SkyWAAtch

The Newsletter of Westchester Amateur Astronomers

November 2023

Jupiter and Ganymede by John Paladini

Using a 9¼-inch Celestron SCT, John was able to show some surface detail on Ganymede, Jupiter's largest satellite (5,288 km diameter). The image was made in the pre-dawn hours of September 7, 2023.

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 November Meeting

Friday, November 10 at 7:30 pm

The Right Stuff…Past, Present, & Future

Andy Poniros
NASA/JPL Solar System Ambassador

Andy will discuss his recent experiences interacting with the U.S. space program, including a trip to California to meet and interview Apollo-Soyuz and three-time space shuttle astronaut Vance Brand. He'll take us behind the scenes to where the "Right Stuff" began at Edwards Air Force Base in California. He will interview Eileen Collins, the first woman to pilot and command a U.S. space shuttle. Andy will also discuss the future of manned space exploration.

Besides being a NASA/JPL Solar System Ambassador, Andy Poniros is a radio show host, Board Member of the Northeast Astronomy Forum, an amateur telescope maker, and a space enthusiast.

Also In This Issue

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

SkyWAAtch is entirely written by human beings.

WAA December Meeting

Friday, December 8 at 7:30 pm

Navigating the Cosmos: Satellites, Astrophysics, and the Balancing Act

Emma Loudon
Department of Astronomy, Yale University

The December meeting is also the official WAA Annual Meeting and officer election. The ballot slate will be sent to members in early November.

Starway to Heaven

Ward Pound Ridge Reservation, Cross River, NY

November 11 (rain/cloud date November 18). This is the last regular star party until March 2024.

New Members

William Cavers	Darien, CT
Sameer Desawale	Briarcliff Manor
Brian and Min Yoo Folk	South Salem
Elizabeth Kinetz	Bedford Hills
Kathlyn Schwartz	Purchase

Renewing Members

Bill Caspe	Scarsdale
Jose E. Castillo	Pelham Manor
Daniel Cummings	Croton-On-Hudson
Thomas Durkin	White Plains
Scott Mellis	New Rochelle
Lars Schneidenbach	Bedford Hills
Erika Soldano	White Plains

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
Editor Emeritus: Tom Boustead
Proofreader: Elyse Faltz

ALMANAC For November 2023

Bob Kelly, WAA VP of Field Events


Bob Kelly


3Q 11/5


New 11/13


1Q 11/20


Full 11/27

In November, **Jupiter** is everything you could want in a planetary apparition. It's big, it has bright moons, a planetary atmosphere in which you can really see features and it gets high in the sky. This month, we are closest to it on the 3rd, which makes everything better. Even binoculars will show the four Galilean moons dancing around the 49 arcsecond Jovian orb. Okay, Jupiter's ethereal rings aren't visible in a scope, but you can't have everything.

I like to observe the planet in three steps: 1) See the disk, 2) Look for up to four of the brightest moons, 3) Look for bands and other features on the disk. The "Great Red Spot" has been shrinking, but it has become more distinctly red in recent years. Take a minute to think about the brightness of the Galilean moons – ranging from magnitude +4.4 to 5.4 – and imagine that you might have been able to see them without optical aid if they weren't so close to the magnitude -2.9 disk of Jupiter. I asked our young visitors at the Somers Library outreach (see page 4) to tell me how many tiny dots there were near Jupiter in my 40x, 2-inch eyepiece of the 200mm dob, and one young lady reported 9 tiny dots – the four Galilean moons, plus five background stars I hadn't noticed! See page 5 for more information on Jupiter.

Saturn continues to be a wonder to behold in the telescope. It's also up at sunset but transits lower in the sky and is one-third the apparent size of Jupiter. The rings, 8th magnitude moon Titan and subtle atmospheric markings reward observers, especially on stable nights when you can crank up the magnification. Iapetus achieves 10th magnitude, showing its bright side as it heads west after passing inferior conjunction with Saturn on the 7th. Now that makes five Saturnian satellites visible at magnitude 10 or brighter. Saturn's rings are tilted 10.5 degrees toward us, the most for the second half of 2023. The tilt will then decrease until we see (or don't see) the rings edge-on in March 2025.

Venus is still a beacon high in the east-southeastern morning sky. At magnitude -4.4, it's the third brightest object in the sky, after the Sun and Moon. Strong binoculars or a telescope, especially when the sky is bright, will show the planet's gibbous phase. The **Moon** makes a close pass, less than two Moon-widths away from Venus, on the 9th. The *RASC Observer's Handbook* recommends using this close approach to compare the phase and surface brightness of the two celestial objects that change shape the most in our sky.

Mercury, too, has phases, but it is coming out of superior conjunction and starts the month nearly fully lit. In the second half of November, Mercury gets enough separation from the Sun to be visible low in the southwest during evening twilight. It gets a little dimmer, a bit larger and retains a gibbous phase into the first two weeks of December. We'll need a clear horizon and high magnification to see Mercury as more than a magnitude -0.5 dot this month.

Mars is too close to the Sun for our viewing, reaching conjunction with the Sun on the 18th. It won't be visible to us, except in the SOHO C3 imager, until it reappears in the morning sky in January.

Uranus comes to opposition on the 13th at magnitude +5.6, following 10 degrees after Jupiter in the sky.

Neptune, at magnitude +7.9, tags along about 10 degrees after Saturn in the sky.

You can find predictions for times that **artificial satellites** pass over our neck of the woods at https://heavens-above.com/. This reference is very helpful, especially for events like the trains of StarLink satellites, which occur for several days before the communication satellites go their separate ways. The ISS is projected to be visible in the morning sky until the 9th, and in the evening from the 13th onward. China's space station, Tiangong, is visible in the morning through the 10th and in the evening starting on the 18th.

The **Leonid** meteor shower peaks on the morning of the 18th after the Moon has set. Leonids are the fastest meteors we see in our skies, hitting the Earth's atmosphere nearly head-on. We might see 5 to 20 an hour that morning. ■

Somers Outreach, October 23rd

Each fall for almost a decade we've run an outreach sponsored by the Somers Children's Library. We view at the upper parking lot in Reis Park, on Route 139 in Somers, where there is good sky exposure except for the far north (so the Big Dipper is, alas, out of sight). This year the sky was absolutely perfect, with great seeing and perfect transparency.

There were at least three dozen families in attendance. The children generally are pre-school or in early grades, some of the youngest not quite able to understand how to look through an eyepiece, but we patiently try to ensure that everyone has a good chance to see the objects.

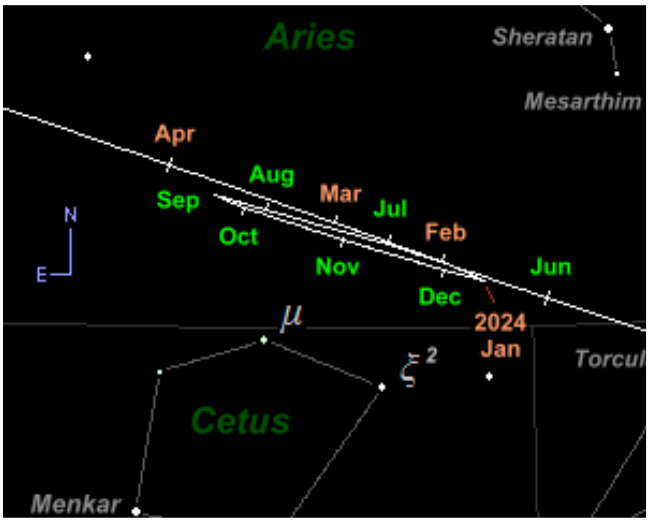
We usually schedule the outreach around the time of a quarter moon, since Luna is always an impressive and easy target for every telescope, and as expected, it was. Saturn was visible throughout the evening, evoking the usual "Oh my Gods" and "It's not real" from the parents. Several children complained "It's small" in the eyepiece even at 225x, which I suspect is a disappointment arising from prior exposure to high quality images. Once it was fully dark, Titan was easy to see. Jupiter rose about 7:00 p.m., and we were treated to a train of two dozen bright, newly-launched Starlink satellites around 7:15 (great for the crowd, bad for astronomy). Over the next hour we were able to show some fainter objects (M13, M31, M57), double stars (Albireo, Polaris) and even Neptune (which *was* tiny).

Scopes were provided by Bob Kelly (8-inch Dobsonian), Tim Holden (4-inch refractor), Mike Lomsky (14-inch motorized Dobsonian) and Larry Faltz (8-inch go-to SCT). WAA President Karen Seiter was on hand and snapped a few cell phone images early in the evening. LF

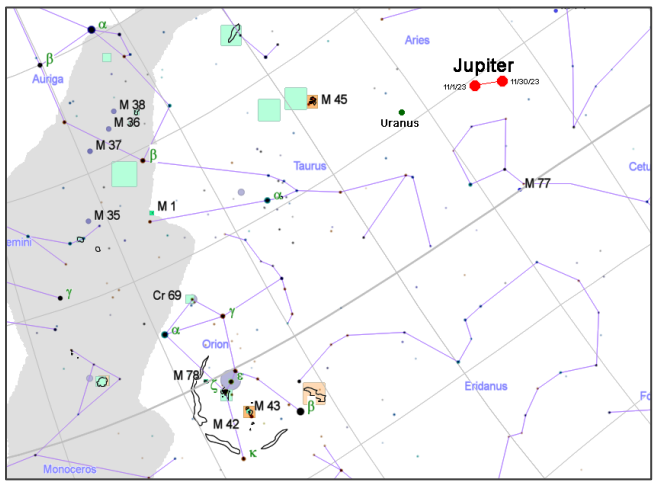
Observing Jupiter in November

As Bob Kelly points out in the Almanac on page 3, Jupiter will be very well placed in November and December for evening viewing. It is in retrograde motion in southern Aries, just north of the head of Cetus, and 23 degrees west of the Pleiades. It will resume its eastward path in January 2024.

