

# Sky WAA tch



## Stellar Nursery

Courtesy of Scott Nammacher is this image of the Rho Ophiuchi cloud complex. Scott used a Takahashi 106mm Refractor with SBIG STL 1100 camera located in Siding Springs Australia (via iTelescope.com).

As Scott notes: The cloud complex is a dark nebula of gas and dust that is located  $1^\circ$  south of the star  $\rho$  Ophiuchi in the constellation Ophiuchus. At an estimated distance of 450 light-years this cloud is one of the closest star-forming regions to the Earth. For more fascinating images go to Scott's [website](#) or see his upcoming show at the Somers library (see pg. 3 of this issue for more details).

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**WAA September Lecture**  
**"Member Presentations Night"**  
**Friday September 11<sup>th</sup>, 7:30pm**  
**Lienhard Lecture Hall,**  
**Pace University, Pleasantville**

WAA members will showcase their photos, equipment and astronomy insights. So if you've done something interesting astronomically this summer, gotten a new piece of equipment, or made some images and would like to talk to fellow club members about it, contact [Pat Mahon, WAA Vice President for Programs, Directions and Map.](#)

**Upcoming Lectures**  
**Lienhard Lecture Hall,**  
**Pace University, Pleasantville, NY**

On October 2<sup>nd</sup>, Charles Lawrence will speak about the Planck Mission. Our speaker for November 6<sup>th</sup> will be science educator Charles Fulco. His topic will be light pollution, in particular how it impacts Westchester. On December 4<sup>th</sup>, Andy Poineros will be presenting on the New Horizons Mission.

**Starway to Heaven**  
**Saturday September 12<sup>th</sup>, Dusk.**  
**Ward Pound Ridge Reservation,**  
**Cross River, NY**

This is our scheduled Starway to Heaven observing date for September, weather permitting. Free and open to the public. The rain/cloud date is September 19<sup>th</sup>. **Note:** By attending our star parties you are subject to our rules and expectations as described [here](#). [Directions.](#)

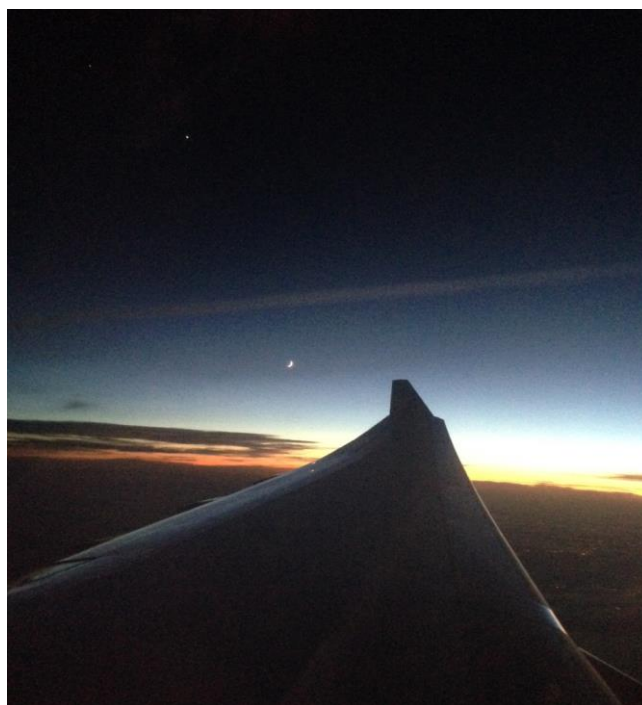
**New Members. . .**

Lisa Kempa - South Salem  
 Kyle Gray - White Plains  
 Susan Blake-Nehama - Baychester  
 Gene Lewis - Katonah

**Renewing Members. . .**

Stephen Groth - Ardsley  
 Leandro Bento - Yonkers  
 Scott Nammacher - White Plains  
 Harry Vanderslice - Mamaroneck

**Call: 1-877-456-5778 (toll free)** for announcements, weather cancellations, or questions. Also, don't forget to periodically visit the [WAA website](#).



Larry Faltz captured this image of the crescent moon, Venus and Jupiter (faintly in the upper left corner) out of the window of a Virgin Atlantic Airbus 330 en route from New York to London on June 18<sup>th</sup>. He used his cellphone camera.

**WAA Apparel**

Charlie Gibson will be bringing WAA apparel for sale to WAA meetings. Items include:

- Hat (\$15)
- Polos (\$15)
- Tee shirts (\$12)



## Astrophotography Exhibition at Somers Library October 3<sup>rd</sup> to October 29<sup>th</sup>, 2015

The Somers Library will be having an exhibition of the astrophotography of Scott Nammacher, a Westchester based amateur astrophotographer. The exhibition opens October 3<sup>rd</sup> and extends to October 29<sup>th</sup>. It is called "Treasures of the Northern and Southern Night Skies."

