SkyWAAtch

The Newsletter of Westchester Amateur Astronomers

June 2025

APEX 2021 Awards for Publication Excellence · APEX 2022 Awards for Publication Excellence · APEX 2023 Awards for Publication Excellence · APEX 2024 Awards for Publication Excellence

NGC 3718 by Olivier Prache

Using his telescope and camera at the Starfront Observatory in west Texas, Olivier combined 44 hours of subs to make this extremely deep image of the spiral galaxy NGC 3718, which is being warped by gravitational interaction with NGC 3729, the galaxy to its right. These galaxies are 47 and 63 million light years distant, respectively. Above NGC 3718 is the galaxy group Hickson 56 (also catalogued as Arp 322), five galaxies that are almost ten times farther away from us than NGC 3718. On the original image, 21st magnitude SDSS quasars are visible, along with hundreds of faint, distant galaxies. This image is deeper and more detailed than SDSS and PanSTARRS images on CdS! The field is 70.9 x 52.8 arcminutes. North is down. See page 22 for more on this image.

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 June Meeting

Friday, June 13 at 7:30 pm

MOXIE- The Oxygen Generator on Mars

Piyush Khopkar

Software Engineer & NASA Solar System Ambassador

The Mars Oxygen ISRU Experiment (MOXIE) is an instrument on board NASA'S Perseverance rover, currently exploring Mars. In 2021, MOXIE successfully produced oxygen from the carbon dioxide that comprises ~95% of the Martian atmosphere, demonstrating, for the first time, the ability to harvest and process existent resources on another planet. A scaled-up MOXIE would contribute to sustainable human exploration of Mars, providing both life support and the oxygen required for a rocket to transport astronauts back to Earth.

Piyush Khopkar is part of the MOXIE and the Mars 2020 – Perseverance Rover mission team. In the MOXIE project, he developed tools and simulations for MOXIE's operation and data analysis and made significant contributions towards operating MOXIE on Mars. Piyush has served as a NASA/JPL Solar System Ambassador since 2016, joyfully sharing the excitement of space exploration through public presentations and outreach. Piyush is a recipient of NASA's Group Achievement Awards as a part of the MOXIE team.

Also In This Issue

WAA September Meeting

Friday, September 12 at 7:30 pm

Members' Night

There are no meetings in July or August.

Starway to Heaven Star Party

Ward Pound Ridge Reservation, Cross River, NY

Saturday, June 21 and Saturday, June 28.
Weather permitting.

New Members

Meaddows Ciuzio	Ossining
Andrew Hyman	Larchmont
Lou Serico	Yonkers
Steven Shepard	Larchmont
Frank Torre	Carmel
Jordi Weinstock	Belmont

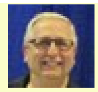
Renewing Members

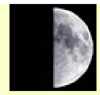
Christopher Abbamont	Goldens Bridge
Arun Agarwal	Chappaqua
Jason Alderman	Pelham
Paul Alimena	Rye
John Benfatti	Bronx
Frank and Kathy Clemens	Larchmont
Emily Dean	Pelham
John DeCola	Mt Kisco
Everett Dickson	Dobbs Ferry
Barry Feinberg	Croton on Hudson
Mitchell and Mary-Ann Feller	Cortlandt Manor
Howard Fink	New York
Thomas Lambe	Bronxville
John Paladini	Mahopac
Claudia & Kevin Parrington	North Salem
Ash Perry	Larchmont
Arlene Persampieri	Mamaroneck
Lydia Maria Petrosino	Bronxville
Charles Pevsner	Riverside
Ajay Royyuru	Yorktown Heights
William Sawicki	Bronx
Karen Seiter	Larchmont
Dante Torrese	Ardsley
Daphne Tsai	White Plains
Alan Young	Tarrytown