Here is some information and graphics that can help you plan your observations.

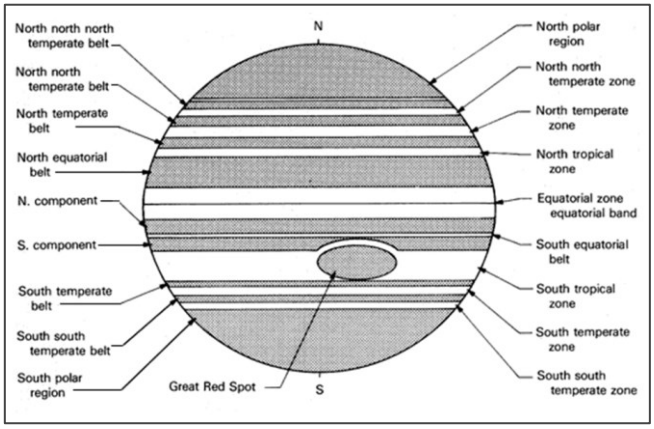


From a map by Martin J. Powell (NakedEyePlanets.com)



Cartes du Ciel, showing celestial coordinates (LF)

Reflectors and Schmidt-Cassegrain telescopes should be well-collimated. SCTs and Maksutovs need to be cooled for at least an hour to eliminate tube currents. Seeing (atmospheric stability) is critical to a good image, whether visual or photographic. Try not to observe over rooftops and chimneys if you can avoid them, but looking is better than not looking!



Cosmicpursuits.com

Jupiter will be 60° above the horizon when it crosses the meridian for the next couple of months.

Meridian Transits (Culmination)

This is when Jupiter is highest in the sky.

Date	Rise	Meridian Transit
11/01/23	17:52	00:50
11/08/23	16:22	23:14
11/15/23	15:52	22:43
11/22/23	15:22	22:12
11/29/23	14:53	21:41
12/06/23	14:24	21:11
12/13/23	13:55	20:42
12/20/23	13:26	20:13
12/27/23	12:58	19:45

Visible Shadow Transits, November 2023

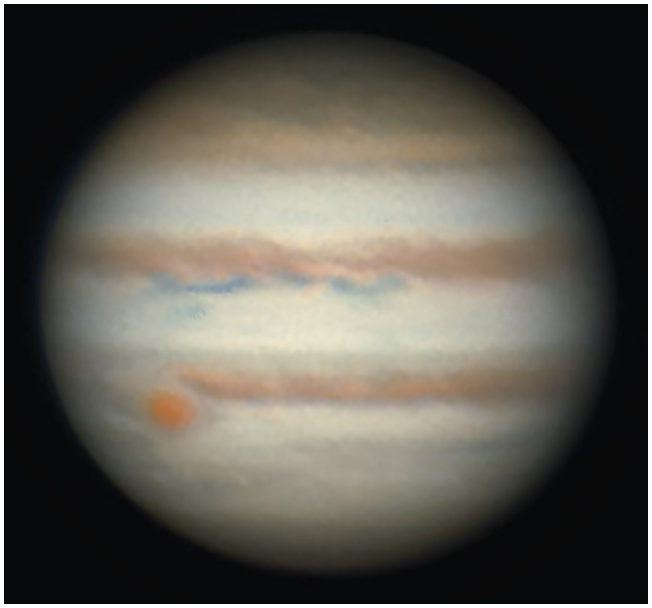
Date	Moon	Start	Alt	End	Alt
11/3	E	23:15	38	23:35	61
11/4	I	23:58	62	01:04	47
11/6	I	17:26	9	19:37	33
11/10	E	22:51	62	01:11	50
11/12	I	00:53	52	03:03	30
11/13	I	19:22	14	21:32	57
11/17	G	17:03	13	18:46	33
11/18	E	01:26	43	03:36	17
11/20	I	21:17	58	23:27	58
11/24	G	21:06	59	22:47	60
11/27	I	23:12	56	01:23	35
11/29	I	17:41	30	19:52	46

These are the transits that are visible during darkness and with Jupiter above 30 degrees altitude for any part of the transit. There are no double shadow transits this month. Use an app or on-line web site to find Red Spot transit times.

Imaging Jupiter

Use a tracking mount, a high focal length and a dedicated planetary camera with as short an exposure and as rapid a frame rate as possible for "lucky imaging." Watch the histogram to guide exposure duration and gain. Focusing is not easy: be patient. Capture a video file (.ser or .avi) of a thousand or more frames, stack, sharpen and denoise with appropriate software. Because of Jupiter's rapid rotation, if it takes more than two minutes to get enough frames, you may have to make several videos and then combine and de-rotate them with the powerful free software WinJUPOS, (http://jupos.org/gh/download.htm) to get the sharpest image.

There are many programs available for image capture. ASI has their own capture and stacking software within the ASIStudio suite, and many people like SharpCap or FireCapture for capturing and Autostakkaert!3 for stacking. Sharpen with Registax or WaveSharp or even PixInsight. ■



Steve Bellavia, Oct. 16, 2023.6" SCT, 2X Barlow, ASI290MC

If you want to learn more about planetary imaging, WAA member and accomplished astrophotographer Mauri Rosenthal will be teaching another class on *Urban Astrophotography: Planetary Imaging*, sponsored by the Amateur Astronomy Association (the NYC club). It's a Zoom course that starts on November 9th and runs for six sessions. Registration is $75 for AAA.org members and $85 for non-members. For more information and to sign up, go to https://aaa.org/classes/.

Mauri Rosenthal, Oct. 12, 2023. 3.5" Questar, 2X Powermate, QHY 5III 178

Deep Sky Object of the Month: Messier 33

Messier 33	
Constellation	Triangulum
Object type	Galaxy
Right Ascension J2000	01h 33m 50.02s
Declination J2000	+30° 39’ 36.7”
Magnitude	5.72 (6.6)
Size	70.8 x 41.7 arcminutes
Distance	3.2 million LY
NGC designation	NGC 598
Nickname	Triangulum Galaxy
Discovery	Hodierna, 1654

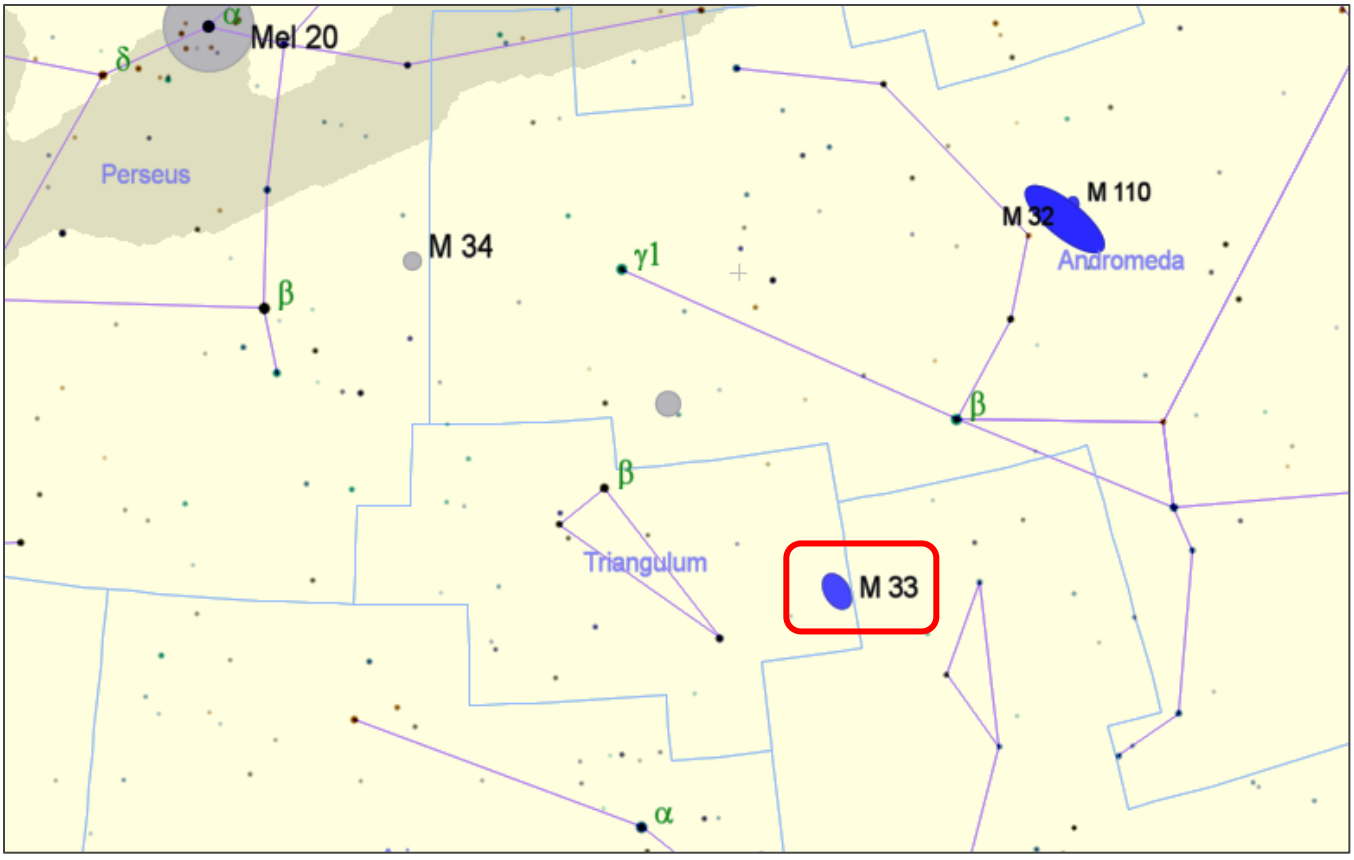
Famous from images, the Triangulum Galaxy needs a dark sky. Although its magnitude is given as 5.72, most observers agree that its effective visual magnitude is 6.6. Observers in Westchester will be able to see it with binoculars or a small telescope, but averted vision may be needed because of its relatively low surface-brightness.