Mr. Nammacher will show his photographs, taken from two remotely operated observatories (one in Australia and the other in New Mexico) and his up-state observatory, Starmere Observatory. He has been photographing nebulae, galaxies, along with cloud and gas regions, and more local solar system targets since the early 2000s. He became more seriously involved after he designed and built an observatory near Catskill, NY in late 2008. He has shown earlier works at locations in the Hudson Valley area, including Pound Ridge.

His photographs are printed using a unique process involving printing on coated aluminum, which enhances the color and vibrancy of the printed pictures. His website is [starmere.smugmug.com](http://starmere.smugmug.com).

Somers Library information:

Route 139 & Reis Park, Somers, NY 10589

Phone: 914-232-5717

Website: [www.somerslibrary.org](http://www.somerslibrary.org)

Artist Information:

Website: [Starmere.smugmug.com](http://Starmere.smugmug.com)

Email: [snammacher@msn.com](mailto:snammacher@msn.com)



Scott's image of NGC 2170, a reflection nebula  
in Monoceros



Scott with some of his imaging equipment



## Almanac

### For September 2015 by Bob Kelly



Sep 5



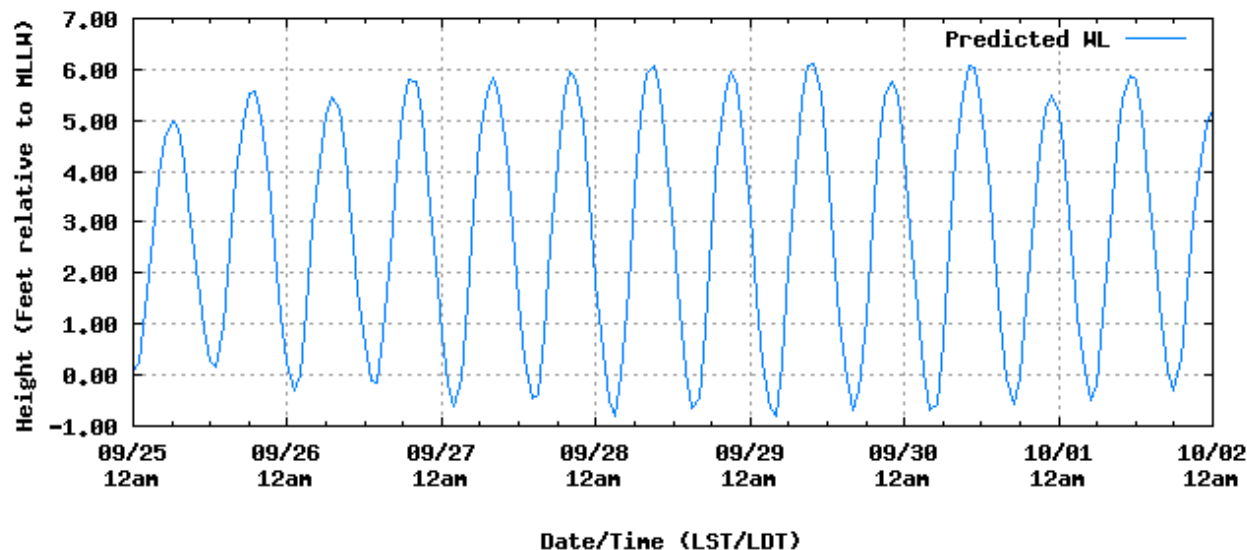
Sep 13



Sep 21



Sep 27



Projected tides at the Battery, Lower Manhattan, New York <http://tidesonline.nos.noaa.gov/> showing a change in range of tides from 5 feet to 7 feet after full moon on the 27th.

We open September with larger than normal tides due to a full Moon within a day of our Moon's perigee; then in late September we have the closest full Moon of the year during a total lunar eclipse. What more could you want?

With a full moon within an hour of lunar perigee near the equinox, the variation in ocean tides from high to low tide will have the largest range of the year in the days following the full moon on the evening of the 27<sup>th</sup>.

But, on to the disappearing acts of September!

Our top story is the last in the set of four-in-a-row total lunar eclipses, which occurs in Prime Time on Sunday the 28<sup>th</sup>. Pay attention – this will be the last total lunar eclipse for our area until January 2019. If you want to watch from your TV room, the Moon will be about half-way above the horizon during the eclipse. Check it out the night before to see if the Moon will be visible from inside. The moon will be somewhat further to the left on the night of the eclipse. The timing of the full Moon and the perigee makes an unusually large Moon during the eclipse (but not much larger).