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

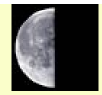
ALMANAC for June 2025

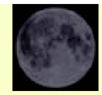
Bob Kelly, WAA VP of Field Events


Bob Kelly


1Q June 2


Full June 11

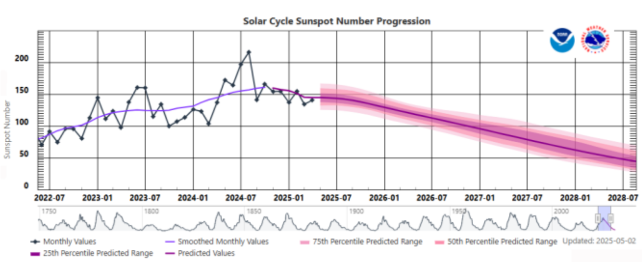

3Q June 18


New June 25

Sun Gets in Your Eyes

The solar "sun stop" or "solstice" occurs on June 20th at 10:42p.m. EDT. The Sun reaches its maximal elevation in the northern hemisphere and the day is the longest of the year (and the opposite in the southern hemisphere). On 20th, astronomical twilight ends at 10:38 p.m. and starts again at 3:15 a.m. EDT, giving us just 4 hours and 37 minutes of total darkness. But, that's not all that's up about the Sun. Some of our planetary neighbors are caught up in the brightness. Mercury is struggling out of its late May solar conjunction. Jupiter meets up with the Sun from our vantage point on the 24th and Uranus slides out from its mid-May conjunction.

The Sun's activity has been on-again, off-again, with some tantalizing aurora activity as far south as upstate New York. Time and observations suggest we have started on the downslope of solar activity for cycle 25, but the sunspot numbers are still substantial. Check the solar observatories to see if any large sunspot groups are worth seeing with the safety of a good solar filter or a hydrogen-alpha scope.



Solar cycle data for the peak of cycle 25 from the Space Weather Prediction Center,[1] through April 2025. The pink line shows 25% confidence interval for future predictions.

Morning's Odd Couple

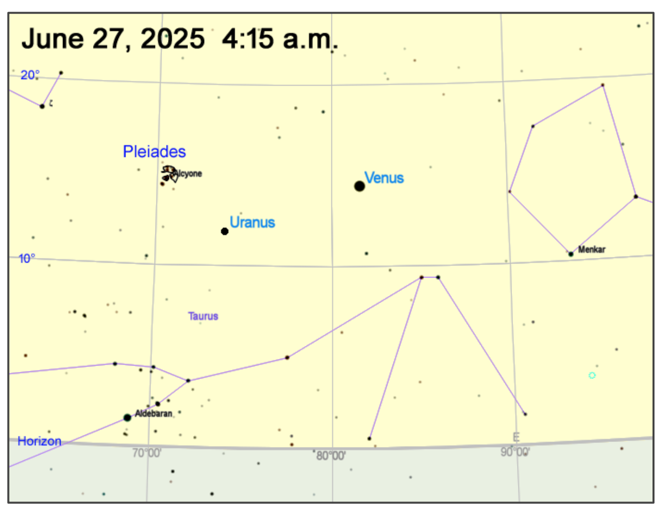
Saturn is flying up out of the morning twilight, seeming to take Neptune with it. They will keep close company, about a degree apart, into August. This is a great time to get a medium power eyepiece on this unlikely pair with Saturn appearing seven times brighter and larger than Neptune. Saturn's rings are starting to angle a bit wider, but they are tilted only three degrees from edge-on. This is near their maximum for the year. Titan, Saturn's brightest moon, is great to observe. In a few months it will cast its shadow on the planet. Iapetus is at its brightest, three Titan distances to the west of the planet, maxing out on the 12th. The two-faced dark/bright moon will be passing well south of Saturn at its superior conjunction on July 1st, which might be a good time to spot the wide-ranging moon.

Morning Domination

Lying low, getting dimmer and showing a less obvious phase, Venus is still incredibly bright at magnitude -4.3, on its way to dimming to -3.9 by late summer. Venus is about 18 degrees above the eastern horizon in twilight, well to the right of the rising Sun. Greatest elongation is on the 1st. The waning crescent Moon poses nicely with the second planet on the 22nd and 23rd. For context, Saturn is well to the upper right.