This month it will be sitting midway between Jupiter and the easily spotted Andromeda Galaxy (M31).

Visibility for Messier 33			
22:00 EDT/EST	11/1	11/15	11/31
Altitude	65° 58’	78° 41’	72° 24’
Azimuth	109° 01’	189° 42’	236° 06’

M33 is the third-largest member of the Local Group of galaxies. Although in the past amateur astronomers have called it the “Pinwheel” galaxy, that nickname is now reserved for Messier 101 in Ursa Major.

See page 18 for Mauri Rosenthal’s image of Messier 33.



Another Movie Telescope

Institute for Advanced Study members Boris Podolsky (Gene Saks), Kurt Gödel (Lou Jacobi), Nathan Liebnecht (Joseph Maher) and Albert Einstein (Walter Matthau) surround a small refractor in a scene near the climax of the 1994 Rom-Com film "I.Q.", starring Meg Ryan and Tim Roth.

Ryan plays Einstein's niece Catherine Boyd, a brilliant mathematician on her way to a Princeton Ph.D. in the mid-1950s. She is engaged to pompous experimental psychology professor James Moreland (Stephen Fry). When her car breaks down, she takes it to a garage where Ed Walters (Tim Roth), a smart but uneducated car mechanic and sci-fi buff, instantly falls in love with her. Einstein meets Ed and realizes he is a better match for Catherine than the obnoxious James. He and his three colleagues plot to make the match happen. To make Ed acceptable to Catherine, he helps him confabulate a proposal for a fusion rocket drive, which he gets Ed to present at a seminar at which Catherine is in the audience. The whole thing is bogus, with Ed mouthing equations about which he has no idea, but the concept enthralls the audience, Catherine included, and even gets national attention. Catherine finally falls in love with Ed, thinking he is a genius, but of course he is found out and the romance tanks, only to be reborn through further clever intervention of Einstein and his crew, who in this scene are on the roof spying on Catherine, entirely for her ultimate benefit.

Godel and Einstein, early 1950s. Photo by Emilio Segre

The character of Nathan Liebnecht is entirely fictional, as are everyone else except Podolsky, Gödel and Einstein (and cameos by President Eisenhower and Louis Bamberger, a founder of the IAS who had been dead for a decade by the time the action in the film takes place). Podolsky, who with Nathan Rosen was Einstein's coauthor on the famous 1935 "EPR" paper on quantum mechanics ("spooky action at a distance"), was not at the IAS in the 1950s. Gödel came to the IAS shortly after Einstein, and then went back to Vienna. To avoid being drafted into the German army in 1939 he escaped via the Trans-Siberian Railroad. He settled at the IAS and became Einstein's closest friend. Unlike the somewhat goofy character played by Lou Jacobi, Gödel was very reserved and almost reclusive except for his friendship with Einstein, a relationship their IAS colleagues could not fathom. His Incompleteness Theorems are the pinnacle of mathematical logic. Computer pioneer John von Neumann, who was also at the IAS, wrote that "Kurt Gödel's achievement in modern logic is singular and monumental—indeed it is more than a monument, it is a landmark which will remain visible far in space and time." ■

Amateur Astronomy Evolves. Should It? Larry Faltz

Modern technology[1] has probably had a greater impact on amateur astronomy than any other 'traditional" hobby. A recent survey showed that the most popular hobbies are cooking, reading, pets, video gaming, outdoor activities, making music and dancing. While there are technical devices that have impacted cooking (among them the microwave, convection ovens, induction burners and the digital meat thermometer), there are no digital hamburgers. The impact of digital e-readers has been small and most readers still prefer printed books. About the only technology that has impacted pet ownership in a significant way is the invisible fence, and for some owners the subcutaneous ID chip and the indoor pet camera.[2] While video gaming depends on new technology, it doesn't involve a conceptual change from any other indoor competitive activity (board games, cards games, dominos, chess, marriage). We may be able to play chess over the internet, but the game itself has been unchanged for a couple of thousand years. Except for digital activity trackers and getting weather reports on your phone, going outdoors for hiking, biking or fishing is fundamentally an escape from technology, the bicycle having had some recent improvements in materials, but no paradigm-shifting technology. The effect of modern technology on sports is peripheral: the pitch clock in baseball still doesn't change the nature of the confrontation between pitcher and batter. Another popular hobby, playing a musical instrument, hasn't really changed at all: the electric guitar and the digital piano don't require much alteration in technique, and music notation has been fixed for 400 years. Recordings may have expanded the repertoire and made music more accessible, but doesn't alter how it is made. Even the midi synthesizer, with all its voices, is basically just an electronic version of a great organ with multiple stops. Bach would have understood it.

While avocations like remote control airplanes and photography have benefitted from miniaturization and computerization (and of course for photography, the development of the electronic sensor), they too are still much like their former incarnations. Maybe film is gone, or airplane controllers are now palm-sized, but activity within the hobby hasn't changed all that much. You take your photos and look at them later, or you take off and land your RC airplane.

For science hobbyists interested in chemistry and biology, one still mixes chemicals in beakers or places drops of pond water on a microscope slide. These hobbies tend to be short-lived, attractive to young learners in preparation for a more formal education in the sciences. No one is selling home polymerase chain reaction or gene-splicing kits to amateurs. Now that we know how chemistry works, alchemy is no longer a thing.[3] No one dedicates their lives to search for the "Philosopher's Stone" to convert lead to gold.

Astronomy is for many a life-long hobby. Observational astronomy hasn't really changed since it was invented in 1609. We need to get and mount a telescope, find and observe an object, and perhaps record our observation, whether by a drawing or a written description in a log. Before the end of the 20th century, we star-hopped using our finders and eyepieces, following routes we plotted on a star map. We used our eyes. Imaging with film cameras was a difficult and frustrating process that required visual guiding, vast patience and a lot of disappointment in the darkroom. Aperture was king: If you wanted to see more, you got a bigger telescope.

It is not that way anymore. Think of the changes in amateur astronomy in the last 30 or so years: digital go-to telescopes with vast, accurate databases, self-alignment, wireless connection of the mount to a computer or smart phone, internal lithium batteries, replacement of the eyepiece with a camera, alignment and guided via plate solving.[4] Modern cameras with photon efficiency approaching 100% (vs. 3-6% for the human eye to form an image). Live stacking, AI-facilitated deconvolution and noise reduction. The instant delivery of images to the internet. The proliferation of small-aperture scopes.

While many of the technological changes make visual observing more productive, the most radical change

[1] We define "modern technology" as instruments with digital devices that use microprocessors and/or digital sensors.
[2] Is the pooper scooper technology or just common sense?
[3] Which interested Isaac Newton.
[4] See the October 2023 SkyWAAtch for more on plate solving.

is a move away from the eyepiece in favor of imaging with digital sensors, either for "electronically assisted astronomy" (viewing the images on a screen in the field) or astrophotography (manipulating images for optimal quality after they are acquired). There are now a few amateur astronomers who don't ever look, and among newcomers to the hobby *may never have looked*, through an eyepiece. With small, lightweight, inexpensive, totally automatic telescopes on the market by Vaonis, Unistellar and most recently the $500 ZWO Seestar, it is likely we will meet more "digital observers," for want of a better term.

Is this good or bad for the hobby? Is digital observing better or worse than optical observing for stimulating an individual's enthusiasm for gaining a wider knowledge of the cosmos? Does it facilitate a long-term passion for astronomy, or is it a novelty that will end up in a closet in a short period of time? Being an amateur astronomer means not just *looking* at the sky but *learning* about what's there and how we know. How do those objects reveal the history and future of the universe, our planet and life on it? We should want to be cosmically curious, extending our interest to astrophysics, cosmology, nuclear physics and the other sciences that astronomy touches, including chemistry and biology. Scientifically knowledgeable citizens ought to be able to make better-informed political and policy choices too. They will know the facts and can think for themselves.

I am as guilty as the next guy in going electronic. I was probably the earliest regular practitioner of "electronically assisted astronomy" (EAA) in the club. Back on Labor Day weekend in 2009, I was at Ward Pound Ridge observing with my fork-mounted Celestron CPC800 telescope, a solid example of a modern optical telescope. It has GPS, go-to, sidereal tracking in alt-az configuration and nearly 100,000 objects in memory. It was a great all-around scope, but as light pollution began to increase, deep sky objects weren't as impressive as I would have liked. John Paladini came over with a Mallincam Color Hyper Plus CCD video camera, which I had never heard of before, and one of those old-style "gamer glasses" that substitute for a video screen. They need a composite (analog) input, which is what the Mallincam provides. We slewed the scope to Messier 16. At the eyepiece, one can see only a few stars of its cluster and no nebulosity at all. John replaced the eyepiece with the Mallincam, powered it with a 12-volt battery, plugged in the display glasses and focused. He had me don the glasses and threw a switch on the camera. Fourteen seconds later there was the Eagle Nebula, intensely red, the Pillars of Creation easily visible. I went nuts. Within a month I had my own MCHP and rigged up a whole system for powering the camera and scope, connecting it to an LCD video monitor and controlling it with a computer. EAA is a great outreach tool because multiple people can see the images at the same time, and my 8-inch SCT was functionally transformed into a 24-inch instrument.[5] All the wires were very impressive too, inspiring long-time WAA member Mike Cefola to christen the setup "Locutis", a reference to Jean Luc Picard's Borg persona on *StarTrek, the Next Generation*.