The Moon goes deeper into the earth's shadow than the last lunar eclipse on April 4<sup>th</sup>, staying in the dark

from 10:11 to 11:23pm EDT. (It happens at the same time in all US time zones – adjust for your time zone if you find yourself away from here; e.g., 7:11 to 8:23 PDT.) If you are outside, watch for fainter stars appearing as the Moon dims. While you won't need a telescope for the eclipse, bring it out anyway to check out faint Uranus, 14 degrees northeast of the darkened Moon. While the Moon passes very close to Uranus in our sky on Monday night, the brightness from the one-day-past-full moon will make the magnitude +5.7 ice giant harder to see. Neptune, our more distant ice giant, dimmer at magnitude +7.4 will be a bit further away on the opposite side of our Moon during the eclipse. Earth will be closest to Neptune for the year at the start of the month, so this is about as bright as it gets and a great time to find it.

One of the brightest stars in the sky, Aldebaran in Taurus the Bull, will be covered up by the bright edge of the last quarter Moon in the middle of the night on the 4<sup>th</sup>/5<sup>th</sup>. The Moon will rise in the east-northeast just about the time it covers up Aldebaran at 11:56pm, but it will pop out from behind the dark edge of the moon about 12:40am EDT on the 5<sup>th</sup>. Since our Moon has no appreciable atmosphere, one second the star won't be there and suddenly it will be there at full brightness.

Try not to blink! Disappearance/reappearance times are different at different locations. Find exact times at <http://www.lunar-occultations.com/iota/bstar/0905zc692.htm>.

Late in the month, a star will slide in among Saturn's moons. At 10<sup>th</sup> magnitude, it's just a little brighter than Rhea, and quite a bit dimmer than Titan. Rhea will sidle up to the star on the 25<sup>th</sup>, closest around 7:20pm. Rhea may hide it for our area and further north, or just miss.

Jupiter hides out behind the Sun – catch it before the 7<sup>th</sup> blazing in the SOHO C3 camera; later in the month, Jupiter joins the morning show, peeking over the horizon during twilight. Venus hides in plain sight for sleepy-eyed early risers, topping out at magnitude -4.8 on the 21<sup>st</sup>, low in the east. It's a lovely crescent when viewed in a telescope, shrinking in overall size as Venus swings away of us in its orbit. Mars is +1.8, much dimmer but still noticeable in the same morning sky. Mars lines up within a degree of Leo's bright star Regulus (+1.4) on the 25<sup>th</sup> giving us a preview of the close encounters of brighter planets in October, with Venus and Jupiter looking on from above and below, respectively.



Olivier Prache imaged the Moon with an 80mm F/6 triplet apo refractor mounted on an iOptron smartEQ.

Saturn is pretty low in the southwestern sky, making an early exit each evening. It's still fun to see the rings even if they are bit fuzzier than last month. Mercury hangs lower in the evening twilight, playing hard-to-find, brightest early in the month before scooting past the Sun at the end of September.

There's a partial eclipse of the Sun on the 13<sup>th</sup>. It's visible in southern Africa and Antarctica. The next total solar eclipse is March 9<sup>th</sup> next year in Indonesia and across into the mid-northern Pacific Ocean.

The International Space Station is visible in the pre-sunrise sky starting on the 9<sup>th</sup> through the end of the month.

Looking forward to October, we have conjunctions galore in the morning sky: Venus, Regulus and the Moon on the 8<sup>th</sup>, Mars and Jupiter on the 19<sup>th</sup>, Venus, Jupiter and Mars on the 22<sup>nd</sup>, Jupiter and Venus from the 25 through the 27<sup>th</sup>.

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David Parmet imaged the Andromeda galaxy at Cherry Springs using a 55mm lens on a dslr. A four minute exposure, which he cropped.

## Have Another Round on WAA

### Larry Faltz

I was pleased to get many positive comments about my “Strange Brew” article in the [May 2015 WAA newsletter](#), which celebrated the conjunction of beer and astronomy. John Paladini, who found “Hevelius” beer and stimulated the whole article, one-upped me when he found another Polish astronomical-themed beer, this one commemorating Nicholas Copernicus, or Kopernik as his name is spelled in Polish. The beer is brewed by Browar Amber of Kolbudy, Poland, just outside of Gdansk. It was created to commemorate the great man’s 540<sup>th</sup> birthday in 2013. John brought me a bottle: it was good, but not as good as the Hevelius I wrote about in “Strange Brew.”