Morning Tag-Alongs

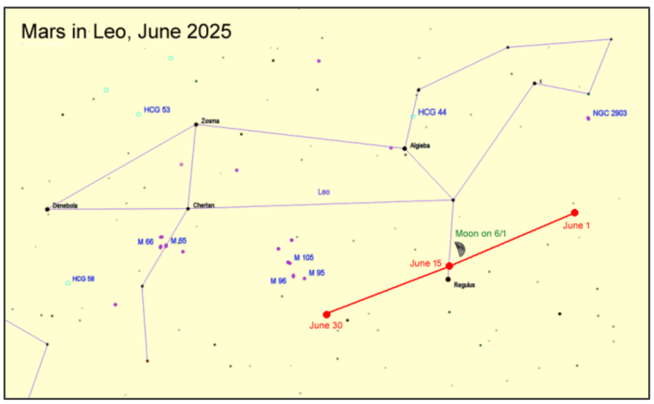
Uranus looks like it's chaperoning the nearby Seven Sisters, not that they need it, as both climb out from their conjunction with the Sun in late June. They sweep up toward Venus as it starts to fall from greatest elongation.



[1] https://www.swpc.noaa.gov/.

Evening Variety: Mars and Mercury

Mars still holds a place in the evening sky. It's tiny, even in a large telescope, just 5.5 arcseconds in diameter on the 1st and 4.9 arcseconds on the 30th. Mars slides over toward the bright star Regulus which stands out as the bright dot at the bottom of Leo's backwards question mark. The Moon hops between the two on the 1st. Regulus and Mars are closest on the 16th, matching brightness at magnitude +1.4. They could be twinsies! Do they really look the same brightness? Compare their colors and any observable differences between them that are due to one being a star-like point and the other being a discernable dot.



In the second week of June, Mercury peeks up out of the Sun's glare to see what's happening in the evening sky. On the 8th, Mercury passes Jupiter on the gas giant's rush to the exit. Both will be hard to see so low in twilight. Later in the month, Mercury lies to the left of Pollux and Castor in Gemini. A thin sliver of our Moon joins the line on the 26th. Mercury's brightness fades from magnitude -1.0 to +0.2 during the second half of the month, even as it gains elevation in the twilight, maxing it's altitude on the 26th. The first planet appears slightly larger and less gibbous later in the month.

Meteors?

There are no nighttime showers this month, but *Sky & Telescope's* Bob King notes a few earth-grazing meteors from the daytime Arietid shower might be seen soaring above the eastern horizon before sunrise around the 7th.

Fewer Space Station Sightings

The International Space Station shows up only in our morning skies, and then only starting on the 20th. Tiangong sightings are limited to the evening sky, and then only through the 8th. Of course there seem to be about a billion tiny satellites rushing across the sky.

Undulatus Clouds

Virginia resident Steve Bellavia lives just 10 minutes from Chippokes State Park. It's just across the James River from Jamestown, the first permanent English settlement in the western hemisphere. It's also 15 miles from Newport News and 32 miles from Norfolk, but dark enough for astrophotography. While waiting for clouds to clear on the evening of May 24, Steve captured these undulatus clouds.

