SkyWAAtch

The Newsletter of Westchester Amateur Astronomers

September 2024

NGC 1333 by Robin Stuart

The reflection nebula NGC 1333 is located in Perseus near the constellation's southern border. At magnitude 5.6, it ought to be easily visible, but the surface brightness is not that high and so it wasn't discovered until Eduard Schönfeld spotted it in 1855. It is an area of active star formation. Within it there are a large number of X-ray sources, Herbig-Haro objects, and brown dwarfs. Surrounding it are dark molecular clouds (catalogued as Barnard 1 and 2) and zones of star-forming gas and dust. The field of view is 1.94 x 1.2 degrees.

Robin made this image at his observatory in Eustis, Maine.

Our club meetings are held at the David Pecker Conference Room, Willcox Hall, Pace University, Pleasantville, NY, or on-line via Zoom (the link is on our web site, www.westchesterastronomers.org).

WAA September Meeting

Friday, September 13 at 7:30 pm

Live or on-line via Zoom

Members' Night

WAA members

A club tradition. WAA members will present short talks on a wide range of topics of interest to fellow members.

Members interested in presenting a talk should contact Pat Mahon, VP for Programs, via email at waa-programs@westchesterastronomers.org.

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

WAA Members: Contribute to the Newsletter!
Send articles, photos, or observations to waa-newsletter@westchesterastronomers.org

Editor: Larry Faltz
Almanac Editor: Bob Kelly
Editorial Consultant: Scott Levine
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Proofreader: Elyse Faltz

Also In This Issue

Westchester Amateur Astronomers

WAA October Meeting

Friday, October 18 at 7:30 pm

Live or on-line via Zoom

Monster Black Holes at the Edge of the Universe

Zoltan Haiman, PhD
Department of Astronomy, Columbia University

Starway to Heaven

Ward Pound Ridge Reservation, Cross River, NY

Saturday, September 7, 7:15 p.m.
Saturday, September 28, 6:45 p.m.
Weather permitting. Use your judgment, check the phone 1-877-456-5778 if you're not sure.

New Members

Jodi Bernhard	New York
Peter Castleton & Melinda Battle	Pound Ridge
Andrew Dorfman	Chappaqua
Michael Giustiniani	Brooklyn
Sabina Kaplan	Larchmont
Roger Quinland	North Salem
Lawrence Scheer	Larchmont
Shirley Williams	Yonkers

Renewing Members

Salman Abbasi	Yonkers
Paul Andrews	Patterson
Leandro Bento	Mohegan Lake
Sameer Desawale	Briarcliff Manor
Michael DiLorenzo	Yonkers
Laura Doty	Ossining
Ireneo Fante	Brookfield
Mitchell and Mary-Ann Feller	Cortlandt Manor
Brian and Min Yoo Folk	South Salem
Manish Jadhav	Ossining
Elizabeth Kinetz	Bedford Hills
Anthony Monaco	Bronx
Christopher Plourde	New Rochelle
Steven Reed	New York
Sunny Turner	Katonah

ALMANAC For September 2024

Bob Kelly, WAA VP of Field Events


Bob Kelly


New

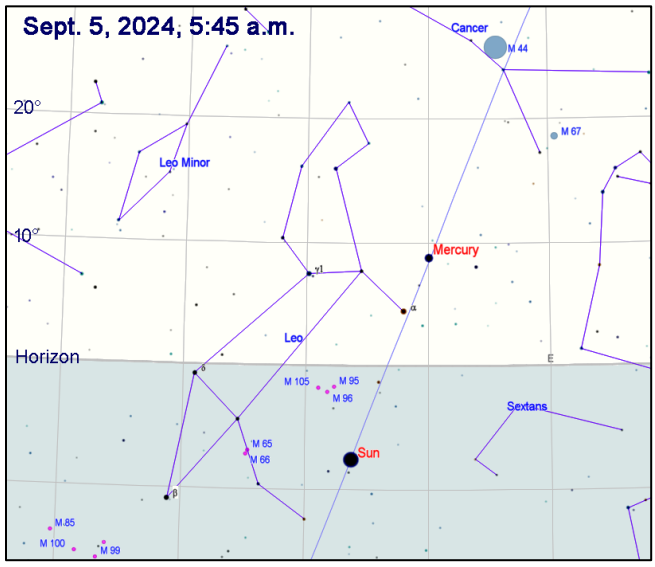

1Q


Full


3Q

The Morning Show

For us folks in the northern hemisphere, Mercury puts on a much better show in this month's morning sky than it did last month in the evening sky. Mercury maxes out its elongation from the Sun on the 5th, shimmering at magnitude -0.3. It rises just after the start of morning twilight, the earliest for this apparition. As Mercury drops out of the morning sky, it brightens through magnitude -1. More of Mercury is illuminated, but it looks smaller as it heads toward superior conjunction with the Sun on the 30th. Mercury is tight with Regulus on the 9th.



Jupiter, Saturn and Mars are already well up in the sky after midnight, making the morning sky the place to see the most planets.

Spill-over into the Evening Sky

But, wait, there's bright planets seeping into the evening sky!

Jupiter rises by 11 p.m. by mid-month, and Mars finally rises before midnight at the end of September.

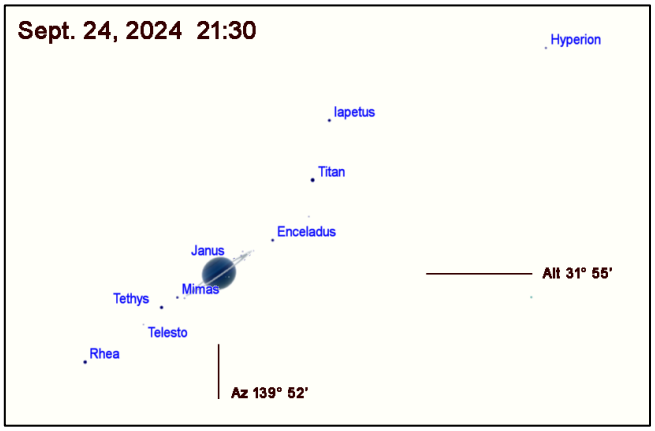
Venus spends another whole month setting before the end of astronomical twilight. It's going to be a while until Venus gets well up in the sky. It's interesting that October's *Sky & Telescope* still laments how low in the sky are combinations of Venus and other objects. Once you spot Venus, you'll find it in the evening sky through early 2025.

The 3-day-old Moon lines up to the right of Venus on the 5th. Even 30 minutes after Sunset, they are only five degrees above the horizon.

Ring, Rings

Saturn pulls an all-nighter as it reaches opposition with the Earth on the 8th. We're closest to Saturn for the year this month. The rings are almost edge-on, opening up a bit to a tilt of 4 degrees toward us. Saturn's peak brightness is only magnitude +0.6. It's surprising how much the rings, when opened wider toward us, contribute to Saturn's overall brightness.

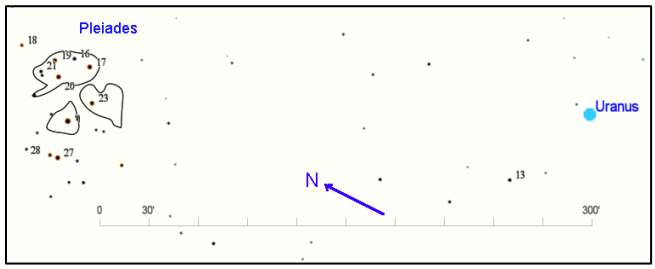
Saturn is well placed in the sky once we get a few hours out from sunset, so it's a great time to get a telescope centered on it. Crank up the power to see what subtle details the planet, rings and moons have to offer. This is a good time to get an app or check a computer program that shows Saturn's rings and the location of its moons. Two-toned Iapetus is near Titan on the 24th, more easily visible as its brighter side turns toward us.



Smaller Fry

Starting about September 21, Mars will be the closest planet to Earth for two months. It still won't be very large in our telescopes, but with a diameter of 7 arcseconds, some details on the reddish planet might be visible with high powers in good seeing. For comparison, Jupiter is 40 arcseconds wide, Saturn is 19.

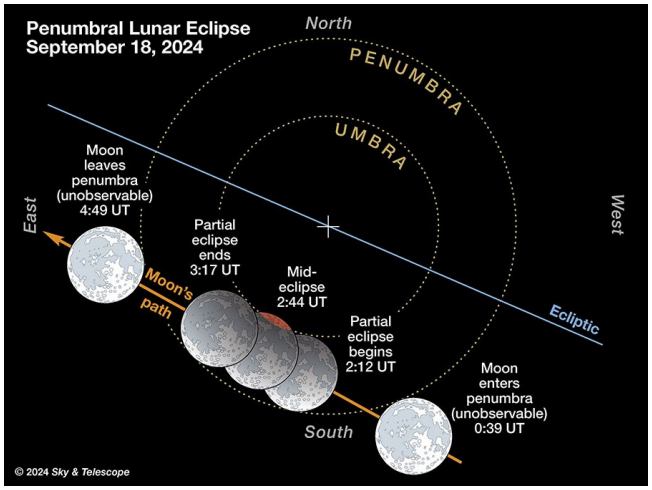
Neptune also comes to opposition this month in Pisces, closest on the 20th. It'll max out at magnitude +7.8 and 2.3 arcseconds diameter.



Uranus hangs out about five degrees to the right (west) of the Pleiades, rising ahead of Jupiter and the winter constellations after 9:30 p.m. Its blue hue and reduced twinkling relative to the stars may give it away in binoculars. We'll need a telescope to resolve its tiny 3.7 arcsecond wide disc.

Just a Touch of a Lunar Eclipse

On Tuesday night, September 17th, the Moon barely brushes the edge of the umbra, the darkest part of the Earth's shadow, for 65 minutes. Maximum eclipse is at 10:44 p.m. EDT (02:44 UT on the 18th). The colors of the edge of the umbra and the lighter penumbra should be wonderful to see. The September full moon is the second closest to Earth for 2024, easily meeting the broad criteria as a "supermoon." Perigee occurs 11 hours after the peak of the eclipse.



During the eclipse, Saturn is off the right of the Moon, and Neptune is to the left, not as far off, but it may be hard to pick out due to the glare, even from a partially eclipsed Moon.