"Locutis": CPC800 with Mallincam 2012

The Mallincam was based on an early video security camera and had a small but very sensitive CCD chip, just 640x480 pixels. It was turned into an astronomy camera with additional timing and amplification circuits designed by Rock Mallin, a Canadian electronics engineer. It could make an exposure as long as 56 seconds. With it I saw objects that would never be visible by eyepiece in an 8-inch scope, including 14th magnitude Pluto and the 17th magnitude Twin Quasar. The time required to connect (and disconnect) everything was substantial. The video image looked good on screen but didn't transfer well to a computer because video-to-USB "frame grabber" adaptors are poor at dealing with the low light typical of an astronomical image. The small chip had obvious limitations.

[5] See some Mallincam images in the November 2014 SkyWAAtch, page 10.

Nevertheless, seeing the spiral arms of M51 or the Dumbbell Nebula in color was a real treat.

Advances in CMOS technology, particularly their lower cost and lower power requirements, have made small-chip CCD cameras like the Mallincam MCHP and its successors relatively obsolete.[6] In 2021 I got a ZWO AM5 harmonic drive mount, an ASI533MC Pro camera and an ASIAir Plus for wireless control, using this combination with a 105-mm triplet Stellarvue refractor that I had gotten at NEAF some years ago. Setup time is substantially shorter and resolution and image quality is much better. For optical observing and lunar and planetary imaging the CPC800 is still my main instrument. SCTs are still the best all-around telescopes, I think.

Stellarvue SVR-105 on ZWO AM5, 2023

A growing segment of the hobby is now dedicated to imaging, whether for EAA or to produce formal astrophotographs. Progress in amateur imaging is evident in the many incredible images submitted to SkyWAAtch. Look in the SkyWAAtch newsletter archive on the WAA web site to see the strides imagers have made in the last decade or so.

Digital observing and digital imaging are growing in popularity. Besides the simple availability of cost-effective technology and amazing software, there are profound external reasons. Growing light pollution has washed out many objects, a problem that imaging can overcome to some extent. In my report of the August 29, 2013 star party at Ward Pound Ridge that appeared in the September 2013 SkyWAAtch I noted a sky quality meter reading of 20.44. But in mid-September 2023, I was at Ward Pound on what appeared to be a very excellent night and got a reading of 19.95. The difference? Ten years during which most municipalities in Westchester replaced sodium vapor streetlamps with first generation 5000 K LED streetlamps, which scatter much more light than the old yellow sodium lamps. There has also been a vast increase in the number of outdoor lighting fixtures, with homes, businesses and public areas, vying for attention at night. Most irksome are the many brightly illuminated empty parking lots.

Another factor is user expectation. In the past, astrophotographs were primarily seen in astronomy magazines and books, perhaps the main exception being television coverage of the Voyager probes. Two things happened in the 1990s: the Internet and the Hubble Space Telescope. The Space Telescope Science Institute, which runs HST, was keen to have the public (and Congress) see the spectacular images coming down from Earth orbit, so they ensured wide publicity. When you see a fuzzy grey blob through the eyepiece of an object that you've already seen as a spectacularly detailed color HST image, it's not surprising that you feel a little disappointed and might seek to employ technology to get closer to what seems like the "proper" way for the object to appear.

There seem to be two groups of amateurs, besides those adopting astrophotography as a distinct hobby, that are embracing digital observing. There are experienced oldsters who find themselves unwilling or unable to carry large instruments but still want to "go deep." I've heard "I can't lift the Meade LX-200 anymore, so I sold it and got a Televue 85" more than once. Some will inevitably substitute electronics for aperture. If you've used a 10-inch scope, you know that with an 85-mm refractor you're not going to reproduce your views with an eyepiece, but with a camera, less is substantially more.

Then there are newcomers to the hobby whose interest doesn't start by being out under a dark sky because there are no dark skies in civilized places anymore. Regular exposure to Hubble (and now JWST) images and planetary space missions (and maybe a super-digital planetarium show) drive their interest, and they won't be satisfied with a faint fuzzy. I was reminded of the World War I song, "How Are You Going

[6] Olivier Prache's image of the Elephant Trunk on page 11 shows that a high-end CCD astronomy camera still has powerful capabilities. The bespoke cameras made for professional observatories, such as the 3.2-gigapixel camera for the Vera Rubin Telescope, are still CCD and not CMOS.

to Keep them Down on the Farm (After They've Seen Paree)."[7]

How are you going to bring someone to the eyepiece of an 8-inch telescope in an SQM 19.95 sky and expect them to be awed when they've grown up on HST images? They can use a two-inch digital telescope to make an image in two minutes that's clearer and deeper than anything they could see visually with an instrument four times the aperture.

The new very small aperture digital telescopes offer incredible value, ounce for ounce and dollar for dollar. They do have their limitations: there is little you can do to change the magnification improve resolution. The sensor in the Seestar is a Sony IMX 462, a 2-megapixel chip that gives the 200-mm f/4 instrument a field of view of 1.61 x 0.91 degrees and a resolution of 2.99 arcseconds per pixel. These are wide-field instruments and don't do well on planets or small DSOs. The "gearhead" factor is absent: you can't mix and match optics or sensors, or upgrade elements of the optical or mechanical train, although solar and light pollution filters can be placed into the optical path.[8] My AM5/SVR-105/ASI533 combination on the previous page delivers a resolution of 1.11 arcseconds per pixel (half that with a 2X Barlow), compared to 2.99 for the Seestar. That advantage comes at nearly ten times the price, and greater weight and bulk. But I do have an optical telescope if I want it, plus the gearhead fun.

Why make a somewhat low-resolution image with a small automatic telescope when you can simply view a much deeper and higher-resolution image on line? There are several reasons: you are out under the stars, and while waiting for your image to appear you can appreciate the always wonderful naked eye view of bright stars, a planet or two, the Milky Way if it's up, some satellites and maybe a meteor or two if you're lucky. Astronomy is a very social pursuit, as evidenced by the large number of astronomy clubs and organizations throughout the world. At a star party you mix with other people who share your interest in the cosmos. There is also a very strong on-line astronomy community. Sites such as Cloudy Nights or Stargazer's Lounge unite amateurs from all over the world. Observers and imagers of all ability levels freely share their work and offer suggestions and ideas. On most nights, one or more amateur astronomers are on https://www.nightskiesnetwork.com/, sharing live views of DSOs. The new all-digital telescopes exploit their connectivity. Users can link to the community of owners to share images and techniques and even participate in citizen science projects.

But an even stronger reason to eschew the passive experience of just looking at someone else's images on line is that when you make an image, your image is *yours*. You can call it an inherent human impulse to create or just to play, but it resonates in all of us. A Velasquez or Picasso comes along once a century yet people still want to make their own art. Photography didn't stop with Ansel Adams or Edward Steichen. It's likely no one will top Bach, Mozart or Beethoven, but there are tens of thousands of people composing "serious" music, not to mention a million garage bands who will never come close to sounding like the Rolling Stones. The greatness of *Moby Dick* and *The Grapes of Wrath* doesn't inhibit thousands of people from writing novels each year.

Evidence that things have changed

On Tuesday, July 11, seven WAA members took advantage of the club's special use permit with Ward Pound Ridge Reservation to set up their telescopes. It was the first clear, moonless, non-Canadian smoke-obscured night in several months. Of the seven, only one was doing visual astronomy, while the others were imaging or doing EAA. No Dobs, no Schmidt-Cassegrains, no Maksutovs, and no visual refractors. The largest telescope among the imagers was a 127-mm triplet refractor. Three of the imagers were using optics of just *two inches* of aperture! The visual observer was using a rare and exotic Takahashi Mewlon Dall-Kirkham 210-mm telescope atop a solid alt-az mount fitted with encoders and a Nexus DSC linked to SkySafari on his iPad so he could move the scope to its targets. Everyone else was using go-to equatorial mounts and guide scopes to optimize tracking. This would not have been the scene just ten years ago!

[7] Sophie Tucker, "The Last of the Red Hot Mamas," introduced the song in vaudeville in 1919. Those of us of a certain age may remember seeing her on the Ed Sullivan Show in the 1950s and early 1960s.

[8] On the other hand, you don't have to. The scope is complete and needs no "pimping." Anyway, not everyone is a gearhead!

Not long ago, amateur astronomer and prolific astronomy writer Rod Mollise described amateur astronomy as a hobby that appeared to be "ageing out." Amateur astronomers were growing older and there didn't seem to be a younger cadre of new enthusiasts to carry the torch to the next generation. His evidence was his interactions with attendees at star parties, club meetings and NEAF. I think modern technology and imaging may be starting to reverse that trend a bit. WAA's David Parmet observed that at a Cherry Springs star party this spring there were many young observers and their families. We are seeing that at our star parties as well.

But I do think that amateur astronomers, old or new, are missing something if they don't look through an eyepiece once and a while. A distinct level of concentration is required to observe a faint celestial object. When you can gather details with your eyes (dark adaptation and averted vision are important) you receive a special kind of gift. That the sight is not a full-color HST-like picture becomes irrelevant. You are engaged in a form of meditation and even communion with the cosmos that looking at an image can't achieve.[9] I've found that for visual observing a binoviewer helps me relax and increases the pleasure of the observing, even for objects at the limit of perception. For the Moon and planets, the binoviewer provides exceptional views. Binos are particularly compatible with SCTs and Maksutovs because these designs provide the in-focus travel that binos need. For monocular observing, using an eye patch is better than actively keeping the non-observing eye shut.

Steve Bellavia, one of our most active astrophotographers, often writes about his observing trips to Cherry Springs, Star Haven in the Catskills or Orient Point on Long Island. While he is gathering data on some object invisible to the eye, everything controlled by a computer with no need for human intervention, he will often look through binos or a small telescope to visit old friends: the brighter Messier objects, double stars and the planets if they are around.

There has never been, and there never will be, a perfect telescope, one that performs optimally under every circumstance, and now there is more than one way to see astronomical objects. New technology is creating new opportunities. The hobby will evolve to meet the needs, skills and interests of both old and new amateur astronomers and the tools available to them. But certain traditions ought not to be abandoned. Future leaders of amateur astronomy need to preserve a link to our traditions even as we adapt to a digital world. If you want to play the piano, whether you ultimately opt for jazz or classical, you would do well to learn some Bach and practice his music once and a while (the best jazz pianists do).