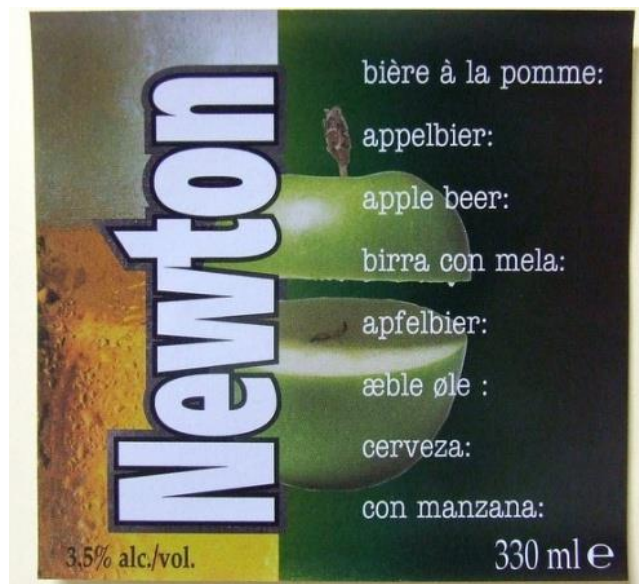


Copernicus was recently honored by another astronomically-themed brewer, the Galaxy Brewing Company of Binghamton, NY. In addition to their “Kopernik Kolsch” (a pale lager), they make “Andromeda” IPA, “Galactic Silk”, “Pulsar” porter, “Space Madness” stout, “Star Gazer” IPA and “White Dwarf” wheat beer. The Kolsch was served at the 2014 AstroFest held by the [Kopernik Observatory](#), the outstanding amateur astronomy and science outreach organization in Vestal, NY, not far from Binghamton.

It turns out that the Poles like commemorating events with beer (well, who doesn’t?) and when 2011 was declared “the year of Heweliusz” (Hevelius) in Poland (commemorating his 400<sup>th</sup> birthday) Browar Amber, teamed up with the Gdansk History Museum to celebrate with “Johannes” beer.

Not to let a good idea go flat, so to speak, the Gdansk History Museum held a beer exhibit and a festival in late June 2015 in Hevelius’ honor. Also co-sponsored

by Browar Amber, the exhibit featured displays of historical glassware and beer production technology.



We did a little more research to see whether any other astronomical greats were commemorated in beer. I was correct in “Strange Brew” that Tycho doesn’t have a beer named after him, but I did find “Newton” beer by the Belgian brewer Brasserie Lefebvre. This is, as you might have surmised, an apple beer, to memorialize the (probably apocryphal) story regarding the origin of Newton’s theory of gravity. On-line reviews of this heavily sweetened beer suggest that, unlike gravity, it is repulsive.

Galileo was honored in 2009 by the large brewer Sierra Nevada with “Galileo’s Astronomical Ale: Theoretically the best beer in the universe.” This brew was made specifically for the 2009 meeting of the American Astronomical Society. 2009 was proclaimed the International Year of Astronomy to commemorate the 400<sup>th</sup> anniversary of Galileo’s first telescopic observation of the heavens. Unfortunately the ale was not made for commercial distribution. Sierra Nevada’s Ken Grossman has an interest in astronomy and helped finance a community observatory and outdoor planetarium in his home town of Chico, California.

As for other astronomical greats, there was once a Ptolemy’s Taproom in Starkville, Mississippi, but it is now closed. There’s a Cassini Cellars wine maker in British Columbia, but that doesn’t count in a beer article. There is a Kepler Brewing Company in Massa-



chusetts that makes a beer called “Element” but nothing astronomically-themed.

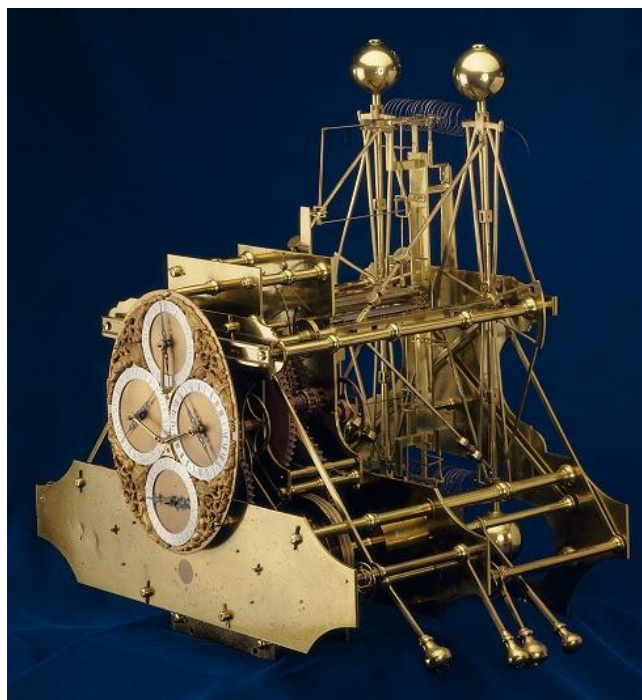


Museums are generally not noted for a direct interest in beer although there are artistically and historically important porcelain beer mugs on display in the decorative arts sections of many museums and pottery vessels for making or serving beer are commonly seen in collections of ancient art or archeology. Elyse and I often stop at the historic Royal Greenwich Observatory when we're in London, especially if there's good weather and we can get there by boat on the Thames as we did this year in late June. The RGO annually presents the free [“Astronomy Photographer of the Year”](#) exhibit, sponsored by *The Sky at Night* magazine, the British equivalent of *Sky & Telescope*. The photographs, from all over the world, are beautifully displayed in the building that houses the Peter Harrison Planetarium (that was showing, what else? the Hayden's [Dark Universe](#)).