Comets

If you have a clear eastern horizon (Long Island Sound would be good), you may have the opportunity to see Comet C/2023 A3 Tsuchinshan-ATLAS as it peeks above the eastern horizon in late September. It's only five degrees above the horizon 45 minutes before sunrise. Binoculars will help in the glare and the haze, despite the predicted peak at magnitude +0.5. Check an online source such as aerith.net or theskylive.com for updates. Reports in late July noted the comet was not brightening as rapidly as predicted, but those fears may have been premature. The thin Moon is to the upper left on the 29th and 30th. Get the Moon in the binoculars and then see if you have any chance to catch what is being called the "Comet of the Year." The best view is expected in the evening sky in mid-October, although the comet will start fading during that time.

Equinox

What we in the northern hemisphere call the autumnal equinox happens on the 22nd at 8:44 a.m. The 22nd is not the day of equal sunlight and darkness. That's because almanacs count the first tip of the Sun over the horizon as "sunrise" and the last peek of sunlight as "sunset". According to timeanddate.com, that happens in our neck of the woods on the 25th, when the Sun rises and sets at 6:46 (a.m. and p.m.).

More Moon

International Observe the Moon Night is Saturday the 14th. The Moon will be three-quarters lit by the Sun that night, so use a neutral density or variable polarizing filter to reduce the glare a bit. Reflect on how blinding the Moon would appear if it's albedo was more than the actual estimate of 11 percent. Luna rises at 5:30, reachs a peak altitude of only 26 degrees above the horizon at 10:15 p.m. p.m. and sets at 3:08 a.m. NASA's official web site, with maps and images, is at https://is.gd/obsmoon24. The interactive Daily Moon Guide is at https://is.gd/nasamoon.

Space Station Sightings

The International Space Station is visible in morning skies through the 8th and evening skies from the 9th through the end of the month. Tiangong is in the morning skies through the 11th, then the evening from the 17th through the end of the month. ■

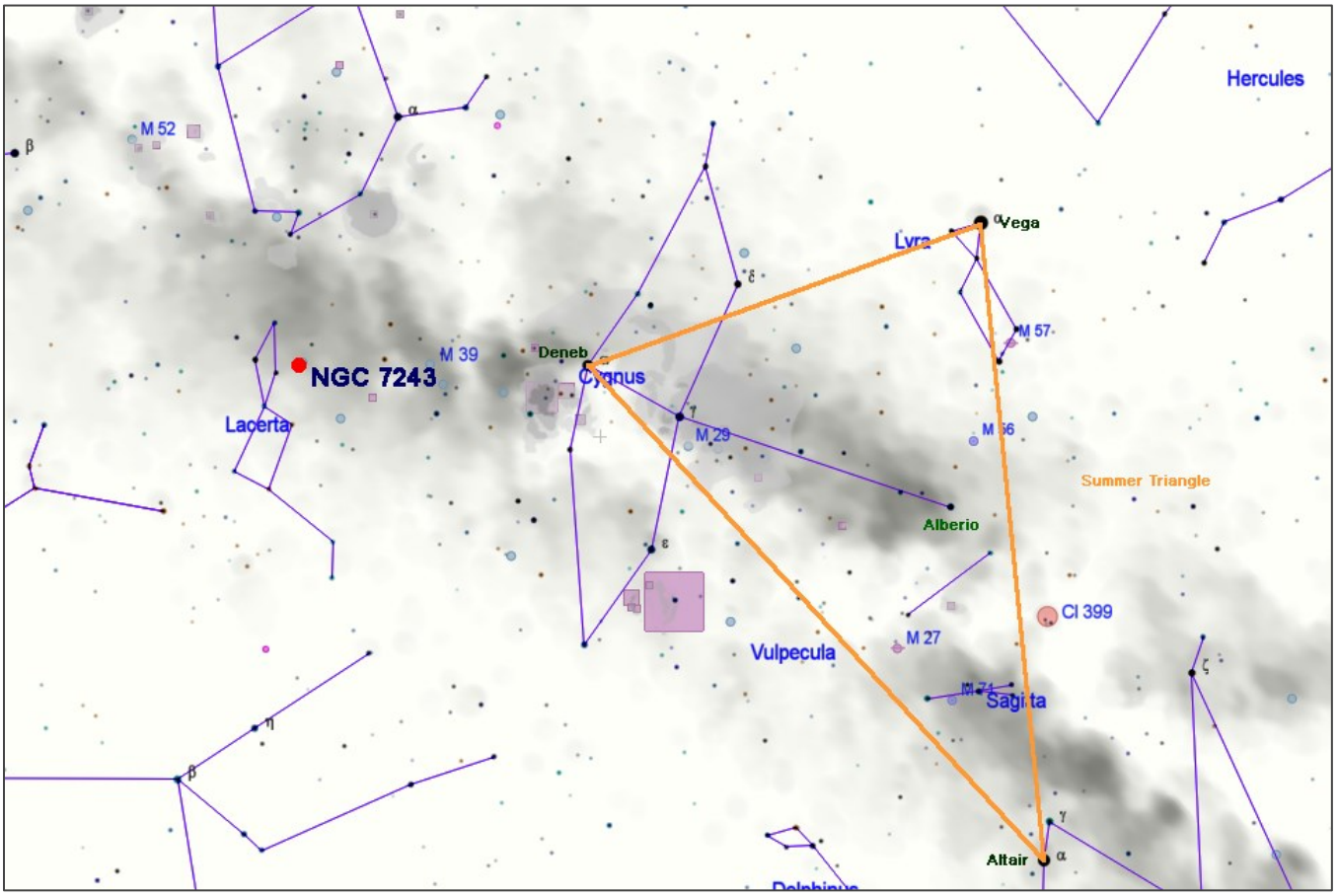
Deep Sky Object of the Month: NGC 7243

NGC 7243	
Constellation	Lacerta
Object type	Open Cluster
Right Ascension J2000	22h 15m 08.6s
Declination J2000	+ 49° 53’ 51”
Magnitude	6.4
Size	21 arcminutes
Distance	2800 light years
Other designation	Caldwell 16 Herschel VIII 75
Discovery	William Herschel September 26, 1788

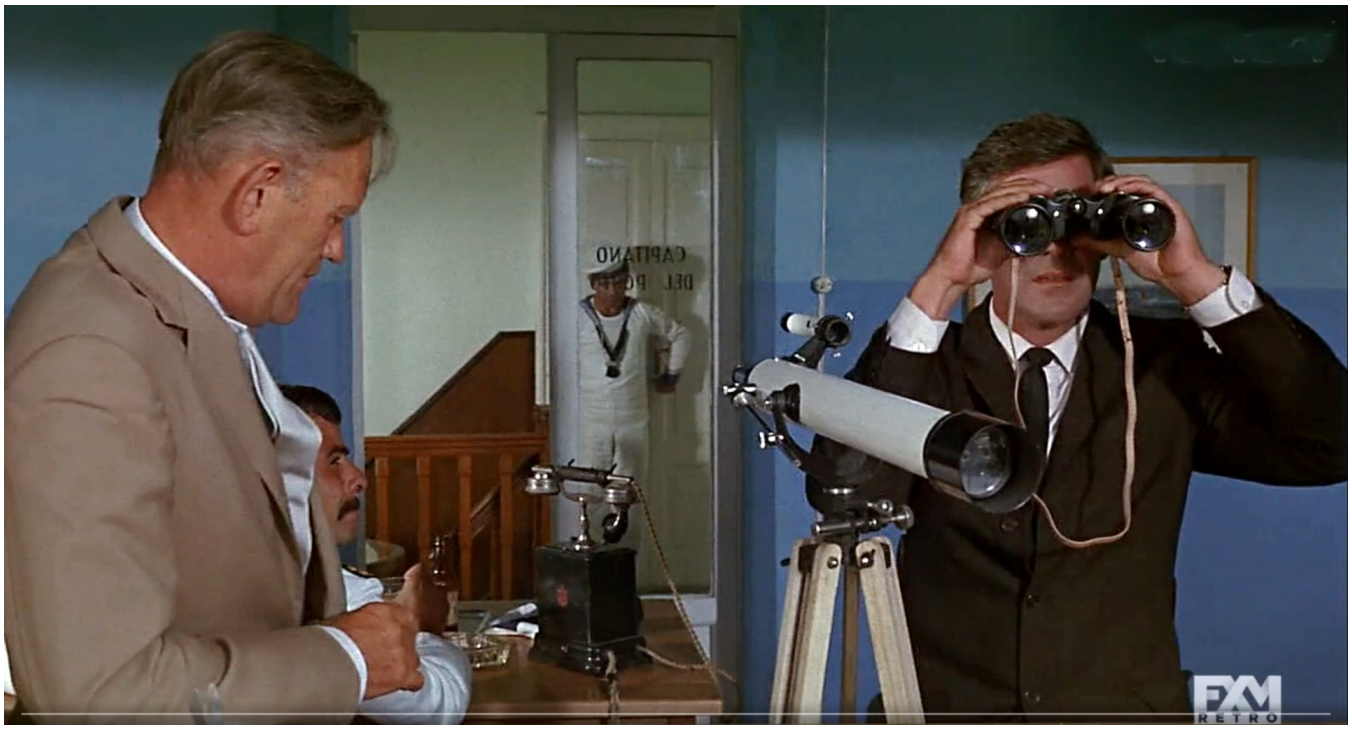
There are only two small-telescope objects in the tiny and obscure constellation Lacerta (the other is NGC 7209). NGC 7243 may be hard to pick out among the stars of the Milky Way. A paper presented in 1999 suggested that this object is not a distinct cluster but just a group of unconnected bright stars. But in a small scope it looks like a typical open cluster.

Visibility for NGC 7243			
2200 EDT	9/1/24	9/15/24	9/30/24
Altitude	63° 42’	72° 20’	79° 52’
Azimuth	56° 17’	52° 47’	27° 41’

Braun, WG, et. al. https://ui.adsabs.harvard.edu/abs/1999AGM....15..P60B/abstract



Another Movie Telescope: Modesty Blaise



We see a small reflector in a scene from the 1966 spy-fi comedy *Modesty Blaise*, loosely based on the comic strip of the same name. The telescope serves as an umbrella stand for part of the scene, but the umbrella disappears between shots, a continuity gaffe in this ultra-campy product of the Bond era. The film stars Monica Vitti, Terence Stamp, Dirk Bogarde and Harry Andrews. It was nominated for a Palme d'Or at Cannes, but frankly its often silly 1960s pop-art sensibility makes it hard to watch these days.