Cuiv, the Lazy Geek, with a new ZWO Seestar.

YouTube has many helpful videos about astronomy. Among the most informative and enjoyable channels is "Cuiv, the Lazy Geek." Cuiv is a European computer guy who images from his balcony in, of all places, Tokyo, probably the most light-polluted place on Earth. He achieves fine results on the Messier objects and brighter NGCs. He reviews new equipment and imaging software and his videos are smart and fun. If you are interested in the new small digital scopes (Seestar and Dwarf 2) check out his video reviews of these instruments. You will certainly understand why they may become a major feature of amateur astronomy's future.

But let's not abandon the eyepiece! Visual observing is still the heart and soul of amateur astronomy. ■

[9] Focused contemplation of truly great art, architecture or music has a similar impact on your nervous system. The wonder grows the longer you are involved with the work. It's the same for astronomical objects.

Images by Members

Galaxy Images with the Vaonis Vespera (50-mm f/4 quad, Sony IMX 462 sensor) by Jordan Solomon

Messier 104, the Sombrero Galaxy, in Virgo (on the Virgo-Corvus border).

Messier 51 in Canes Venatici

The Elephant Trunk by Olivier Prache

The star-forming region IC 1396 in Cepheus is an emission nebula with gas and dust excited by the hot, massive multiple star system HD 206267 (out of the field to the left; the main component is a binary of class O6V+O9V). The intense solar wind of HD 206267 shapes the leading edge of the dust cloud within the nebula known as the "Elephant's Trunk."

Olivier writes:

This is a 13 hour shot of the Elephant's Trunk nebula. I have seen so many narrowband images and wanted to try my hand at broadband. It was a new challenge because it is a dark nebula and I am more used to try to bring out details to the light, so to speak. In this case one has to be careful about the average sky values as they are above the dark nebula and color noise has to be battled down.

Taken in Pleasantville with a 12.5-inch Hyperion astrograph and ML16803 camera ("old CCD standby but still quite capable" per Olivier) over three nights in August and early September. RGB only, no luminance data. The field is 40.6 x 36.1 arcminutes.

The Full IC 1396 by Steve Bellavia

Here's pretty much the full extent of IC 1396, which requires a shorter focal-length telescope, in this case a 6-inch Celestron SCT fitted with a Starizona Hyperstar, using a ZWO ASI533MC Pro CMOS color camera and an Antlia dual band filter to give f/2 and a field of 2.2 x 2.01 degrees. Full technical information is at https://www.astrobin.com/o5yps3/. Steve made this image on July 24, 2023 at the Custer Institute in Southold, Long Island.

The multiple star system HD 206267 is in the center of the image. X-rays, ultraviolet rays and ionized particles, emanating from the star system are clearing out the core of the nebula and energizing the gas, particularly as it meets the dust that forms the Elephant's Trunk. The stellar wind from HD 206267 is moving at 3,225 km/s, among the highest stellar wind velocities ever measured.

Two Galaxies by Arthur Miller

NGC 2903

9th magnitude galaxy in Leo

NGC 3521

11th magnitude galaxy in Leo

Both images were made with an 11-inch SCT in Quail Creek, Arizona.

Messier 33 by Mauri Rosenthal

M33 is the third sister in our local group of galaxies. Smaller and fainter than Andromeda, the glittery face-on spiral makes for a good repeat imaging target.

In this case I've used the short exposure technique, live-stacking 8-second exposures, each with a dark frame adjustment, into six-minute stacks, then treating the stacks as calibrated subframes for integration in PixInsight. The total integration time of 75 minutes used 560 individual short exposures but I only had to transfer and process 12 files. Aside from eliminating tracking error, the short exposures prevent bright stars from "blowing out," helping me maintain color in the stars. AI tools, particularly BlurXterminator and NoiseXterminator, enable me

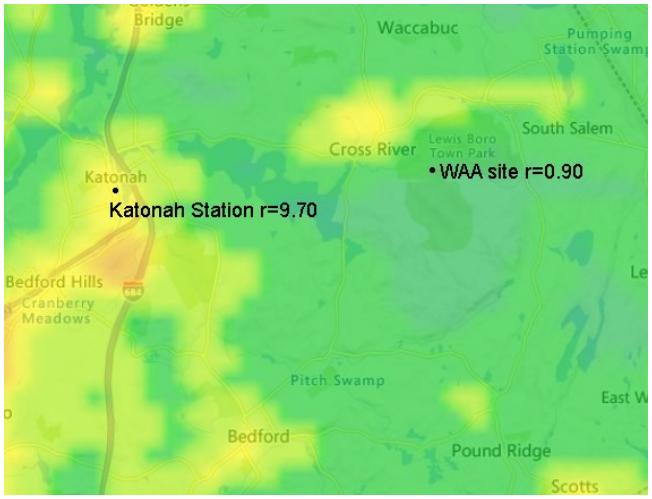
to achieve a finished, creamy look. My IDAS LPS-V4 filter falls in-between an older light pollution filter (only reducing typical street lighting wavelengths) and a new dual band filter (only allowing H-alpha and OIII wavelengths). While this distorts the colors of a white light target like a full spiral galaxy, PixInsight's Photometric Color Calibration helps rebalance the colors to match the stars to reference images. Of course, the filter helps with light pollution – my Yonkers yard is Bortle 7. Conditions were good on Saturday night and I didn't take a sky quality reading, but on recent similar nights I registered 18.7 SQM-L.

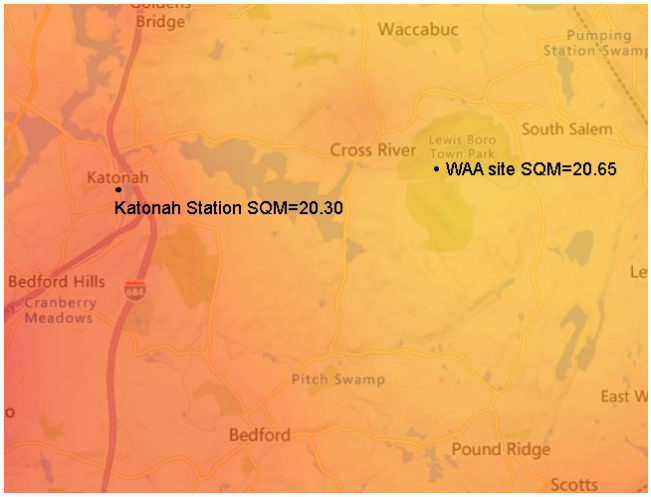
The scope used for this image is a Borg 71FL with a 1.08X Flattener. The camera is a ZWO ASI 533 MC Pro and the mount is a Rainbow Astro RST-135E harmonic drive. I use NINA for a 3-point polar alignment at the start of a session and SharpCap Pro for image capture including live-stacking and mount control during capture.

--Mauri Rosenthal

Editor's note on light-pollution measurements:

You can find light pollution maps at https://www.lightpollutionmap.info/. You can select from the World Atlas 2015 or the VIIRS (the Visible Infrared Imaging Radiometer Suite aboard the joint NASA/NOAA Suomi National Polar-orbiting Partnership [Suomi NPP] and NOAA-20 satellites) which gives radiance readings. The VIIRS data is annual, from 2012 to 2022 as of this writing. For astronomical purposes, the VIIRS data shows what an observer in space might see looking down at the Earth. The World Atlas map uses radiance data with additional calculations to account for atmospheric scattering, to show what an observer on the ground might see looking up. It uses the color-coded Bortle scale and also reports magnitudes per square arc-second, like a sky quality meter.





The VIIRS radiance map (left) and the World Atlas 2015 map (right) show a significant difference in the gradient between our observing site at Ward Pound Ridge Reservation and downtown Katonah (4.7 miles west of the Meadow Parking Lot). The direct radiation of light from Katonah is more than ten times greater than that from the park (not a surprise) but the sky brightness varies much less between the two sites.

Given the data published in *Science* last year that reported light pollution increasing at a rate of 10% per year, the 2015 value of 20.68 for WPRR is completely inapplicable today. It was probably not 20.68 in 2015, as noted in my measurement on page 11, and now it is much less. The map's Bortle reading of 4 for WPRR should probably be considered a full unit too low. It's still possibly the best place to observe in Westchester. Conditions down-county have changed less and Mauri's site in Yonkers is still probably Bortle 7. The 2015 map gives SQM of 18.88 for his location, as against his measured 18.7.

That things are getting worse in northern Westchester reflects continued commercial and residential development north of I-287 and the conversion to blue-enriched LED streetlights. Short blue wavelengths scatter more than longer yellow or red wavelengths, reducing sky darkness. Down-county has long been a light pollution disaster, which Mauri manages to transcend.

The Pleiades by David Parmet

David made this image at the Black Forest Star Party in Cherry Springs, Pennsylvania on September 29, 2023. He used a William Optics RedCat 51-mm f/4.9 telescope and ASI533 MC Pro camera, 20x180 seconds, 10 darks, flats and biases. The image was "pickled in PixInsight," per David.

The Pleiades' dusty nebulosity is actually a cloud of matter through which cluster's stars are moving. Astrophotographers in the very distant future may no longer see the wispy material, which was first noticed by Ernst Wilhelm Tempel in 1859 (see the January 2018 SkyWAAtch, page 5, for more information on Tempel).

Messier 16 by Larry Faltz

This shot was made at Ward Pound Ridge Reservation in July with the equipment described on page 11. The field of view is 0.92 x 0.92 degrees. I only captured about 30 minutes of signal and used darks but not bias or flat frames. I'm still early on the astrophotography learning curve. I'm not a PixInsight user (yet), but I did fool around with the image after I watched a couple of YouTube videos. To make the nebula more prominent I used StarNet++ to remove the stars, and then added them back at lower intensity using layers in GIMP. I also used Topaz Denoise AI to remove some residual noise.

