also study bubbles of charged gas that are known to cause communication problems.

A second NASA mission, called ICON, short for Ionospheric Connection Explorer, will launch later in 2018. It will be placed in an orbit just 350 miles above Earth—through the ionosphere. This means it will have a close-up view of the upper atmosphere to pair with GOLD's wider view. ICON will study the forces that shape this part of the upper atmosphere.

Both missions will study how the ionosphere is affected by Earth and space weather. Together, they will give us better observations of this part of our atmosphere than we have ever had before.

To learn more about the ionosphere, check out NASA Space Place: https://spaceplace.nasa.gov/ionosphere

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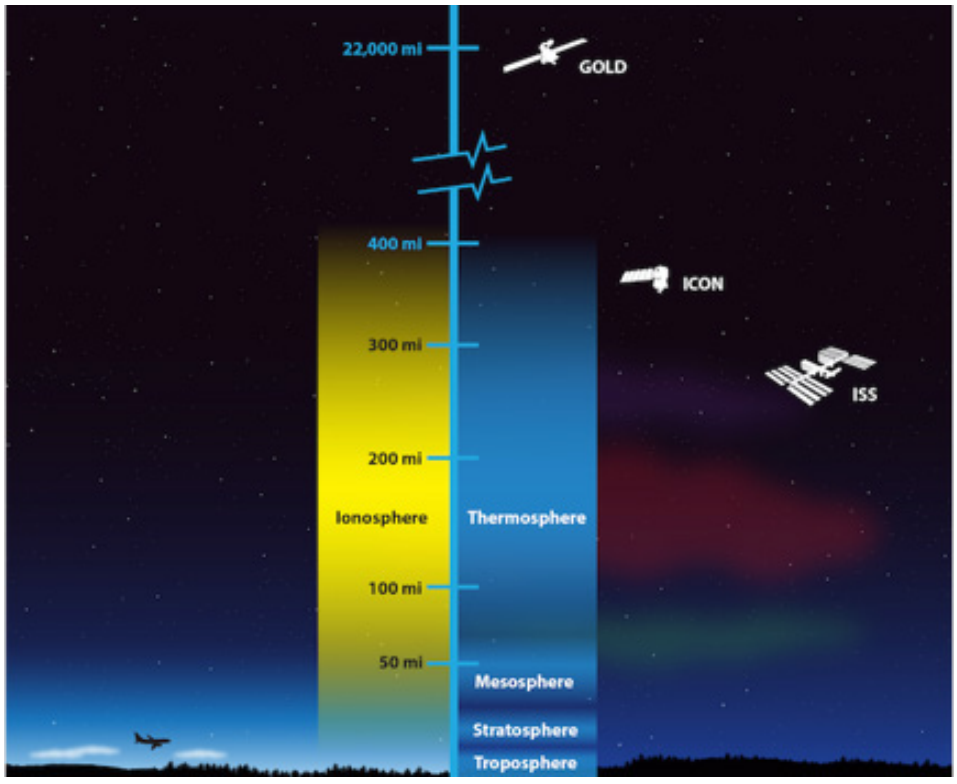

This illustration shows the layers of Earth's atmosphere. NASA's GOLD and ICON missions will work together to study the ionosphere, a region of charged particles in Earth's upper atmosphere. Changes in the ionosphere can interfere with the radio waves used to communicate with satellites and astronauts in the International Space Station (ISS). Credit: NASA's Goddard Space Flight Center/ Duberstein (modified)

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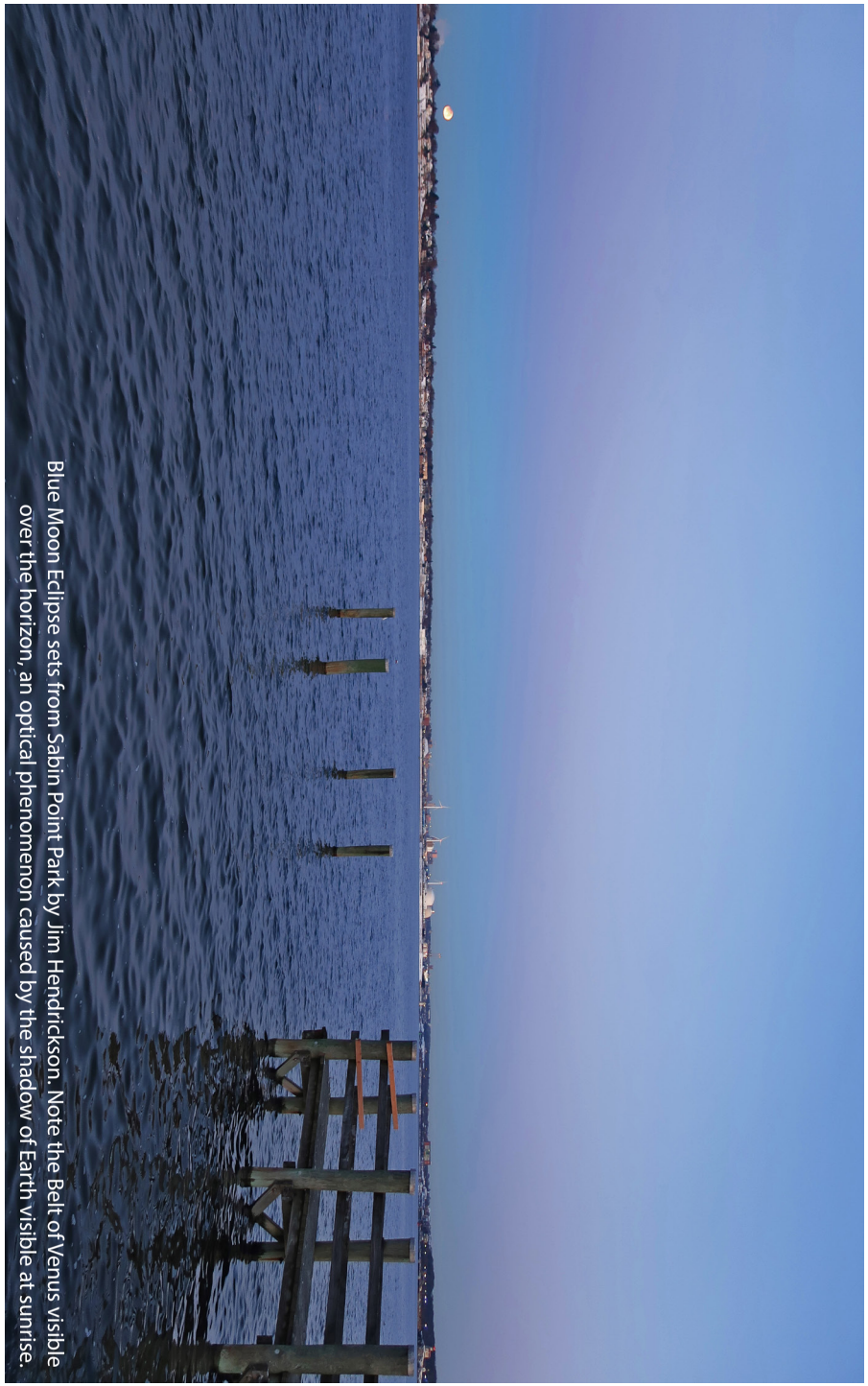

Blue Moon Eclipse sets from Sabin Point Park by Jim Hendrickson. Note the Belt of Venus visible over the horizon, an optical phenomenon caused by the shadow of Earth visible at sunrise.

Directions to Seagrave Memorial Observatory

www.theSkyscrapers.org

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:
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