I came across “Prime Meridian” English ale for sale in the RGO gift shop (it's not available on their web site) among a raft of “Prime Meridian” logo souvenirs. The RGO, as you all must be aware, is the origin of the prime meridian of the world (0 degrees longitude) and if you've ever been there, you know that it inspires vast numbers of (often silly) tourist photographs posed with one foot on either side of the metallic strip in the courtyard that marks the meridian's historical location. As it turns out, the modern prime meridian is about 100 meters to the east, the result of the adoption of modern systems of global mapping such as the International Terrestrial Reference System (ITRS). Your GPS receiver uses the modern reference point.



If you pay the RGO's admission price (£9.50 adults, £7.50 seniors), you get access to the meridian line for your commemorative photograph, entrance to Christopher Wren's Octagon Room, exhibits on astronomical instrumentation and the superb exhibit on time measurement (critical for determining longitude at sea until the development of GPS), featuring John Harrison's famous H1 clock, still keeping excellent time after 280 years.



Harrison's H1 Sea Clock (1736)

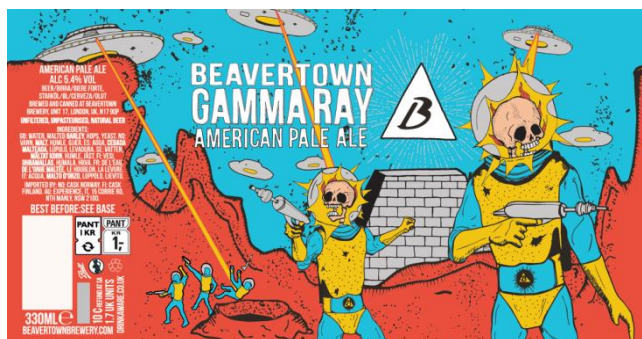


The Royal Greenwich Observatory on 6/26/15 from the National Maritime Museum (LF)

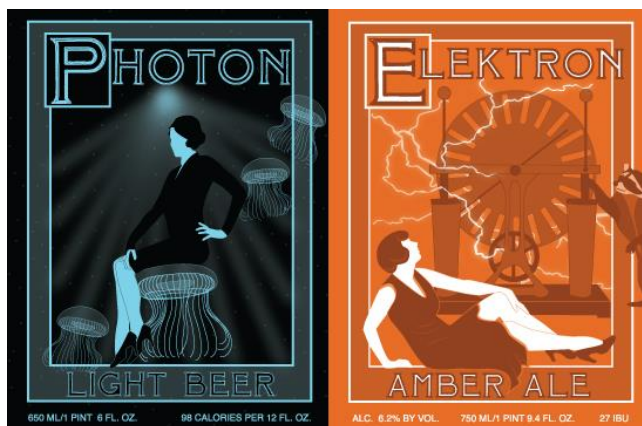


A typical (relatively sedate) tourist photo at the Prime Meridian someone uploaded to Google Earth.

On our London trip this year we took advantage of more rare sunny English weather to make our first visit to the magnificent Kew Gardens. This huge, immaculately maintained botanical park, the largest collection of plants in the world, traces its origins to the 1760's. Joseph Banks, botanist on the famous 1769 Transit of Venus expedition to Tahiti led by Captain James Cook, championed the Gardens during his more than 41 years as President of the Royal Society (1778-1820). Banks was a friend and supporter of astronomer William Herschel. On our way back to town, we stopped at a pub near the Kew Gardens underground station for some refreshment. Elyse had a "Gamma Ray" pale ale by London brewer Beavertown.