Observing Report — Steve Bellavia

My friend Tom Ludlum (a former Brookhaven National Lab co-worker, though he was Director of Physics so perhaps "co-worker" is not correct) and I did some observing on August 13th from the deck near the top of his house, which is close to the east end of Long Island.

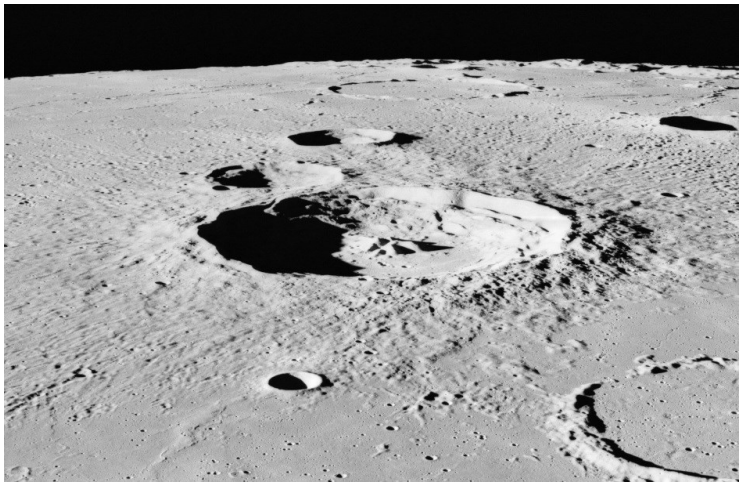
He was curious about the performance of my new (post-NEAF purchase) Explore Scientific First Light 152-mm Maksutov-Cassegrain. He is really into double stars and wanted more aperture and focal length than his 102-mm refractor oprovides. So I brought the telescope over and we observed with various eyepieces/magnifications, ranging from my super-wide William Optics 40-mm, 72-degree AFOV (60X) all the way down/up to an Orion 12.5-mm, 55 degree AFOV (192X). Here's what we looked at:

Deep Sky Objects:

- M13, globular cluster in Hercules
- M57, Ring Nebula in Lyra (with and without a Televue Bandmate OIII filter)
- M27, Dumbbell nebula in Vulpecula (with and without a Televue Bandmate OIII filter)
- NGC 6826, blinking planetary nebula in Cygnus, (with and without a Televue Bandmate OIII filter)
- M29, open cluster in Cygnus
- NGC 457, open cluster in Cassiopeia

Double stars:

- Albireo
- Gamma Delphinus
- Kuma (Nu Draconis)
- Rasalgethi (It appeared orange-and-blue, kind of like Albireo). The separation was only 4.6 arcseconds. It was easily split with several eyepieces, but we liked the view with the 12.5-mm Orion the best.



Bullialdus from Apollo 16, looking south

And we finished up with the Moon, which was just mind-blowing. Crater Bullialdus was near the terminator and I could easily see the shadow of the central peak.

I was very impressed with how smooth and nice-sounding his iOptron ZEQ25 mount was especially, considering that the scope is fairly heavy. We needed the extension bar for the 11-lb counterweight.

It was a great night, with comfortable temperatures, and no insects or dew.

The Editor encourages WAA members to write brief observation reports. Even if you just dragged your scope out for a short time, tell us what you looked at, what equipment you used and what you thought about the objects. In case you doubt your writing skills, we'll edit it for readability.

Seeing the Surface of Uranus (Pre-Voyager) Larry Faltz

A familiar view: Uranus from Voyager 2, January 17, 1986

I sometimes think that the optical telescope, used with an objective lens and an eyepiece, only generated two "paradigm shifts" of the kind proposed by Thomas Kuhn in *The Structure of Scientific Revolutions*: Galileo's initial observations in 1609 and 1610, which completely transformed the cosmos, and William Herschel's discovery of Uranus in 1781, which truly freed the solar system from its Aristotelian/Ptolemean limits. All the other contributions by visual observers, the vast amount of position measurements, magnitude observations and nebula descriptions, added vital data and advanced the science of astronomy but didn't cause a revolution in the foundational conception of the universe or our place in it. The next paradigm shifts were the offspring of spectroscopy.

Uranus had been seen and charted as a star by astronomers before Herschelbut they didn't see it move and thought it was a star. Herschel's observations were made with a superior telescope of the time, a 6.2-inch f/13 speculum metal reflector that he made in the basement of his home in Bath, England. Herschel had a musician's capacity for detail, concentration and perseverance and a Galilean capacity for objectivity (but he was a much less irascible fellow). In 1781, having abandoned his musical career, Herschel was compulsively charting stars for evidence of parallax, a property suspected by astronomers but not demonstrated until 1832 by Bessel. In his report to the Royal Society, Herschel wrote,[1]

> On Tuesday the 13th of March, between ten and eleven in the evening, while I was examining the small stars in the neighbourhood of H Geminorum [1 Gem in Flamsteed's catalog, HD 41116, SAO 77915], I perceived one that appeared visibly larger than the rest: being struck with its uncommon magnitude, I compared it to H Geminorum and the small star in the quartile between Auriga and Gemini, and finding it so much larger than either of them, suspected it to be a comet.

Herschel found the object at 227X, and observed it at even higher powers, 460X and 932X. He noted that the diameters of the "fixed stars" were not enlarged at the higher magnifications, but the object "appeared hazy and ill-defined at these great powers," so it was natural to think it was a comet. Why would anyone think that there were planets in the solar system other than the six then known?

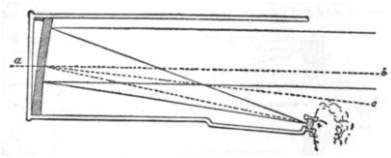
Herschel observed the "comet" for the next month, carefully recording its position and even measuring its diameter with a micrometer. At one point he thought it had gotten larger, "from which we may conclude that the Comet approaches us." On April 6, 1781, he saw that it "appeared perfectly sharp upon the edges" and lacked a tail. He measured its transverse velocity as "2¼ seconds per hour."

After providing details of his observational and measurement methods (including diagrams of his micrometer) Herschel concluded by reporting that he was "happy to surrender [the Comet] to the care of the Astronomer Royal [Neville Maskelyne, with whom he had corresponded] and others, as soon as I found they had begun their observations upon it." At no time in this paper does Herschel comment on its distinctive color, nor did he claim to see any details.

Herschel's discovery paper was read to the Royal Society on April 26, 1781. By that time, he had received a letter from Maskelyne, who wrote "I don't know what to call it. It is as likely to be a regular planet moving in an orbit nearly circular to the sun as a Comet moving in a very eccentric ellipsis." The orbit is only a little elliptical (eccentricity 0.0469), as found independently by the Swedish astronomer Anders Johan Lexell and German astronomer Johann Elert

Bode. It became clear that the object was a planet and not a comet. Herschel named the object *Georgium Sidus*, the Georgian Star, after King George III, who later gave Herschel a generous stipend that permitted him to build larger telescopes. Undoubtedly it cheered King Goerge a little in exchange for losing the American Revolution.

Herschel improved image brightness in his bigger telescopes by moving to a "front-view" system, eliminating the diagonal. Like the mirror, it was made of speculum metal, which only has 66% reflectivity. He placed the eyepiece in the reflected light cone at the front edge of the tube, the mirror slightly tilted to achieve proper alignment. This is now known as a Herschelian telescope. Ideally, the mirror on an off axis instrument like this should have a slightly asymmetric figure.



Herschelian "front view" telescope

Ever careful to point out the advantages and disadvantages of his inventions, Herschel noted that heat rising from the observer's head could affect seeing!

Herschel measured the diameter of *Georgium Sidus* between October 1781 and November 1782, using a system that compared it to paper discs of defined size. He came up with values between 3.51 and 5.11 arcseconds.[2] During this interval, Uranus' actual diameter was 3.8-3.9 arcseconds. In addition, Herschel calculated that the planet's diameter was 4.454 times that of the Earth. The actual ratio is 3.981. Not bad, all things considered.

On October 22, 1781, Herschel reported that

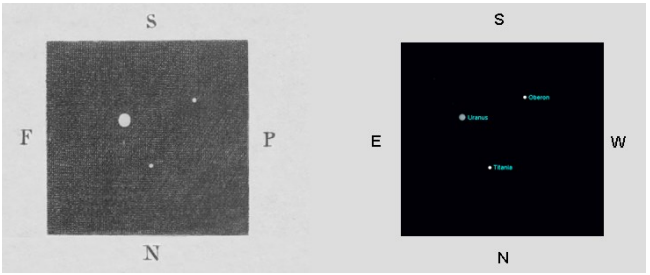
> the *Georgium Sidus* was perfectly defined with a power of 227; had a fine, bright steady light; of the colour of Jupiter, or approaching to the light of the Moon.

He made a dozen observations over the next year. On October 2, 1782, he wrote

> When I first saw the Sidus and luminous circle [the colored disc he used to estimate diameter] together, I was struck with the different colours of their lights; which brough to my recollection γ Andemedae, ε Bootis, α Herculis, β Cygni, and other coloured stars. The Planet unexpectedly appeared blueish (*sic*).

This was the first time Uranus' color made an impression on Herschel.

Observations from January 11 to February 11, 1787 resulted in the discovery[3] of two satellites. Herschel reported that on the evening of February 6-7 "I began to purse [a] satellite…about six o'clock in the evening, and kept it in view till three in the morning on Feb. the 8th; at which time, on account of the situation of my house, which intercepts a view of part of the ecliptic, I was obliged to give over the chase." That's a problem frequently encountered by many of us backyard astronomers today! How often do we secretly wish we could cut down a neighbor's tree?



(L) Herschel's drawing of Uranus and its two brightest satellites as seen on February 11, 1787 at 2 a.m. from reference 3. P is "preceding" and F "following" (recall there was no RA drive, so the objects drifted across the eyepiece from east to west). (R) Cartes du Ciel plot of Uranus and its two brightest moons as seen on that date and time in Bath, UK. (LF)

Ever the cautious observer, Herschel wrote

> I have not seen [the satellites] long enough to assign their periodical times with great accuracy; but suppose that the first performs a synodical revolution in about eight days and three-quarters, and the second in nearly thirteen days and a half.

The modern values are 8.7062 and 13.464 days.[4] His accuracy is a testament to Herschel's equipment, patience and exactitude. He also noted that they make a "considerable angle" with the ecliptic, which we now know is due to the radical tilt of Uranus' axis. But he was not yet prepared to make measurements of the exact angle until he refined his micrometers. "I have, nevertheless, several resources in view, and do not despair of succeeding pretty well in the end."