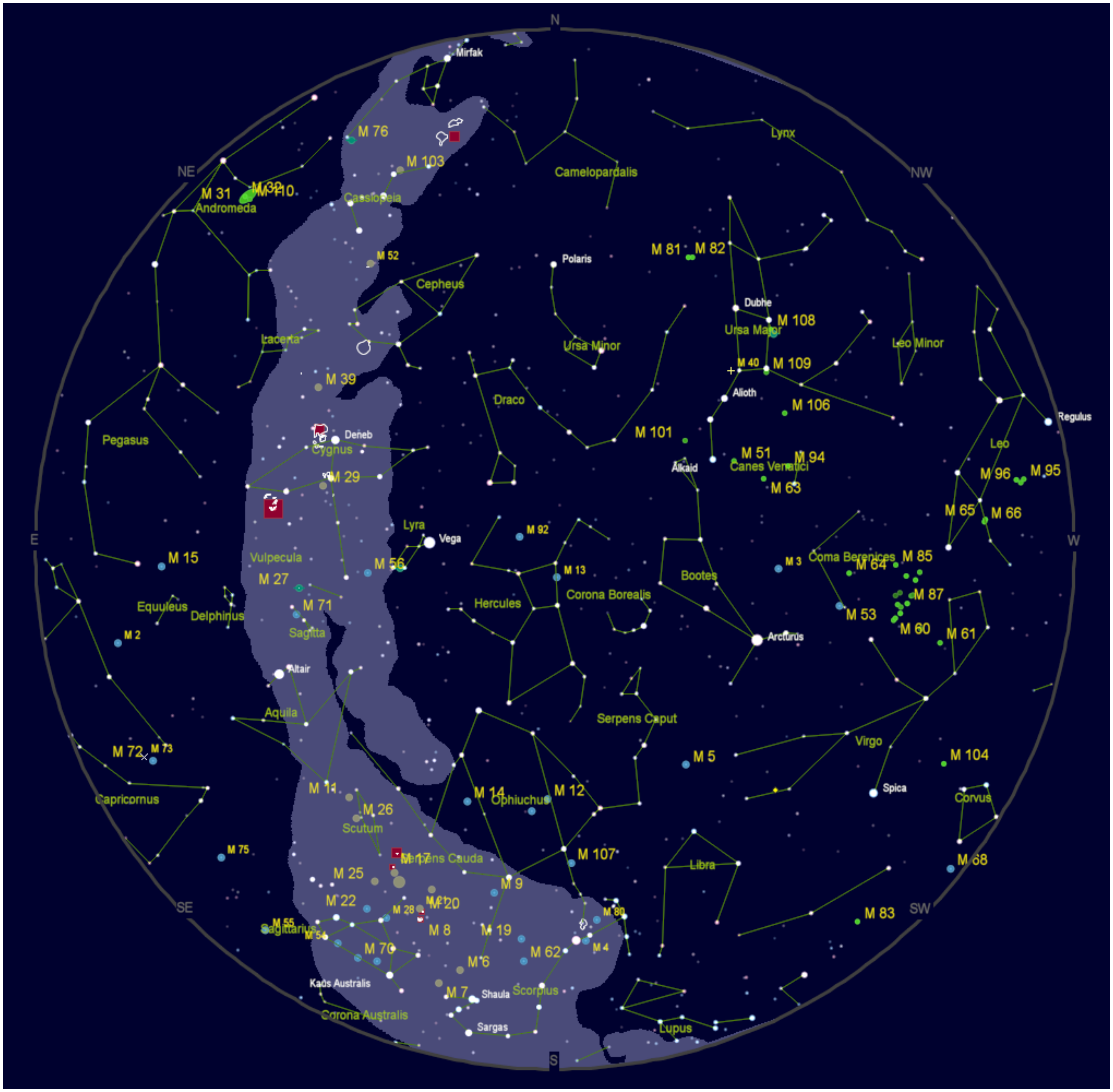
Six different types of clouds can take on undulatus morphology. Wind at the clouds' height blows at right angles to the serrated cloud banks. The clouds above are probably altostratus undulatus (sounds like the stage name of an exotic dancer in ancient Rome).

Happily for Steve the clouds were gone in the early morning hours. He was able to make a nice image that we'll show next month.

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: Eric Baumgartner

June Sky Map



The map above shows the night sky from Westchester at 1 a.m. EDT on June 1, midnight on June 15 and 11 p.m. on June 30. Solar system objects are not shown (but there aren't any except the Moon this month!).

Join the WAA Discord Server

Discord is an app (iOS, Android, Windows) that will vastly enhance communication within the club and increase the value of your membership. It's free.

Join the "Office Hours" Discord chat hosted by WAA President Jordan Webber every other Wednesday at 7:00 p.m. For more information and to join, go to https://is.gd/WAADisc.

Annual WAA Member Picnic

Saturday. July 19, 2025, from 12pm - 4pm

Croton Point Park, Pavilion 1

RSVP by Monday, July 14 to:

Eva Andersen: andefam55@gmail.com or text 845-803-4949

Please include number attending and any food allergies

Make your plans now to join us for the annual WAA Member Picnic at beautiful Croton Point Park. Spend a relaxing and fun afternoon catching up with old friends and making new acquaintances. *A benefit of your membership is our annual complimentary member picnic.* Our memberships are considered family memberships so feel free to bring family members or a guest.

The club will provide hot dogs, hamburgers, chicken, veggie dogs & veggie burgers, salads, chips and non-alcoholic drinks. We supply condiments, plates, cups, utensils, napkins and official WAA club cookies. **Bring your own beer and win**e. **Hard liquor is not permitted on Park grounds**. We will provide coolers and ice for your beverages. Feel free to bring a side dish or dessert to share.