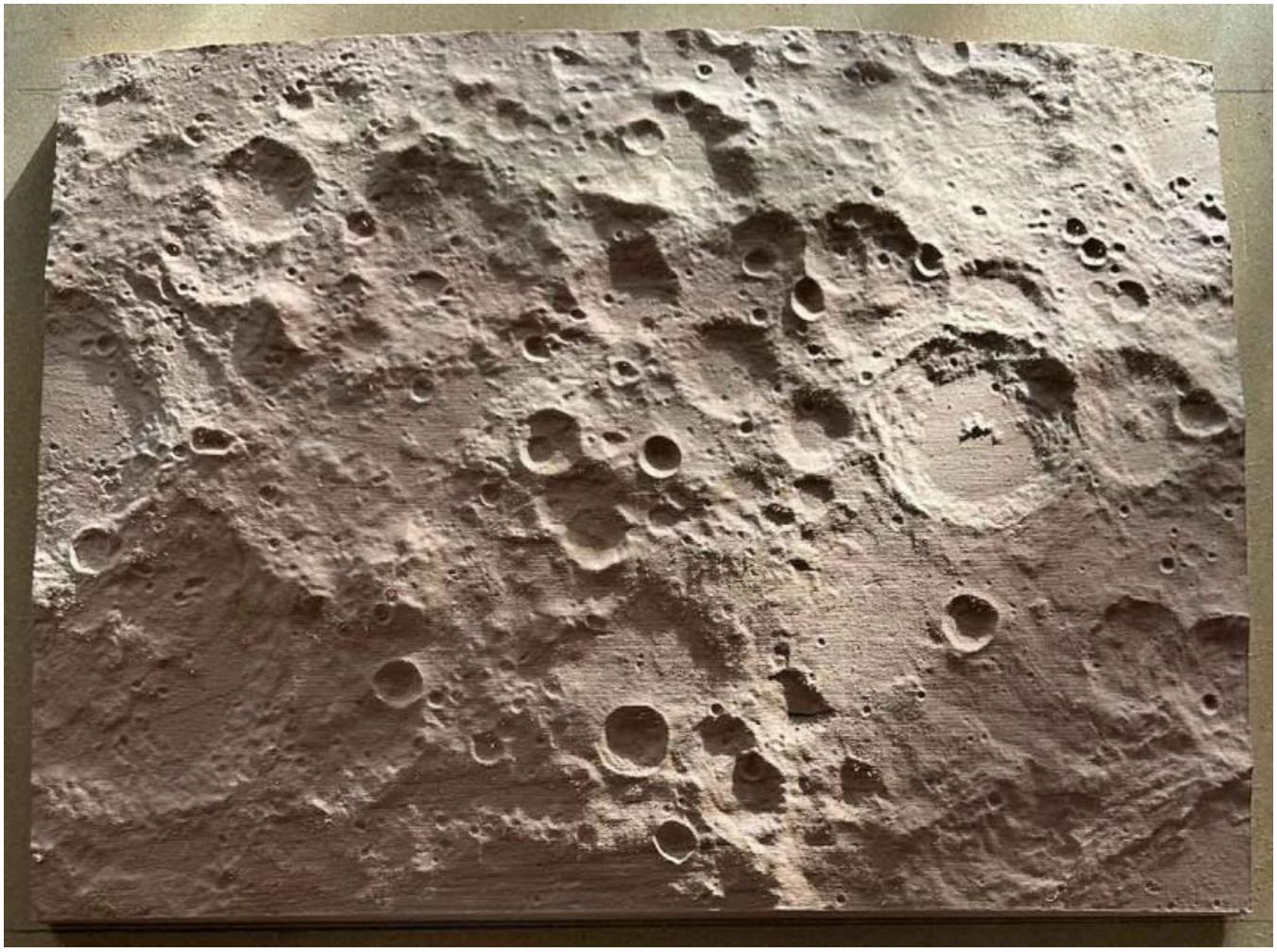
Seeing the Pillars of Creation on one's own image is always exciting, even if it's just a "beginner" shot or capture of an EAA (electronic-assisted astronomy) image. For a particularly spectacular image of M16, see David Parmet's shot from Cherry Springs in the October 2023 SkyWAAtch, page 23.

Super Blue Moon, August 30, 2023, by Larry Faltz

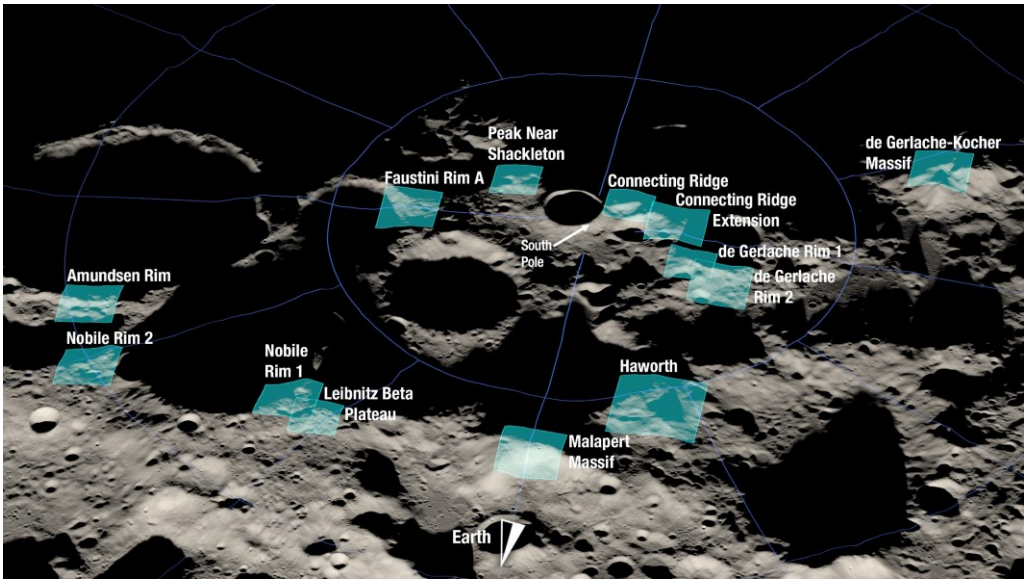
I find the publicity that surrounds the full Moon to be rather irksome. I hate that each full Moon is given a name, presumably from some indigenous culture, which is then splashed across my phone's news feed. These quaint appellations reflect and may perpetuate scientific ignorance. The Moon is magnificent enough with just the name "Moon," isn't it? The "Harvest Moon" I understand, because it has an actual impact on agricultural behavior: the low angle of the ecliptic to the horizon around the autumnal equinox means that there is a bright, near-full Moon in the evening for a few days running, extending the time that it's light enough after sunset to reap crops (it's not a good idea to be swinging a scythe in complete darkness). And it recalls the old song that ends up being a veritable earworm once you think of it (sorry!). But the other names given to full Moons are simply silly. It's 2023: these Moons deserve *modern* appellations. January ought to be "The High ConEd Gas Bill Moon," April's should be the "Form 1040 Moon," and November's could be "Another Thanksgiving Dinner with Your Obnoxious Relatives Moon." October should of course be "The Mets Are Not In the Playoffs Again Moon."

And as for "supermoons," well, yes they appear larger in the sky because they are at lunar perigee, but let's face it: if you want the Moon to be larger, just increase the focal length your optic. Anyway I bit the bullet for the August 30 "super Blue Moon" ("Blue" because it was the second full Moon in the month. See the September 2015 SkyWAAtch, page 10 for the full story on why it's called "blue") and went to Larchmont Harbor to wait for it, DSLR at the ready, hoping to make an artistic shot and possibly capture it within the Belt of Venus. But there were low clouds over Long Island that blocked the entire Moon for a degree and a half, washed out the Belt and obscured lunar details. Here's the "The best laid schemes o' mice an' men gang aft agley Super Blue Moon."