In a 1788 paper[5] he reported Uranus' diameter as 3.90554 arcseconds on October 25, 1787, which seems excessively optimistic in terms of significant digits but close to the actual value nevertheless. Herschel also calculated the density of Uranus, coming up with a ratio to that of Earth of "0.220401 to 1."

The Earth's density is 5.514 gm cc^{-1}, so that would put Uranus at 1.215 gm cc^{-1}. It's actual density is 1.271 gm cc^{-1}. It's a remarkably accurate result, especially considering Cavendish didn't do his famous gravity experiment until 1798 (see "Weighing the Earth" in the December 2018 SkyWAAtch).

Making further observations over the next decade that he summarized in a paper read to the Royal Society in December 1797 and published in 1798,[6] Herschel claimed to have discovered four more moons. He also described the planet as being slightly flattened at the poles, and he made many more micrometer measurements of the planet's disc. On several occasions he thought he saw a ring around the planet. In his quest for more detail, he observed at insanely high powers, sometimes 2400X, with his 6.2-inch "7-foot" telescope, an absurd magnification that even the best modern instruments of that aperture could not tolerate. One of his papers even mentions trying to observe at 7200X! Nevertheless, he was a careful and objective observer, grabbing the most useful information at powers of 200-300X. He ultimately concluded that Uranus "has no ring in the least resembling that, or rather those, of Saturn." [Uranus' thin rings were discovered in 1977].

In 1815, the now 77 year old astronomer published all of his notes from 154 observing sessions between January 11, 1787 and May 12, 1809.[7] Although most of his data refers to respectively the "first" and "second" satellites (Titania and Oberon,) Herschel continued to present observations of what he claimed were additional satellites.

Herschel's son John observed Uranus between 1828 and 1832 using his father's "20-foot" telescope at Slough.[8] The planet was in a southern declination and observations were difficult. He noted that the satellites "have never been observed, or even seen (so far as the author is aware) except in the telescope with which they were originally discovered." John Herschel refined the periods of the two satellites to 8.705 and 13.463 days, essentially the modern values. Writing of himself in the third person, he concluded that "of other satellites than these two he has no evidence; but if any exist, he hopes to procure a sight of them. Neither has he ever seen any appearance about the planet which gives ground for the least suspicion of a ring."

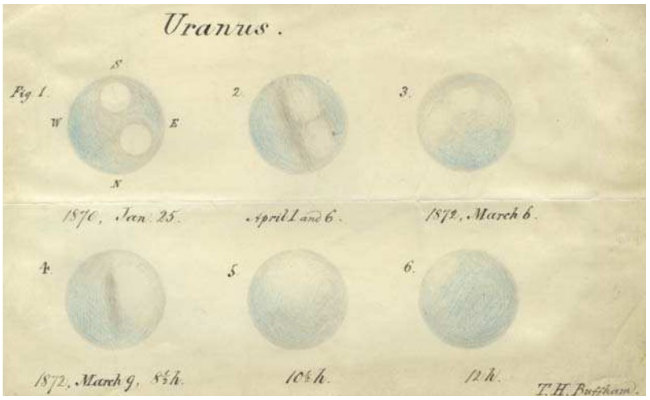
Neither William nor John Herschel claimed to see any detail on the face of the planet. The first report of surface markings in the published literature was apparently made by Thomas Hughes Buffham using a modest 9-inch glass-mirrored With-Browning reflector (f/8.5) on an alt-azimuth mount. Buffham reported,[9]

> 1870, Jan. 25, at 11^h to 12^h, in clear and tolerably steady air. —Power 132 showed that the disk was not uniform. With powers 212 and 320 two round bright spots were perceived, not quite crossing the centre, but a little nearer the eastern side of the planet, the position-angle of a line passing through their centres being about 20° and 200°. Ellipticity of Uranus seemed obvious, the major axis lying parallel to the line of the spots.

Buffham made additional observations and with them calculated "merest approximations" of a rotation rate of 12 hours and an orbital inclination of 80°.

Buffham submitted drawings to the Royal Astronomical Society. They are not included in his paper, which has a note "These were exhibited at the Meeting." Doing a little sleuthing, I found a 2017 article in the *Journal of the British Astronomical Association* by Kevin Bailey. Although the beginning of the article is open access,[10] the full article and images are restricted to members of the British Astronomical Association. I was sufficiently curious, and enough of an Anglophile, to fork over £32 to become a BAA member for a year. The BAA has several sections (I joined the Historical section), hosts in-person and on-line meetings, publishes an excellent quarterly journal and sponsors a variety of other activities.

Here are Buffham's drawings, a screenshot from Bailey's very informative article.



Buffham's interest in astronomy waned, and he became an expert in British marine algae, eventually

being recognized by the Linnean Society and having two algal species named after him. His large specimen collection resides in the Natural History Museum in London.

In his paper, Buffham refers to

> Mr. Lassell's observation of 1862, Jan. 29, where he says, "I received an impression, which I am unable to render certain, of an equatorial dark belt, and of an ellipticity of form."

William Lassell published this observation in 1867.[11] Lassell was a wealthy amateur astronomer (like Hevelius, his fortune came from beer). With his homemade 24-inch diameter equatorially mounted speculum-metal reflector, just 17 days after Galle found Neptune in 1846 Lassell discovered Triton, its largest satellite. In 1851, he confirmed two new moons of Uranus, Ariel and Umbriel. Lassell built a 48-inch equatorial reflector (also with a speculum-metal mirror), which he installed in Malta. Its history is described in "On the Fate of Telescopes" in the January 2021 SkyWAAtch.

Giovanni Schiaparelli, famous for the Martian *canali*, observed markings on Uranus in 1883. He wrote:

> During the previous series of observations and especially when the air was calmer, I was able to see that Uranus also has spots and varieties of colors on its surface: Mr Fornioni also found the same thing on the evening of May 21st. Nonetheless, after spending many hours in useless attempts to draw the rotation of the planet, I had to convince myself that this is not something to do with an 8-inch lens, even if this is a Merz masterpiece. But I believe that it will not be impossible to achieve this goal by applying the power of large modern telescopes to Uranus, when good definition is not lacking.[12]

The Henry brothers, Paul and Prosper, were pioneering astrophotographers who were instigators of the ill-fated Cartes du Ciel photographic atlas. They also captured, but did not see, the Horsehead Nebula a year before it was found by Williamina Fleming (see the April 2023 SkyWAAtch). Making visual observations in 1884, they found bands on Uranus' surface.[13] The bands were grey, with a brighter zone between them along what they presumed was the planet's equator. The poles were darker. Although the article does not state the aperture of their telescope, it was probably the 38-cm (15-inch) Arago refractor which is still in the East Tower of the Paris Observatory.

In 1893, the Princeton astronomer C.A. Young, known more for his solar work, saw "faint belts" like those on Jupiter and Saturn, using the 23-inch refractor at Halstead Observatory. He noted they were "very vague and in a far from satisfactory manner." In 1899, Serbian astronomer Leo Brenner (born Spiridion Gopčević), observing with a 7-inch f/15 refractor, drew atmospheric features and calculated a rotation rate of 8 hours 27 minutes.

Reports of bands on the surface continued to appear occasionally in the literature. For example, one Arthur Henderson claimed to see them with a 10½ reflector.[14] But the controversial Thomas Jefferson Jackson See, observing with the 26-inch Clark refractor in Washington in 1900 and 1901, failed to see anything on the surface in spite of several nights of extraordinary seeing (one of his notes reads "Disk as sharp as if it were an engraving.")[15]

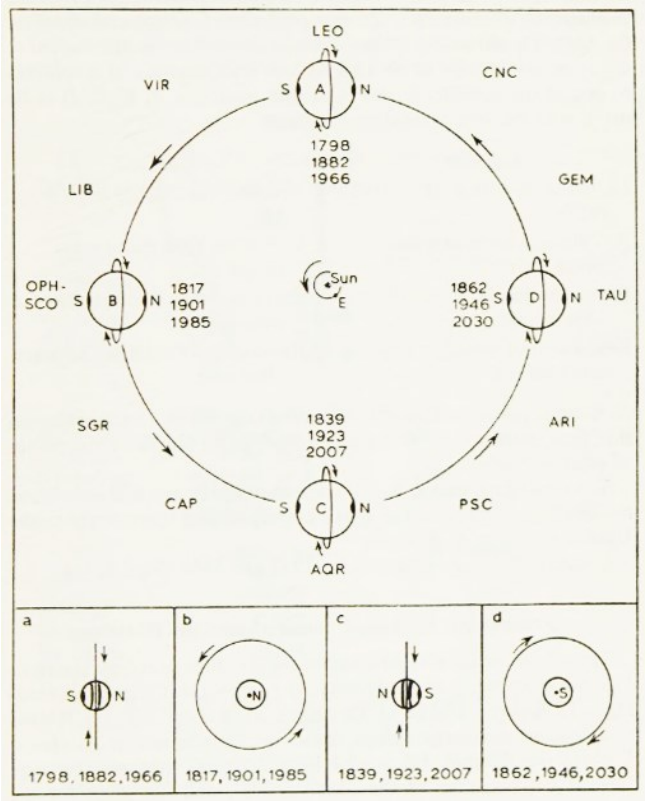
In 1915, physician, amateur astronomer and future RAS president William Herbert Steavenson, then just 21, published a drawing of Uranus made with a 10-inch Cooke refractor. He saw darker bands above and below the equator.[16]

It had been a mystery why the plane of the satellites' rotation was at nearly a right angle to the ecliptic. Astronomers assumed that Uranus, like Jupiter and Saturn, rotated rapidly on its axis with the same orientation as the other planets, in which case it might be flattened at the poles. Herschel spent a good deal of his observing time trying to measure its oblateness. His initial measurements seemed to suggest a 10% flattening, but continued observation by him and later astronomers gave smaller but still inconsistent measurements.

Herschel saw the southern side of Uranus at an oblique angle when he discovered it in 1781; by 1798 it had reached equinox and the equator was projected towards the Sun, at which point the oblateness would have been maximal. With what we now know is only a 2.2% flattening, it's no wonder consistent measurements couldn't be obtained.