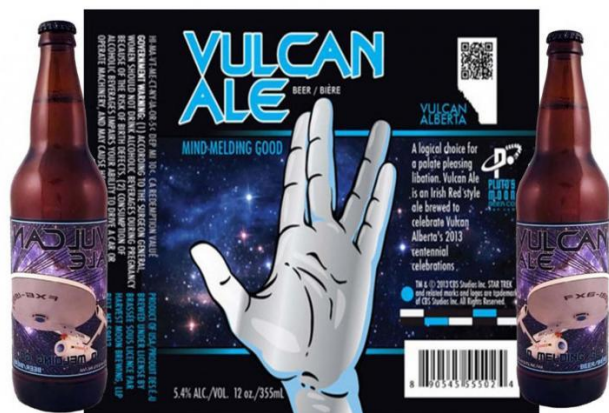
Now that we are moving into physics for beers, we found that the Actual Brewing Company of Columbus, Ohio makes a "Photon" beer and an "Elektron" amber ale. Their mantra is that the beers are "brewed with tender loving science." The Firefly Hollow Brewing Company of Bristol, Connecticut, makes a "Photon Imperial Crimson Ale" and an "Up Quark" IPA. Earth Bread and Brewery, in Mt. Airy, PA makes a "Top Quark" stout. These beers remind me of some jokes: A photon stopped at the bar and asked if there was a room to rent. The bartender said "Sure thing. Can I take your bag up to your room?" The photon said "No, I'm traveling light." A neutron walks into a bar and asks the bartender, "How much for a beer?" The bartender replies, "For you, no charge."



Taking its name to heart, the town of Vulcan, Alberta (population 1,836) holds an annual *Star Trek* convention known as "Spock Days." Local brewer Federation of Beer makes a "Vulcan Ale" and also sells "Klingon Warnog" (a "Danish Roggen Dunkel") by the Tin Man Brewing Company of Evansville, Indiana. This beer is officially licensed by the Star Trek franchise. Federation of Beer also sells "Syndicate Lager, the Orion Seductress" by a Czech brewer. Syndicate honors the green-skinned creature played by Yvonne Craig in the original Star Trek series episode "Whom Gods Destroy." Craig, who sadly passed away on August 17<sup>th</sup> at age 78, will be remembered primarily for

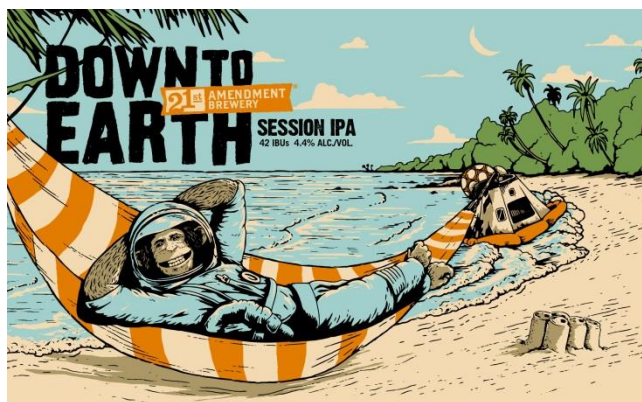


her role as Batgirl in the idiotic mid-60's Batman series. A "Genesis Effect" beer, commemorating the planet-terraforming device in the movie *Star Trek II*, is promised soon.



Of course, someone had to do it, so Cerveceria La Constancia (SABMiller) in El Salvador brewed "Romulan Ale," named for the legendary drink banned in the Federation but occasionally smuggled in for special occasions. It's mentioned in at least 11 *Star Trek* TV shows and movies. This beer was on sale at the Star Trek Experience in Las Vegas, which operated from 1998-2008. There is a "Romulan Ale" energy drink still for sale, but it's not a brewed beverage.

I was turned on to a most unusual space-themed beer by long-time WAA member and brew connoisseur Darryl Ciucci. It illustrates something about marketing in the craft beer industry. The May 13, 2015 *Wall Street Journal* carried a story about San Francisco's 21<sup>st</sup> Amendment Brewery, which made "Bitter American" pale ale. The label featured a cartoon of the chimp Ham, who made the first American space flight, a 16-minute suborbital voyage in a Mercury capsule on January 31, 1961. The picture suggested that Ham was not real happy about his situation. The beer sold poorly, but when the same beer was re-named "Down to Earth" and the label redrawn to show Ham happily relaxing on a hammock on the beach with his capsule back on *terra firma*, sales skyrocketed. Beer names and labels really matter!



I'm sure there are more astronomy and physics themed beers. If you find any, let us know at [info@westchesterastronomers.org](mailto:info@westchesterastronomers.org). ■

## Blue Moon on July 31<sup>st</sup>

Larry Faltz



The origin of the term “Blue Moon” is exceedingly difficult to pin down. The phenomenon is a byproduct of Julius Caesar’s annual calendar, still with us in its Gregorian form, having months (except for February) that last longer than the lunar period of 29.53 days. This interval is the synodic month, the gap between successive appearances of the moon on a line connecting the Sun and the Earth (a linear alignment of 3 celestial bodies is known as a “syzygy,” one of the truly great words in the English language). Muslims don’t

have Blue Moons, since their months always begin with the first sighting of the crescent moon.