The Lunar South Pole by Howard Fink



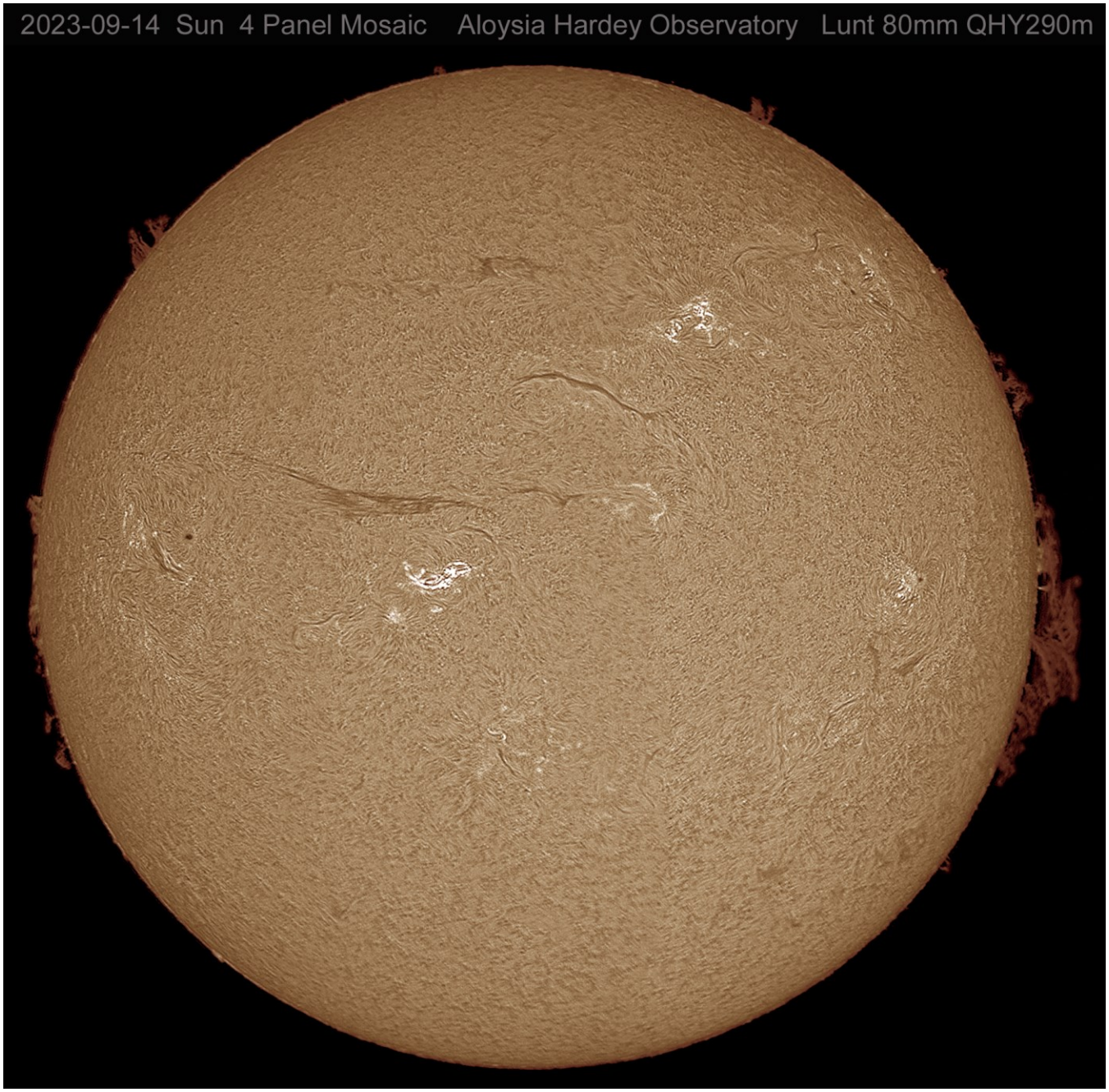
This is not a lunar photograph (this view can't be seen from Earth) but a 12" x 16" 3-D relief model at a scale of 1:1,500,000, using data from NASA's Celestial Mapping System. Howard made this using CNC machining. The material is clear cherry lumber. Machining took approximately 4 hours.



The model encompasses all thirteen of the proposed Artemis III mission landing sites. Artemis I, an uncrewed fly-by, took place in December 2022. Artemis II, a crewed fly-by, is scheduled for November 2024. The Artemis III mission, an actual landing, is now scheduled for 2025.

This image is a map of the proposed Artemis III landing zones. (NASA).

The Hydrogen-Alpha (656.28 nm) Sun on September 14 by Rick Bria



Rick writes:

This is a four panel mosaic of the Sun taken at the Aloysia Hardey Observatory on September 14, 2023. I was at the observatory for routine maintenance when I noticed the sky was perfectly clear and decided to have a look at the Sun. I was surprised to see a huge prominence along with several smaller ones arching from the Sun's disc. This was the largest prominence and the most activity I've seen on the Sun. I quickly attached the QHY290M camera to the 80mm Lunt solar telescope and started acquiring data.

Previous solar imaging tests indicated a four panel mosaic should be employed when imaging the Sun with this telescope/camera combination. The resulting image confirms the mosaic strategy records more surface and prominence details than single images. The original png file is over 13 MB.

Hydrogen-Beta Sun (486.1 nm) by John Paladini

John used a spectroheliograph, which is capable of imaging the Sun at any wavelength. In this case the image, made on October 5, is at the hydrogen-beta wavelength. The incredible detail is generated by a new diffraction grating in the instrument. It has 3600 lines per millimeter (91,440 lines per inch). The bandpass is <0.2 Å.

John wrote “Huggins would have wished he had one of those gratings,” referring to William Huggins (1824-1910), the English amateur astronomer who was a pioneer in stellar spectroscopy. In 1864 he found that the planetary nebula NGC 6543 (the Cat’s Eye) had a bright line spectrum, with two greenish lines which could not be identified as of any known element and were assigned to a hypothetical element, "Nebulium." We know these are the “forbidden” lines of doubly ionized oxygen (OIII). He concluded that this nebula was not composed of stars, which have a continuous spectrum, but of glowing gas. On May 18, 1866, he made the first spectroscopic observation of a nova and found emission lines of hydrogen. In 1868 he observed the spectrum of a comet and identified the spectral lines of ethylene.

Research Highlight of the Month

Sun, G, Faucher-Giguere, C-A, Hayward, C, Shen, X, Wetzel, A, Cochrane, RK, Bursty Star Formation Naturally Explains the Abundance of Bright Galaxies at Cosmic Dawn, *Astrophysical Journal Letters*, 955:L35, October 1, 2023. https://iopscience.iop.org/article/10.3847/2041-8213/acf85a.

The James Webb Space Telescope was primarily designed to extend our reach to the earliest galaxies in the universe, with red shifts greater than 10. The cosmic microwave background formed 380,000 years after the Big Bang, at a red shift of 1096, but the first stars and galaxies only formed a few hundred million years later, at red shifts of 20 or so. Theory says they should be small and not too luminous, relying on mergers to grow.

The JWST's haul of early galaxies was perplexing. They were brighter than expected in the UV (red-shifted to the IR by the expansion of the universe) than would be expected from the current cosmological model, known as ΛCDM, which assumes the presence of cold dark matter and a small cosmological constant that accelerates expansion of the universe at the current epoch. Many simulations of the early universe have shown that, given inputs consistent with current theory, mass density, theories of star formation and other factors, a universe consistent with the density variations at the time of the CMB would evolve into the universe we see today, with galaxies, dwarf galaxies, galaxy clusters, and cosmic voids all at the dimensions that have been measured. But the early galaxies detected by JWST should have had lower star formation rates. Is ΛCDM wrong?

Although astronomers have a good idea of the physics and chemistry of star formation in the current universe (see "Stars Come in All Sizes: in the June 2023 SkyWAAtch), most of the details of star formation at earliest times are highly speculative.

In this highly technical paper, the authors used a well-accepted supercomputer simulation to address the question, proposing that the rate of star formation in the earliest galaxies was "bursty." That is, there were intermittent but intense cycles of gas inflow, star formation, star maturation, and gas outflow. If this was the rhythm of star formation in these early, high ultraviolet luminosity galaxies, it would account for the JWST's census of early galaxies and preserve ΛCDM as the leading cosmological theory.

However, the failure to find dark matter (see "Axions as Dark Matter" in the July 2023 SkyWAAtch) and a growing list of well-known observers and theorists who are skeptical about the very existence of dark matter (among them Pavel Kroupa and Sabine Hossenfelder) means we are still far from certain about how the universe works and what makes these early galaxies so bright in the UV. Consistent with simulations, but with reality?

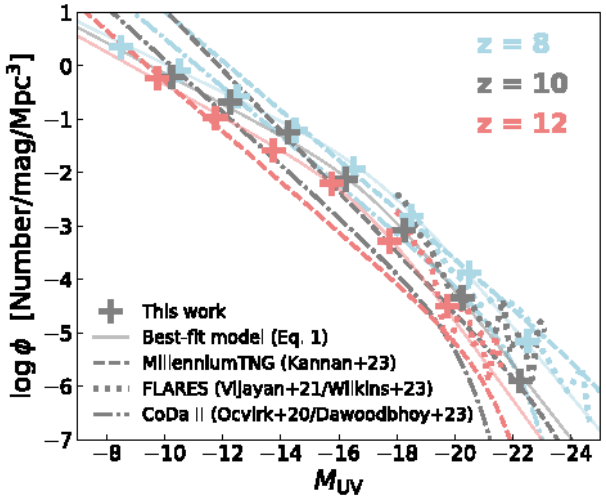


Figure 2. Dust-free UVLFs at $z = 8$, 10, and 12 predicted by the FIRE-2 simulations and from the literature.

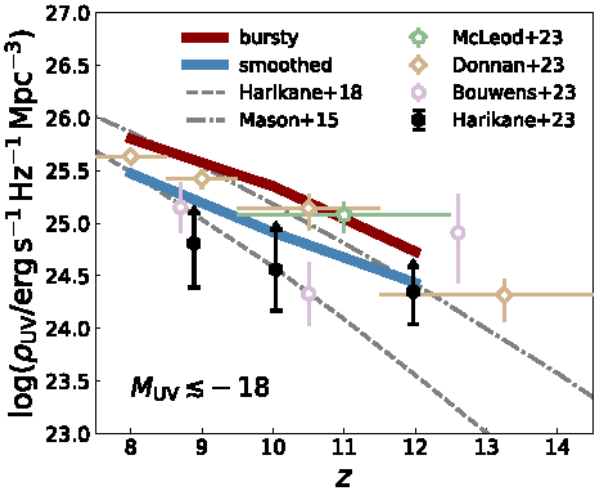


Figure 3. The cumulative UV luminosity density $\rho_{\rm UV}(<M_{\rm UV,lim})$ integrated down to $M_{\rm UV,lim} \simeq -18$ with dust attenuation included