In 1829, in his great tome *Traité de mécanique celeste*, Pierre-Simon Laplace wrote,

> If the various satellites of a planet move in a plane greatly inclined to that of its orbit, it can be inferred that they are kept in that plane by the action of the planet's equator, and that therefore the planet rotates around an axis nearly perpendicular to the plane of the orbits of its satellites. It may therefore be affirmed that the planet Uranus, all of whose satellites move in a single plane almost perpendicular to the ecliptic, itself turns on an axis very little inclined to the ecliptic.



Uranus' orbital orientation, from Alexander's *The Planet Uranus.* The lower panel shows the appearance from Earth, with the satellites' plane and direction of rotation indicated.

Uranus peculiar inclination is listed as either 82.23° or 97.77°, depending on whether it is being compared to the "invariable plane of the solar system" (in which case it is rotating in a retrograde fashion) or using the right-hand rule (thumb in direction of orbit, fingers along the rotation of the planet. One orbit takes 84 years. Each pole is in darkness for half an orbit.

Through most of the twentieth century, little attention was paid to visual observation of Uranus. In 1938, Mt. Wilson Observatory astronomer Theodore Dunham, Jr, wrote "The surface of Uranus shows very little. Its color is definitely greenish (owing to absorption of red light by methane in the atmosphere) and some observers have detected faint bands."[17] A few, like Walter Haas, Steven James O'Meara and astronomers at Pic Du Midi saw white spots like those drawn by Buffham. In 1984 O'Meara derived a rotation rate of 16.31 hours from cloud observations using Harvard's 9.2" refractor.

Summarizing the status of Uranus observations in his 1963 book *Watchers of the Skies*, Willy Ley wrote

> One unsolved problem, in addition to that of the nature of the white areas is that Uranus as a whole seems brighter at some times than at others. Some difference in brightness is to be expected depending on whether we happen to have an equatorial or a polar view, since the cross section of the planet during a polar view is obviously somewhat larger. But even if this factor is taken into account, plus the relative distances between the earth and Uranus at the moment, there still are variations in brightness. They might be due to activities in the atmosphere of the planet, but we probably will have to wait for a view of Uranus from a space station or from a lunar observatory before more can be said.

The balloon-borne Stratoscope II was an unusual 36-inch Gregorian telescope that imaged at f/100 from a height of 80,000 feet. The project ran from 1963 to 1971 and was managed for NASA by Nancy Grace Roman. It made images of Uranus on photographic film in 1970. No surface details were seen. The planet's diameter, density, and oblateness were measured, and the depth of its hydrogen atmosphere was estimated to be 100-km.[18]

Voyager 2 made its closest approach to Uranus on January 24, 1986. Although the most iconic image showed no surface detail (see page 8), when imaged through filters circumferential bands and a few cloud features were revealed.

In 1986, the largest telescope on Earth was the 6-meter BTA telescope in Russia, an instrument that never provided adequate images. The 200-inch (5 meter) Hale Telescope at Mount Palomar had better resolution, but I could not find any images of Uranus from that instrument. Without CCDs and "lucky imaging," subtle details on a faint object like Uranus would be impossible to capture. With the implementation of 8- and 10-meter class telescopes and the Hubble Space Telescope in the 1990s, there were new opportunities to visualize Uranus, which we'll cover in next month's issue of SkyWAAtch. ■

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[3] Herschel, W., An Account of the Discovery of Two Satellites Revolving Round the Georgian Planet. By William Herschel, LLD. F. R. S., *Philosophical Transactions of the Royal Society of London*, 77: 125-129 (1787) https://www.jstor.org/stable/106717

[4] The moons were not named until 1852, when William Lassell, who definitively found two more, asked Herschel's son John, a famous astronomer and scientist in his own right, to name them (although Lassell may have suggested the names). Herschel, at that time president of the Royal Astronomical Society, chose fairy characters from Shakespeare's *A Midsummer Night's Dream* and *The Tempest* and Alexander Pope's *The Rape of the Lock*.

[5] Herschel, W. On the Georgian Planet and Its Satellites. *Philosophical Transactions of the Royal Society of London*, 78: 364-378 (1788) https://www.jstor.org/stable/106665

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[10] Bailey, K., Thomas Hughes Buffham—Uranus Pioneer, *Journal of the British Astronomical Association* 127: 207-208 (2017) https://britastro.org/journal_contents_ite/thomas-hughes-buffham-uranus-pioneer (membership in BAA required for full article)

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[12] Schiaparello, G., Urano, *Astronomische Nachrichten* 106: 81-86 (1883). https://articles.adsabs.harvard.edu/pdf/1883AN....106...81S

[13] Henry, Paul, Henry, Prosper, Mémoires et observations. Observations faites à l'observatoire de Paris, *Bulletin Astronomique*, Serie I, 1:238-238 (1884) https://articles.adsabs.harvard.edu/pdf/1884BuAsI...1..238H

[14] Henderson, A, The Planet Uranus, *Journal of the British Astronomical Association*, 7: 57-58 (1896) https://articles.adsabs.harvard.edu/pdf/1896JBAA....7...57H

[15] See, TJJ, Micrometrical Measures of the Diameter of Uranus, *Astronomische Nachrichten*, 157: 389-404, https://articles.adsabs.harvard.edu/pdf/1902AN....157..399S

[16] The drawing is published in A.F. O'D. Alexander, *The Planet Uranus*, London: Faber and Faber, 1965. https://archive.org/details/planeturanus0000afod/page/n7/mode/2up

[17] Dunham, T, Knowledge of the Planets in 1938, *Publications of the Astronomical Society of the Pacific*, 51:253-273. https://articles.adsabs.harvard.edu/pdf/1939PASP...51..253D

[18] Danielson, RE, et. al., High Resolution Images of Uranus Obtained by Statoscope II, *Astrophysical Journal* 178:887-900 (1972) https://articles.adsabs.harvard.edu/pdf/1972ApJ...178..887D

There's nothing like reading the original literature to see how discoveries were made and documented. Papers written before the First World War are often intimate in the sense that they reflect the astronomer's personality. In those days, astronomers sat up all night looking through their telescopes. One can easily perceive in Herschel's papers his incredible patience and almost maniacal attention to detail. We are fortunate that so much of the astronomy literature, dating back over 240 years, is available on the NASA/ADS site and other online libraries, and most of it is open access. (LF)

August 10th Star Party

By sunset we had ten scopes at the August 10th star party at Ward Pound Ridge Reservation. The Perseids were scheduled to peak the following night, so quite a few members of the public came by since the shower is known be active for some days before and after. Alas, the weatherman's tempting prediction of "mostly clear" turned out not to be true, once again. Your Editor tried to capture some meteors with an all-sky lens on an ASI290 MM camera, but there were too many clouds and it only got worse towards midnight. A couple of meteors were glimpsed by a few attendees, but the only streaks on the images were airplanes. We did have the Moon early, Saturn late and a few Messier objects in between the clouds. Here are photos of some of the early birds.

This was about the clearest sky of the evening at 22:37. The field of view is 180° across and 100° high.

LEFT: New WAA members Peter Castleton and Melinda Battle with a Meade 150-mm LX-75 refractor.

RIGHT: L to R, Irenio Fante, guest Danny Russo and Aliza Fante with a venerable orange tube 8" Celestron SCT on Celestron AVX mount

LEFT: L to R, WAA President Jordan Webber, Melinda Battle, Peter Castleton, WAA VP for Field Events Bob Kelly, Tony Bonaviso. The scope is Bob's new 8" SkyWtcher Dobsonian with encoders.

RIGHT: Eli and Evan Goldfine with Eli's 10" Celestron StarSense Dobsonian.

Images by Members

IC 405 and IC 410 by Olivier Prache

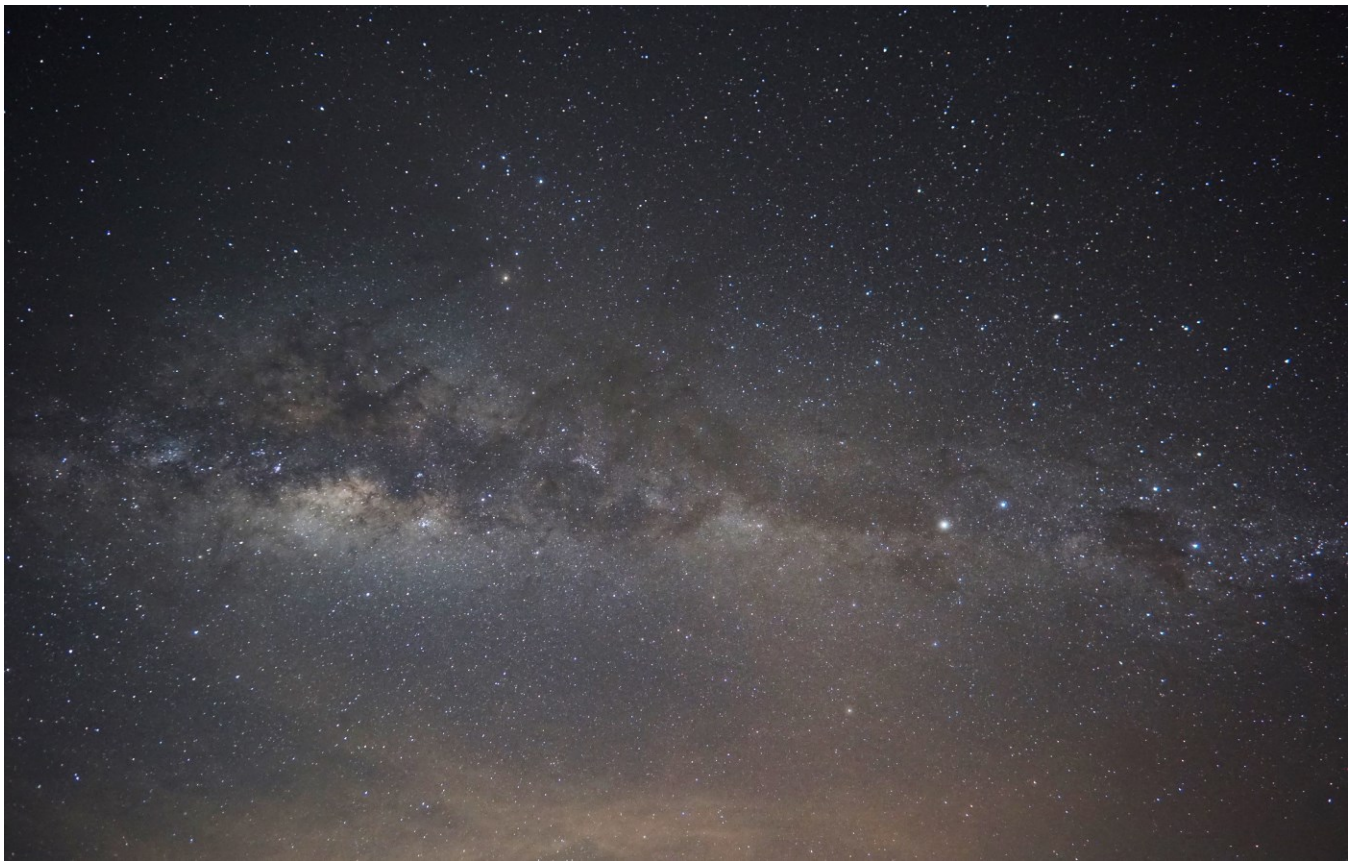
Olivier captured two nebulas in Auriga in this 3.39 x 2.25 degree field, with north towards the right. It was made with a Celestron RASA-8 f/2 astrograph. On the lower right is IC 405, the Flaming Star Nebula. Above it, separated by a line of young class A and B stars, is IC 410, the Tadpole Nebula. The Tadpole is energized by radiation from the open cluster NGC 1893, a young (4 million years) cluster with many hot blue stars.