There are actually 2 astronomical definitions of what constitutes a “Blue Moon.” The older one is that it’s the third full moon in an “astronomical season”, which is just a regular calendar season. Since each season is about 91.25 days, there are usually just three full moons each season. Why it’s the third and not the fourth beats me. The other is that it’s the second full moon in a given month, which is now the common



definition, apparently the result of an error made by amateur astronomer Hugh Pruett in an article in *Sky and Telescope* in 1946. His miscalculation was later retracted by the editors, but the definition stuck. By that time the use of the term “Blue Moon” was already commonplace, as evidenced by the hugely popular Rogers and Hart song “Blue Moon”, written in 1934, although “blue” in the sense of the song was really more about sadness. The phrase “once in a blue moon” to mean something rare has a much older provenance.

One of the first books that fascinated me as a child was a tome published in 1946 called *A Book About a Thousand Things* by George Stimpson, a Washington DC journalist and member of the National Press Club. It was one of a series of books he wrote that can best be described as “scholarly trivia.” *A Book About a Thousand Things* gives paragraph-length answers to questions like “Why is the Black Sea called black?”, “What does ‘Hobson’s Choice’ mean?” and “Why do some shoes squeak?” This range information was utterly fascinating to me as a 9-year-old. On page 321 Stimpson considers the question “How did ‘once in a blue moon’ originate?” Here is his answer:

The origin of *once in a blue moon* is obscure. Originally it signified “never,” but now it is generally used in the sense of “seldom” or “very rarely.” Some authorities think they see a relation between the phrase and the moon under certain conditions. Dr. E. Cobham Brewer, for instance, who in his *Dictionary of Phrase and Fable* defined *once in a blue moon* as *very rarely indeed*, says: “On December 10, 1883, we had a blue moon. The winter was unusually mild.” In 1927, during a total eclipse of the sun, many observers at Belfast, Ireland, fancied that the moon took on a decidedly blue tinge. Moons of unusual colors, such as green and blue, have been seen after certain violent volcanic explosions and occasionally through smoke-laden fogs. Similar blue moons are caused by the refraction of moonlight through ice crystals high in the atmosphere, dust storms and cloud banks near the horizon at sunset. It was only natural that such phenomena, which occur seldom, should be popularly regarded as the source of *once in a blue moon* in the sense of *infrequently*. But inasmuch as the phrase originally meant *never* it is not probable that it was suggested by such lunar phenomena. As early as 1528, in the second part of Roy and Barlow’s *Rede Me and Be Not Wroth*, we find the idea of a blue moon regarded as absurd:

Yf they say the mone is blewe  
We must believe that it is true.  
Admyttinge their interpetacion.

The “they” in this quote refers to Catholic clergy, who are being facetiously attacked as liars by these newly-converted Protestant writers.

We astronomers hate full moons because of their sky-killing brightness, but they do provide elegant and frankly irresistible illumination for a romantic evening. Elyse and I spent Columbus Day weekend in 1992 in Yosemite Valley, staying at the famous Ahwahnee Lodge. A full moon graced my birthday on the 11<sup>th</sup>, and the weather was perfect. We strolled through the valley (my nominee for the most beautiful place on Earth) with the walls of El Capitan and Half Dome magically bathed in moonlight. It was an unforgettable experience.

WAA gets inquiries about the phenomenon of a Blue Moon almost every time it occurs, particularly in temperate seasons when people are more likely to go outside for a look. One journalist called me just before the July event to ask, “Where would I go to see it?” to which I had to respond, “Just go outside and look up.” Nevertheless, any event that allows us to talk about astronomy to the public is welcomed, and I provided some information about the lunar cycle, astronomers’ general distaste for full moons, and, since I had her ear, a jibe at light pollution.

There’s almost no point in observing or imaging the full moon because the overhead illumination by the sun prevents shadows from defining lunar features. You can, however, make a silk purse out of a sow’s ear, to use another common phrase of obscure genesis (no help from Stimpson on this one) by shooting the full moon through a hydrogen-alpha filter. This substantially enhances contrast. My photograph of was taken about 11:30 pm on July 31<sup>st</sup>, some 17 hours past full (notice the detail on the moon’s eastern limb, where the terminator is starting to be visible). I used my Stellarvue SVR-105 f/7 triplet refractor and a Canon T3i DSLR. A 1.25” Astromik hydrogen-alpha filter with 12nm bandpass was screwed into the camera adaptor. The camera was in monochrome mode since the color image would have been deep red. I didn’t use any tracking. The exposure was 1/60 sec at ISO 800. After focusing with 10x magnification on the live view image, I made a bunch of still frames using the camera’s continuous shooting mode. I used Registax to stack and align them, but I found that a single image worked just as well and that is what is presented here. I used a minimal amount of wavelet processing to enhance detail and boosted contrast a little in Photoshop. ■

## Solar Wind Creates—and Whips—a Magnetic Tail Around Earth

### Ethan Siegel

As Earth spins on its axis, our planet's interior spins as well. Deep inside our world, Earth's metal-rich core produces a magnetic field that spans the entire globe, with the magnetic poles offset only slightly from our rotational axis. If you fly up to great distances, well above Earth's surface, you'll find that this magnetic web, called the magnetosphere, is no longer spherical. It not only bends away from the direction of the sun at high altitudes, but it exhibits some very strange features, all thanks to the effects of our parent star.