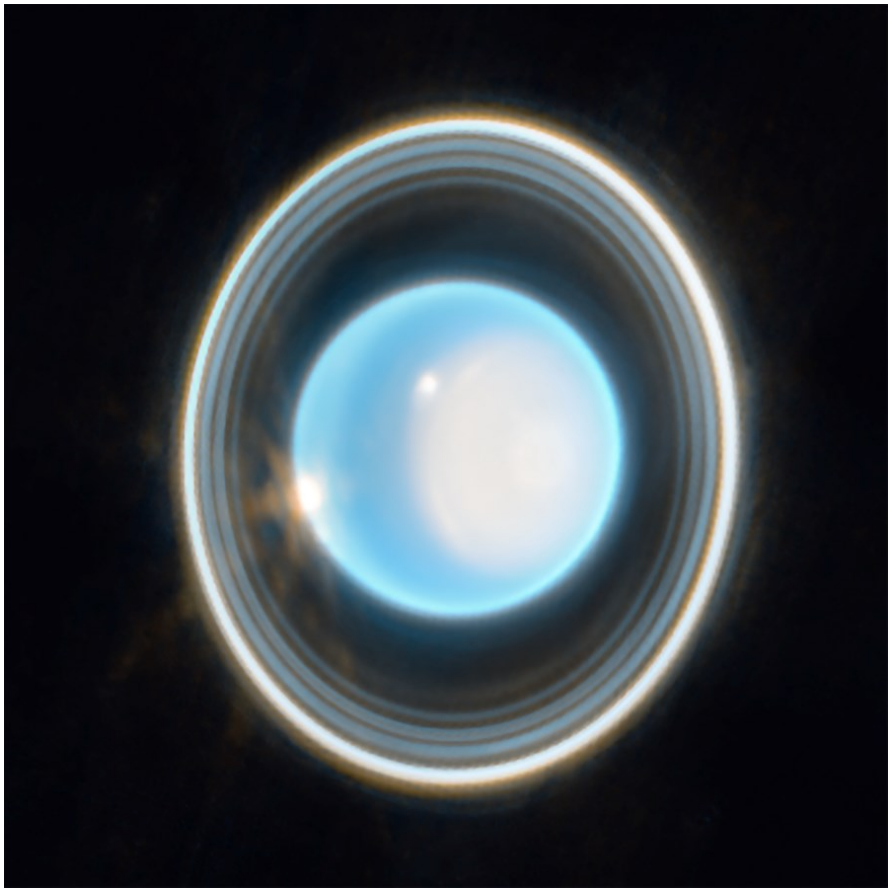
Member & Club Equipment for Sale			
Item	Description	Asking price	Name/Email
Apertura AD8 8-inch f/5.9 Dobsonian	Purchased from High Point January 2022, used once. The scope is in new condition. 2" Crayford dual-speed focuser, mirror cooling fan, RACI finder. Two eyepieces, Farpoint lifting straps, 1 lb magnetic counterweight, Bob's Knobs installed. Apertura collimator. Original boxes with foam packing.	$500	Mark Lane jmarklane@gmail.com
Orion 6-inch f/5 reflector on EQ mount	Little used, if at all. Solid EQ4-type non-go-to equatorial mount with an electric RA drive as well as slow-motion stalks. The setting circles are large and very readable, unlike most EQ mounts for scopes of this size. An image of the mount head is here. 9 and 25 mm Plössl eye-pieces, polar alignment scope with reticle, Orion flash-light, finder, counterweights, gold-colored aluminum tri-pod (missing tripod tray, but you can make one easily enough). Good intro scope for a bright young person. A 6" f/5 OTA alone costs at least $300. Donated to WAA.	$150	WAA ads@westchesterastronomers.org
Celestron Nexstar 114 GT telescope	Computer-controlled go-to reflector, 114 mm f/8.7 (1000-mm focal length). Nexstar hand control, finder, 25-mm eyepiece. Excellent condition. Good beginner scope. Image here.	$125	Eli Goldfine emgoldfine@gmail.com
Celestron Cometron telescope	Small, lightweight 114 mm f/4 reflector. Red dot finder, 25 mm eyepiece. Dovetail bar. A light travel scope or a wide-angle starter scope for a smart, interested child. No tripod: will fit on a camera tripod. Excellent condi-tion. Donated to WAA.	$40	WAA ads@westchesterastronomers.org
Explore Scientific FirstLight EXOS Nano Mount EQ3	Non go-to GEM mount. Payload 15 lbs,; weight of mount head 10 lbs. Counterweights. Tripod has 1¼" legs. Excellent condition. Would be a good grab-and-go mount. Could even be configured as an alt-az. See an image here.	$120	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 the dovetail bar. Like new condition, no scratches. See them on the ADS site at https://tinyurl.com/ADM-R100. List $89.	$50	Larry Faltz lfaltzmd@gmail.com
Tiltall photo/spotting scope tripod	TE Original Series solid aluminum tripod with 3-way head, center stalk. Very solid. 3-section legs. Height range 28.5"-74". Can carry up to 44 lbs. Folded length 29.6". Weighs 6 lbs. Carry bag. Image here. List $199.50. Donated to WAA.	$75	WAA ads@westchesterastronomers.org
RUBYLITH Screens	I have two 1/8" thick rubylith screens for placing over a laptop or tablet screen. Sizes are 14½x9" (for 17" diago-nal 16:9 laptop) and 10½ x 7" for a tablet. Includes strong rubber retainers. I don't need them anymore. First come, first served.	Free	Larry Faltz lfaltzmd@gmail.com

Want to list something for sale in the next issue of the WAA newsletter? Send the description and asking price to waa-newsletter@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 be-longs to WAA (and will be so identified). Sales of WAA equipment are final. *Caveat emptor!*

Spy the Seventh Planet, Uranus

By Liz Kruesi



Uranus hosts 13 faint rings, 11 of which are visible in this JWST image. The planet was 19.67 times the Earth-Sun distance from our planet (1.83 billion miles) when JWST captured exposures through two near-Infrared filters on February 6, 2023. The white region in the right side of Uranus is one of the planet's polar caps. This icy world orbits the Sun differently from the rest of the solar system's planets – Uranus rolls along on its side.

[NASA, ESA, CSA, STScI; Image Processing: Joseph DePasquale (STScI)]

For more about this unusual planet, visit NASA's Uranus page https://science.nasa.gov/uranus/.

You might be familiar with Saturn as the solar system's ringed planet, with its enormous amount of dust and ice bits circling the giant planet. But Uranus, the next planet out from the Sun, hosts an impressive ring system as well. The seventh planet was the first discovered telescopically instead of with unaided eyes, and it was astronomer extraordinaire William Herschel who discovered Uranus March 13, 1781. Nearly two centuries passed before an infrared telescope aboard a military cargo aircraft in 1977revealed the planet had rings.

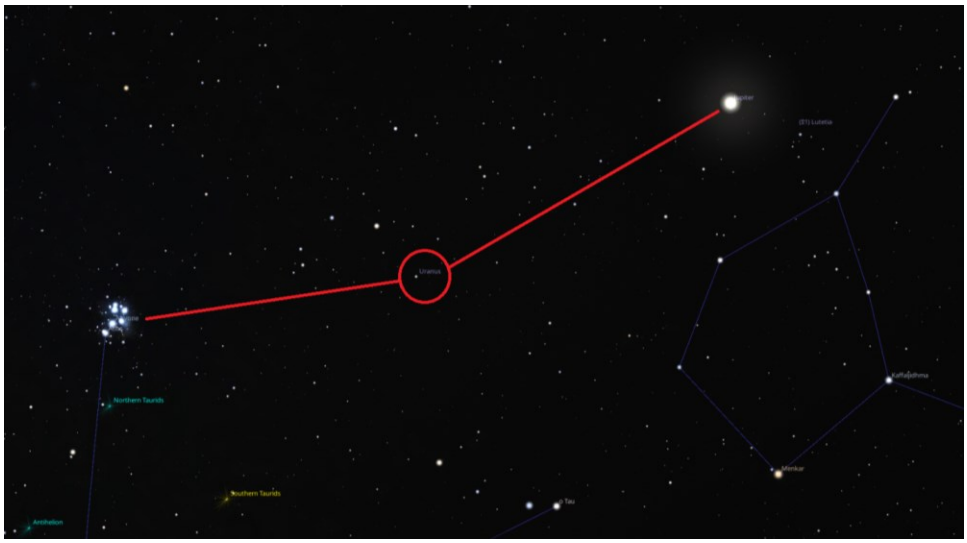
[1]

Since that discovery, multiple observatories have revealed more details of Uranus and its ring system. Most recently, the NASA-led JWST space observatory captured the planet and its rings in detail. This recent image combines just 12 minutes of exposure in two filters to reveal 11 of the planet's 13 rings. Even some of the planet's atmospheric features are visible in this image. Even with advanced imaging like that from JWST, much of Uranus remains a mystery, including why it orbits the Sun on its side. Only one spacecraft has ever visited this planet: NASA's Voyager 2, which flew by Uranus in 1986.[2]

[1] For more about the infrared scope, https://web.archive.org/web/20230429120852/https://www.nasa.gov/vision/universe/watchtheskies/kuiper.html

[2] See more about the flyby at https://www.nasa.gov/history/35-years-ago-voyager-2-explores-uranus/

Planetary scientists are hoping to change that soon, though. Scientists recommended in a report (https://is.gd/UranusReport) released last year from the National Academies of Sciences, Engineering, and Medicine that Uranus be the focus on the next big planetary science spacecraft mission. Such a large-scale mission would gain insight into this icy giant planet and the similar solar system planet, Neptune.



Sky map picturing M45, Uranus and Jupiter, Stellarium

If you want to catch Uranus with your own eyes, November is prime time to view it. This ice giant planet is perfectly position this month, coming into opposition on November 13th when it will be on the other side of the Sun from Earth, at a distance of 1.7 billion miles. The planet will be at its brightest, magnitude 5.6. This disk is 3.8 arcseconds in diameter, resolvable as a planet in small telescopes at high power.

To find it, look overhead (45 to 60 degrees above the horizon, southeast to south, depending on the time of the night) in a dark sky just after midnight mid-month (a little later earlier in November and earlier in the second half of the month). Uranus will lie about halfway between the brilliant planet Jupiter and the diffuse glow of the Pleiades star cluster (M45). While Uranus may look like a bright blinking star in the night sky, its blue-green hue gives aways its identity. Binoculars or a telescope will improve the view and are needed in our area because of light pollution. Here's a more detailed finder chart from in-the-sky.org for non-go-to scope users.