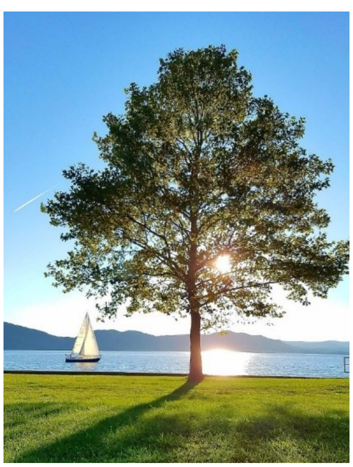
Meet us in Pavilion 1, located at **1A Croton Point Avenue, Croton on Hudson, NY 10520**. The pavilion has capacity for 200 people and includes picnic tables and cooking grills. **This is a rain or shine event.**

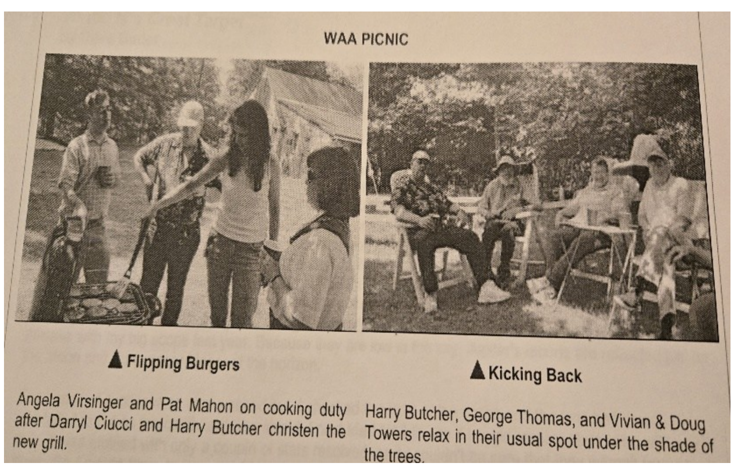
Croton Point Park is a lovely 508-acre Westchester County Park located on the largest peninsula on the Hudson River. This Park is well known to **bird watchers,** so bring your binoculars! There are several **hiking** trails in the park. **Dogs** are permitted but must be leashed at all times.

For more information: **https://parks.westchestergov.com/croton-point-park**

There is no cost for the picnic and no admission fee to enter Croton Point Park but there is a **parking fee:** $5 per car for Westchester Park Pass holders, $10 per car without Park Pass.

The annual Trivia contest will be held at 2PM!





WAA PICNIC

▲ Flipping Burgers

Angela Virsinger and Pat Mahon on cooking duty after Darryl Ciucci and Harry Butcher christen the new grill.

▲ Kicking Back

Harry Butcher, George Thomas, and Vivian & Doug Towers relax in their usual spot under the shade of the trees.

STATE OF NEW YORK
EXECUTIVE CHAMBER
ALBANY 12224

KATHY HOCHUL
GOVERNOR

April 11, 2025

Westchester Amateur Astronomers
P.O. Box 44
Valhalla, NY 10595

Dear Friends:

It is my pleasure to send greetings to everyone gathered for Westchester Amateur Astronomers' 40th Anniversary Celebration.

Since its inception, Westchester Amateur Astronomers (WAA) has united people of all ages to pursue their shared interest in observing our universe. From gathering at "Starway to Heaven" parties, to attending lectures by expert astronomers, members embrace all the opportunities that WAA provides.

Today, you gather to celebrate Westchester Amateur Astronomers's four successful decades, while looking forward to the club's future. On behalf of all New Yorkers, I am grateful for your dedication to creating opportunities for fans of space in our state. Best wishes for an enjoyable celebration.

Sincerely,

Kathy Hochul

Kathy Hochul
Governor

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Deep Sky Object of the Month: NGC 6229