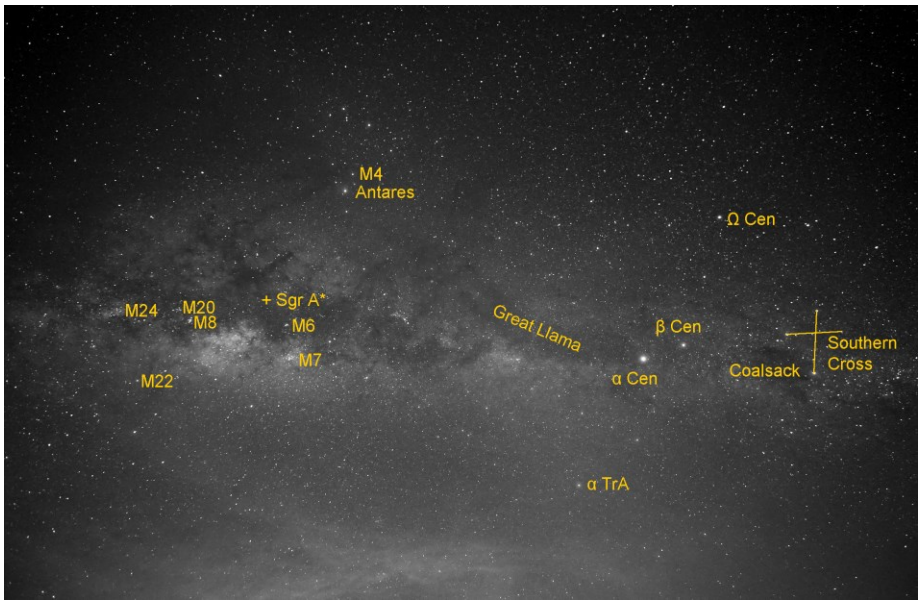
The bright star near the left edge of IC 405 is AE Aurigae, a variable (magnitude 5.8-6.1) B star thought to have been ejected from the Orion nebula some 2.5 million years ago when two binary star systems encountered each other. AE Aurigae did not form from the gas in IC 405, but it illuminates and agitates the surrounding nebulous gas, which has a density of only 1,000 particles per cubic centimeter.

IC 405 was independently discovered by J.M. Schaeberle, Eugen von Gothard and Max Wolf in 1892. They were photographing a new nova (the star T Aurigae) that was first seen on Feb.2, 1892 by Thomas David Anderson, a Scottish amateur astronomer. In 1903, Wolf published in MNRAS a wide-angle view of the area (field 6.25° x 8.19°, rotated to match Olivier's image) a five hour exposure. It showed a much larger area of nebulosity, a bit of which can be seen throughout Olivier's image. Here's a screen shot of the image from the scan of Wolf's paper on NASA/ADS. Although it doesn't reproduce perfectly, it shows the vast amount of nebulosity in the area (and was good enough for astrometry.net to plate solve). Wolf commented that AE Aur was a "flaming star" that would be interest to spectroscopists, and that's how the nebula got its name.

Two Views of the Southern Milky Way by Peter Spenser

Peter went to the Galapagos and then to the Sacred Valley of Peru, between Cuzco and Machu Pichu. Staying in the town of Urubamba, one night he hired a taxi to take him about 45 minutes outside of town so he could image the Milky Way. The image was made under somewhat windy conditions with a tripod-mounted Sony α6500 with Rokinon 12mm lens (full frame equivalent 18 mm), 3200 ISO, f2.2, 15 seconds exposure.

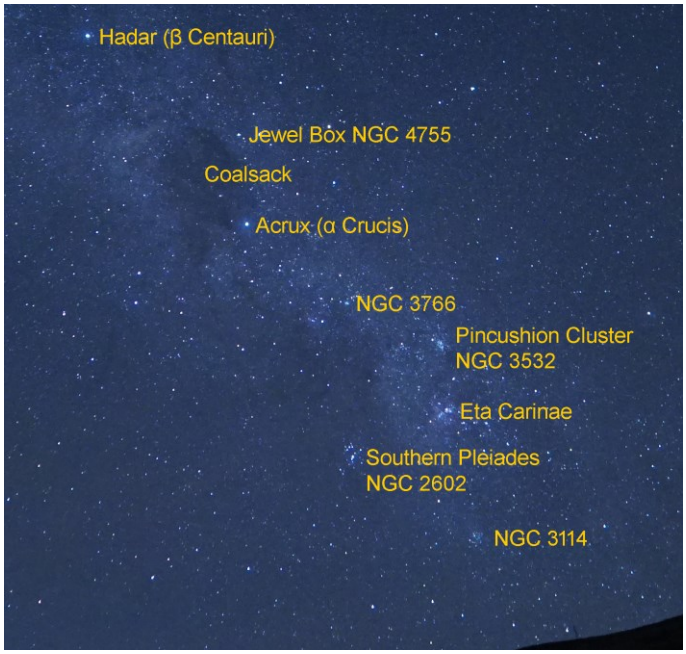




Since Centaurus, the Southern Cross and the Coalsack are not visible from our northern latitude, we made a monochrome version of Peter's image and labeled the major objects. The Large and Small Magellanic Clouds were well below the horizon when the image was made. The South Celestial Pole would be below the lower right edge of the image. In the center of the image the dark nebula of Great Llama of the Incas can be seen.

Peter made another image a short time later with the Milky Way beginning to set behind the mountains. Had it been daylight, you might have seen the remarkable terraces that the Incas carved into the hillsides for agriculture, seen all throughout the Sacred Valley. He used a tungsten color setting, so the sky color is blue.

This image shows a little more of the Milky Way that's even farther away from our latitudes. In particular, Eta Carinae and the Southern Pleiades are visible. Below is a labeled enlargement.



Typical Incan agricultural terraces (*andenes*) seen via Google Earth. These are evidence of human activity, not natural formations. They look like contour lines on a map. This location is 13° 24' 26.44 S, 72° 01' 46.9 W, near Lake Piuray 9 miles southeast of Urubamba. There are thousands of terraces in the hills around the Sacred Valley. Some have extremely well preserved stone facades, evidence of Incan engineering and fabrication skill.

Comet 13/P Olbers by Steve Bellavia

The comet was low in the northwestern sky just after the end of twilight on July 25th. Steve made this image at Orient Point at the tip of Long Island's North Fork. This is the 54th comet that Steve has imaged. Full technical information at https://www.astrobin.com/ulj0dq/.

Steve also made an annotated video on July 27th showing the movement of the comet over a 50-minute span. It's at https://www.flickr.com/photos/125134422@N06/53887241598/in/album-72157676787568522/.

Comet 13/P Olbers reached peak magnitude of 6.4 on July 2nd. It will fade to around 9th magnitude by September but will be higher in the sky. It has an orbital period of 69.11 years. The orbit is inclined 44.67° to the ecliptic. Perihelion is 1.1 AU (just beyond the Earth's orbit), aphelion is 32.51 AU (just beyond Neptune's orbit).

The German astronomer Heinrich Wilhelm Matthias Olbers discovered the comet on March 6, 1815, just two weeks before Napoleon returned from Elba to commence the "100 days" that effectively ended with his defeat at the Battle of Waterloo on June 18, 1815. The comet was faintly visible to the naked eye at the time of discovery. Did it fulfill for Napoleon the comet's traditional role as a harbinger of bad luck? We recall the famous palindrome "Able was I ere I saw Elba."

In addition to discovering this comet, Olbers discovered the asteroids Pallas, in 1802, and Vesta, in 1807 (the first asteroid, Ceres, was discovered in 1801 by Giuseppe Piazzi). Olbers is most famously remembered for "Olbers Paradox," the idea that if space is infinite and eternal, every sight line should end up on the surface of a star. Since there would have been an infinite amount of time for the light to reach us, the entire sky should appear as bright as the surface of the Sun. But it's not. Why not? This is discussed in "Webb, the Early Universe and Infinity" in the April 2022 SkyWAAtch.

ZWO SeeStar S50 Images

Messier 13

Arthur Miller

This image was taken in the backyard of Arthur's house in New Rochelle and processed with Adobe Photoshop CS6 and MaximDL. He used Topaz SharpenAI, and Curves and Levels in Photoshop. The image was cropped.