The sun isn't just the primary source of light and heat for our world; it also emits an intense stream of charged particles, the solar wind, and has its own intense magnetic field that extends much farther into space than our own planet's does. The solar wind travels fast, making the 150 million km (93 million mile) journey to our world in around three days, and is greatly affected by Earth. Under normal circumstances, our world's magnetic field acts like a shield for these particles, bending them out of the way of our planet and protecting plant and animal life from this harmful radiation.

But for every action, there's an equal and opposite reaction: as our magnetosphere bends the solar wind's ions, these particles also distort our magnetosphere, creating a long magnetotail that not only flattens and narrows, but whips back-and-forth in the onrushing solar wind. The particles are so diffuse that collisions between them practically never occur, but the electromagnetic interactions create waves in Earth's mag-

netosphere, which grow in magnitude and then transfer energy to other particles. The charged particles travel within the magnetic field toward both poles, and when they hit the ionosphere region of Earth's upper atmosphere, they collide with ions of oxygen and nitrogen causing aurora. Missions such as the European Space Agency and NASA Cluster mission have just led to the first accurate model and understanding of equatorial magnetosonic waves, one such example of the interactions that cause Earth's magnetotail to whip around in the wind like so.

The shape of Earth's magnetic field not only affects aurorae, but can also impact satellite electronics. Understanding its shape and how the magnetosphere interacts with the solar wind can also lead to more accurate predictions of energetic electrons in near-Earth space that can disrupt our technological infrastructure. As our knowledge increases, we may someday be able to reach one of the holy grails of connecting heliophysics to Earth: forecasting and accurately predicting space weather and its effects. Thanks to the Cluster Inner Magnetosphere Campaign, Van Allen Probes, Mars Odyssey Thermal Emission Imaging System, Magnetospheric Multiscale, and Heliophysics System Observatory missions, we're closer to this than ever before.

*Kids can learn about how solar wind defines the edges of our solar system at NASA Space Place.*  
<http://spaceplace.nasa.gov/interstellar>

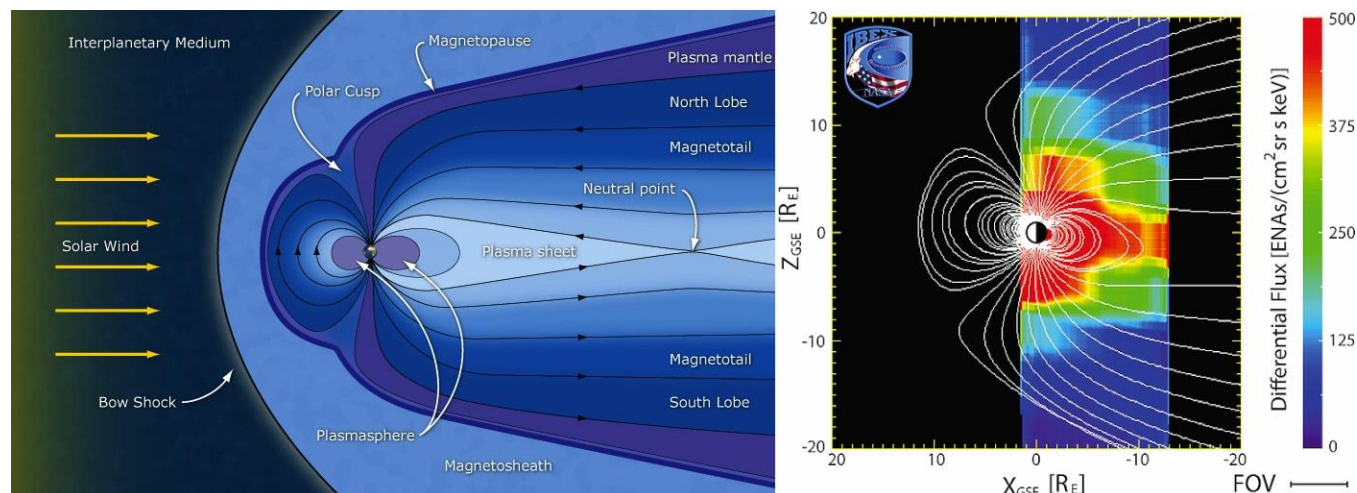


Image credit: ESA / C. T. Russell (L), of Earth's magnetic tail and its cause: the solar wind; Southwest Research Institute / IBEX Science Team (R), of the first image of the plasma sheet and plasmasphere created around Earth by the solar wind.