NGC 281

John Paladini

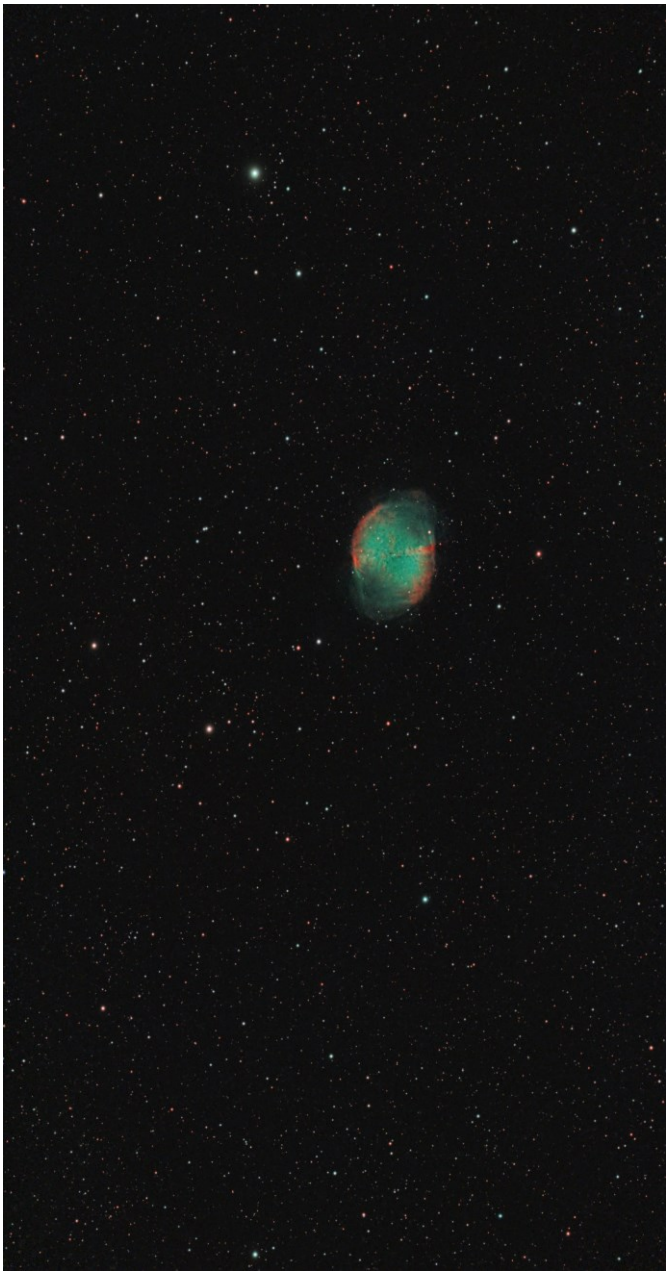
Emission nebula in Cassiopeia. Taken in Mahopac, NY.

John reports the SeeStar "works pretty well with little effort."

SeeStar Images by Olivier Prache

IC 443 in Gemini

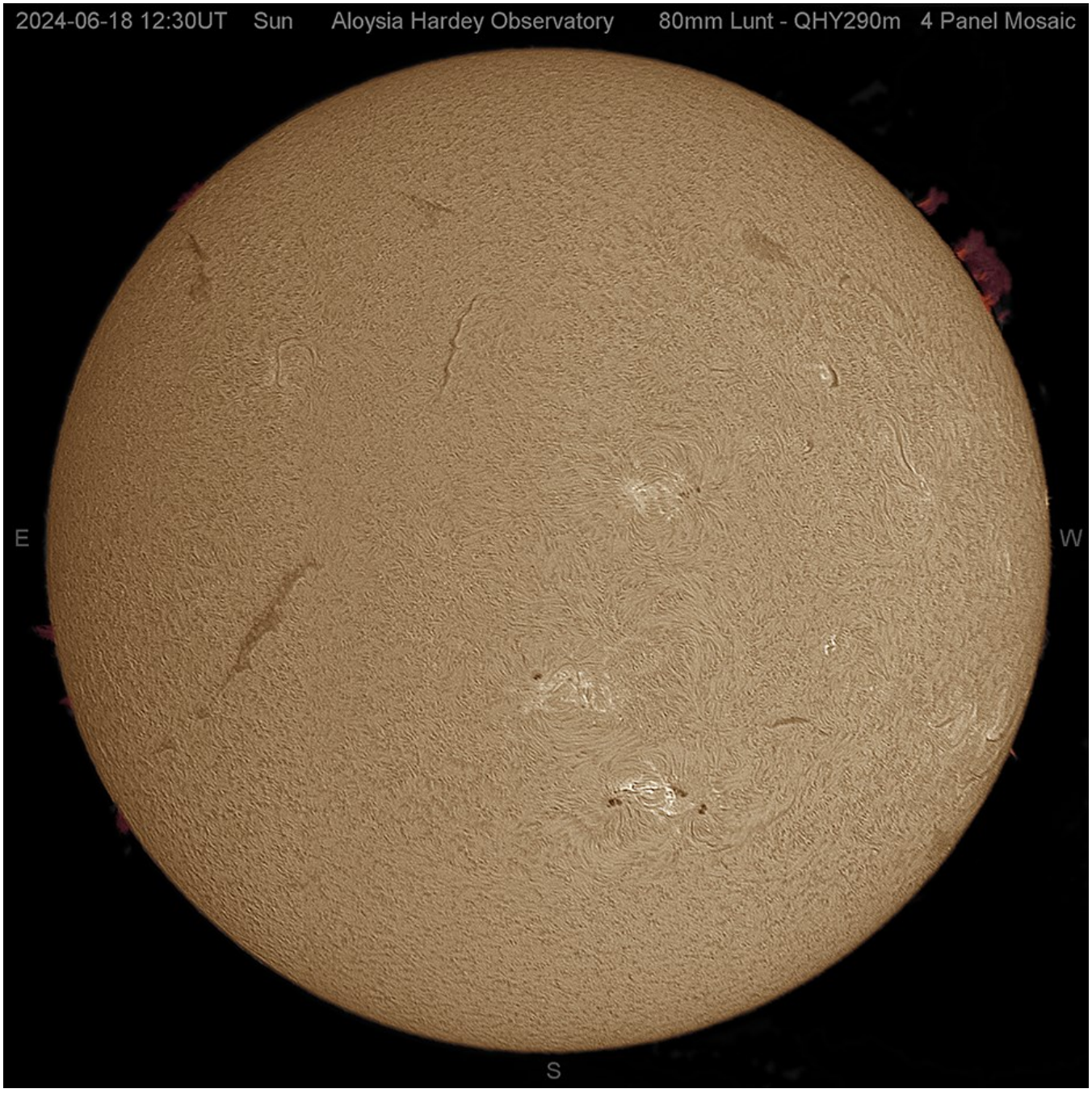
Also known as the Jellyfish Nebula and catalogued as Sh2-248, IC 443 is a supernova remnant. Its progenitor star exploded 30-35,000 years ago at a distance of about 5,000 light years from Earth. IC 443 is about 45 arcminutes in diameter (one half again the size of the full Moon) and is interacting with surrounding molecular clouds, unusual for a SNR.



Messier 27: The Dumbbell Nebula

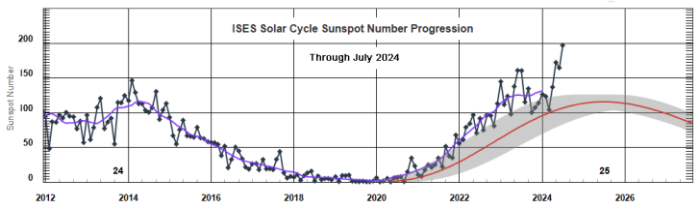
The color saturation in the 8.0 x 5.6 arcminute Dumbbell is often the artist's choice. The intense blue of the forbidden lines of doubly-ionized oxygen (OIII) in the center of the planetary nebula is encased in a red glow from singly ionized hydrogen (HII) (of course, hydrogen can only be singly ionized!). At magnitude 7.4 it's a good visual object and is well-placed for autumn viewing in Vulpecula.

Four Panel H-alpha Mosaic of Sun on June 18, 2024 by Rick Bria

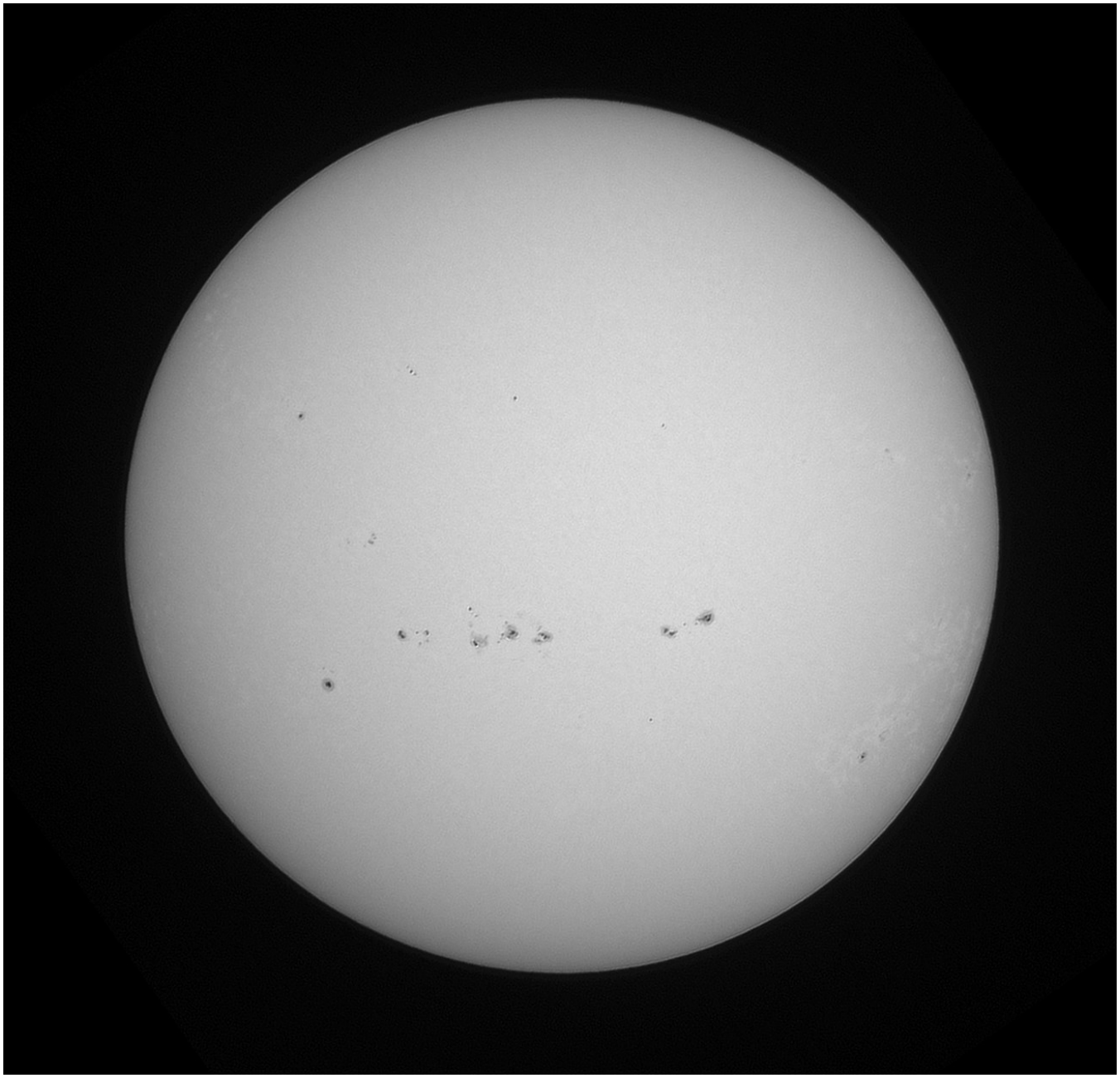


Each quarter-disc panel was made from the best 50 of 500 frames, processed and assembled using AutoStakkert4, AstroSurface3 and Photoshop. The monochrome image was colorized to emulate a hydrogen-alpha view.

Solar cycle 25 is about to reach its peak. Sunspot counts are ahead of predictions.



The White Light Sun on July 19, 2024 by Larry Faltz



A lovely line up of sunspots just below the solar equator is a harbinger of the coming flip of the Sun's magnetic poles. Imaged in Larchmont, NY at 10:27 a.m. The Sun was at 51° 37' altitude. Stellarvue 80-mm f/6 doublet, SkyWatcher AZ-GTI mount, Baader mylar solar filter, Canon T3i DSLR (in monochrome), Registax 6.1 stacked 8 images made at ISO 100, 1/2500 second, taken quickly using a remote shutter release. The camera acquired the images in RAW format and were batch converted to TIF with Canon Digital Photo Professional 4, sharpened with imPPG, rotated so that north is up and cropped with Photoshop Elements. I had tried to make an avi file with an ASI290MM but needed a 0.5X focal reducer with a 10 mm extension tube to get the full solar disk to come to focus on the small ASI290 sensor. The resulting images were too soft and didn't sharpen well. Registax 6.1 is happy to stack a sequence of TIF images as if they were frames in an AVI file. The seeing was 7/10 so I figured stacking the best eight images would be enough.

Research Highlight of the Month

Ravasio, ME, et. al, A mega–electron volt emission line in the spectrum of a gamma-ray burst, *Science* 385: 452-455 (2024)

Gamma-ray bursts are the most powerful explosions in the cosmos, second in energy only to the Big Bang itself. They were first discovered in 1967 by satellites originally designed to detect treaty-violating Soviet atomic bomb tests (which apparently never occurred). They can last from milliseconds to tens of minutes, and no two have the same light curves. They are thought to arise during supernova events when massive stars undergo core-collapse to form black holes, emitting an ultrarelatavistic (near light-speed) jet of particles. They can also occur when neutron stars merge, as in the case of GW170817 (see the December 2017 SkyWAAtch). All the detections to date have been in distant galaxies. No GRBs have been detected in the Milky Way, which is good because their enormous energy, as much as the output of the Sun in its entire 10 billion year lifetime emitted in just a few seconds, could pose an extinction event for Earth, as has been suggested for the Late Ordovician mass extinction 455 million years ago.

Up to now, the spectrum of gamma rays (their energy distribution) has been featureless, that is, a smooth distribution across gamma ray energies. The authors examined the spectrum of GRB 221009A, which was detected by the Gamma-Ray Burst Monitor aboard the Fermi gamma ray telescope. Arising in a galaxy with a redshift of 0.151, It lasted 460 seconds. The peak luminosity was 10^{54} erg/second. During the later stage of the event, they detected an emission peak at an energy of about 10 mega-electron volts with a significance above 6σ. This narrow emission line is not predicted by current models of GRBs.

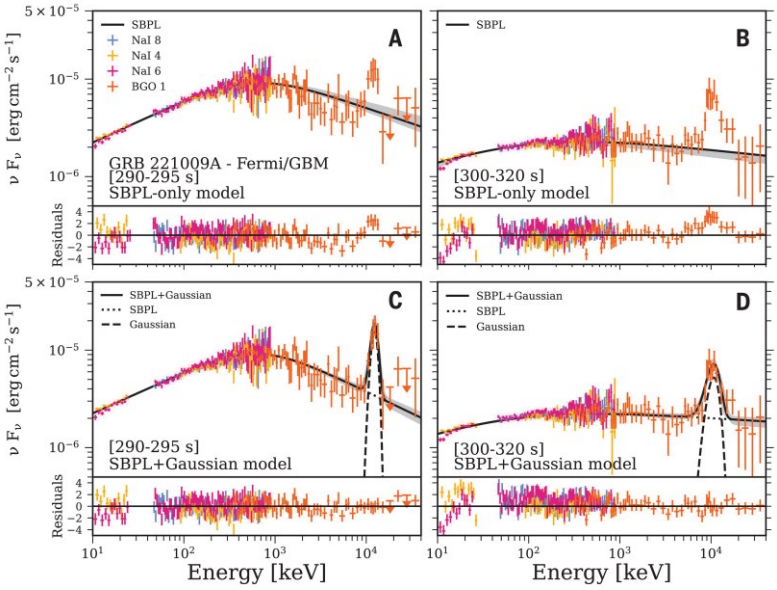


Figure 1 from Ravasio et. al. showing the spectrum at two different intervals

The authors interpret this feature as arising from a blue-shifted electron-positron pair annihilation line. The conditions that produce electron-positron pairs inside the jet of a GRB include internal shocks and magnetic reconnection events. The authors state that "We estimate that during the brightest pulse in GRB 2210009A, a sufficient number of electron positron pairs could have formed through two-photon annihilation within a region of the jet moving at a moderate bulk Lorentz factor Γ=20 at a radial distance of ~10^{15} cm [about 67 astronomical units—Ed.] from the central engine (likely a black hole). The annihilation of electron-positron pairs would then produce a spectral feature with duration, luminosity and spectrum consistent with the one we observe." The Lorentz factor quantifies the amount of the transformation of space and time when objects are moving near the speed of light, as described by special relativity.

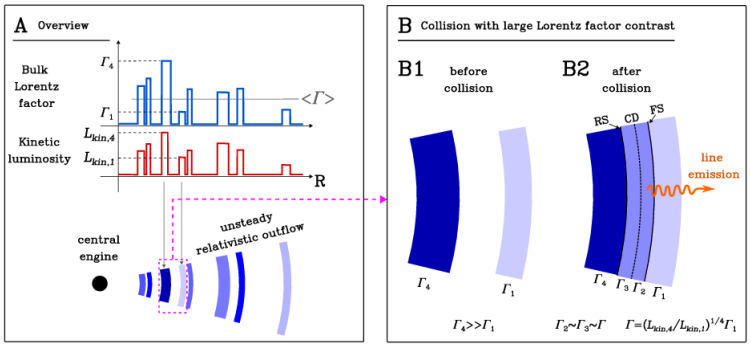


Figure S3 from the paper, showing the authors' model for the production of the emission feature.

Member & Club Equipment for Sale

Item	Description	Asking Price	Name/Email
iOptron CEM25P equatorial go-to mount	A complete IOptron "center-balanced" equatorial mount. Includes Go2Nova 8408 hand control with >50,000 objects, 4.7 kg counterweight, heavy-duty tripod, QHY PoleMaster for easy polar alignment (laptop required). Low periodic error. Payload 27 lbs (without counterweight). The mount weighs 10.4 lbs. Excellent condition. Although this model is discontinued by iOptron, the current very similar mount lists for about $2,097. Details of the CEM25P and an image are still available on iOptron's web site. Donated to WAA.	$350	WAA ads@westchesterastronomers.org
NEW LISTING iOptron IEQ45Pro equatorial mount head	Traditional German equatorial mount. Includes Go2Nova 8407 hand control (358K objects), counterweight, QHY PoleMaster for easy polar alignment, but no tripod. Payload 45 lbs (without counterweight). Mount weighs 25 lbs. This model is also discontinued by iOptron. The current very similar mount (GEM45) lists for $2,598 (plus $269 for the PoleMaster.) A 1.75" iOptron "Lite-Roc" steel tripod costs $350; piers and other tripods are available. Specs still available on iOptron's web site. Donated to WAA.	$400	WAA ads@westchesterastronomers.org
Celestron Nexstar 5SE	Mint condition white Celestron 5-inch f/10 (1250-mm) Schmidt-Cassegrain. Go-to alt-azimuth, single fork arm. Only used a couple of times. Complete with hand control, tripod, finder, eyepiece, diagonal. Picture here. Celestron lists this instrument now for $939. Weight 17.8 lbs complete, including tripod. Runs on 8 AA batteries or external 12-volts. A fantastic telescope for lunar, planetary and bright DSO observing. A great deal!	$400	Heather Morris heathermorris4381@gmail.com
Celestron StarSense auto-alignment	Automatically aligns a Celestron computerized telescope. Includes finder camera, hand control (substitutes for the original HC), two mounting brackets, cables. Works with any computer controlled Celestron scope that has a hand control. Like new condition, in original box. Image here. Description and FAQ are here.	$220	Manish Jadhav manish.jadhav@gmail.com
ADM R100 Tube Rings	Pair of 100 mm adjustable rings with large Delrin-tipped thumb screws. Fits tubes 70-90 mm. You supply dovetail bar. Like new condition, no scratches. See them on the ADS site at https://tinyurl.com/ADM-R100. List $89.	$30	Larry Faltz lfaltzmd@gmail.com
1.25" Filters	Thousand Oaks LP-3 Oxygen III (2 available)	$50	Eugene Lewis genelew1@gmail.com
	Astronomic UHC (2 available)	$75	
	High Point Neutral Density (2 available)	$10	

Want to list something for sale in the next issue of the WAA newsletter? Send the description and asking price to ads@westchesterastronomers.org. Member submissions only. Please offer only serious and useful astronomy equipment. WAA reserves the right not to list items we think are not of value to members.

Buying or selling items is at your own risk. WAA is not responsible for the satisfaction of the buyer or seller. Commercial listings are not accepted. Items must be the property of the member or WAA. WAA takes no responsibility for the condition or value of the item, or for the accuracy of any description. We expect but cannot guarantee that descriptions are accurate. Items subject to prior sale. WAA is not a party to any sale unless the equipment belongs to WAA (and will be so identified). ***Prices are negotiable*** unless otherwise stated. Sales of WAA equipment are final. *Caveat emptor!*