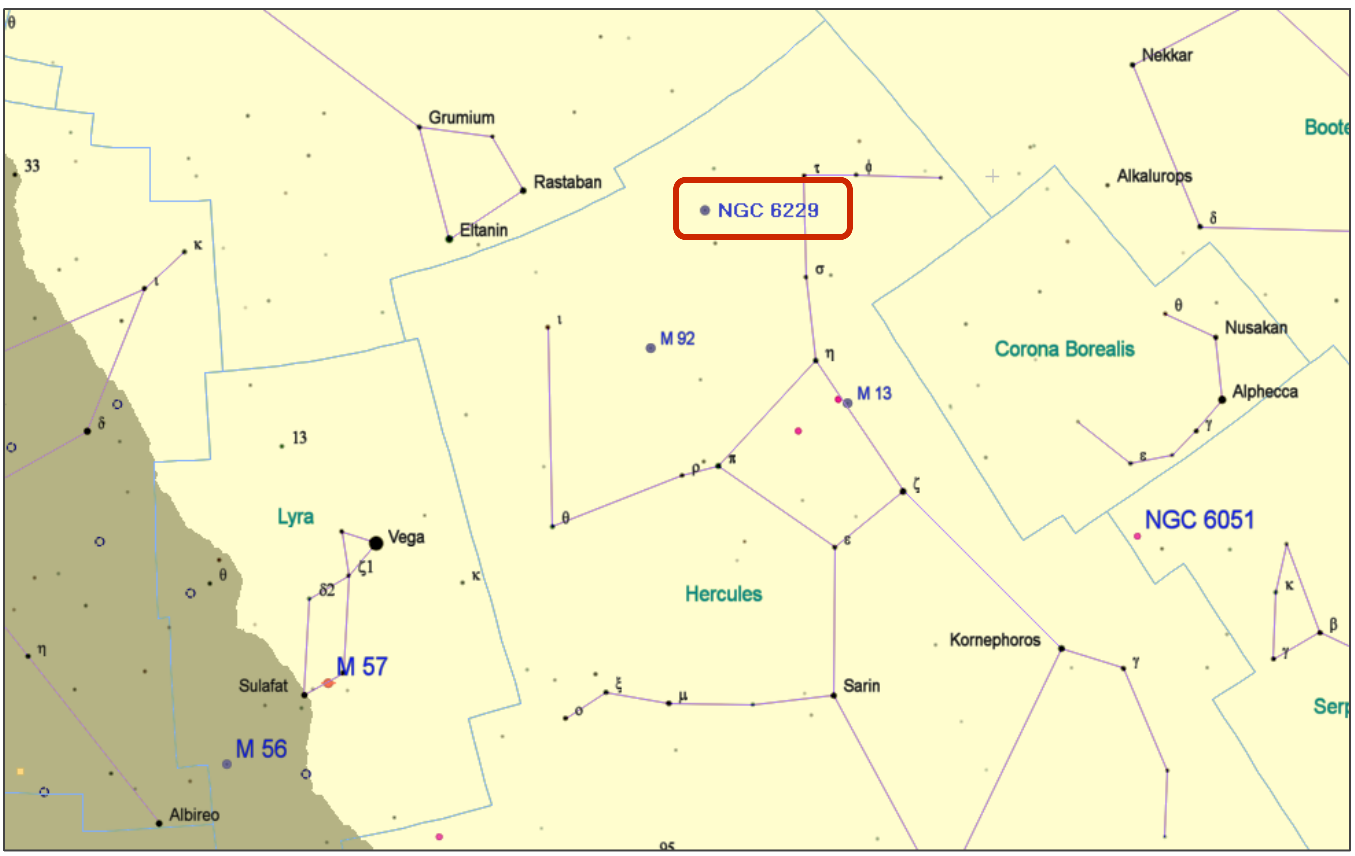
NGC 6229	
Constellation	Hercules
Object type	Globular Cluster
Right Ascension J2000	16h 46m 58.8s
Declination J2000	+47° 31′ 40″
Magnitude	9.4
Size	4.5 arcminutes
Distance	100,000 light years
Discovery	William Herschel May 12, 1787

Everyone looks at Messier 13, the Great Hercules Cluster. At magnitude 5.8 it's easily visible in small telescopes. Also frequently observed in Hercules is Messier 92, at magnitude 6.4. More challenging is NGC 6229, just 7 degrees north of M92, but three magnitudes dimmer. It's four times farther away than either M13 or M92. Two bright stars, each 6 arcminutes from NGC 6229, are 8th magnitude.

NGC 6229 is composed of two generations of stars and might be the core of a dwarf galaxy that was disrupted by the Milky Way.

Visibility for NGC 6229			
11:00 p.m. EDT	6/1	6/15	6/30
Altitude	67° 51′	76° 52′	83° 25′
Azimuth	62° 51′	54° 54′	07° 01′

See Johnson, CI et al. https://arxiv.org/pdf/1709.00048 for a spectroscopic analysis of this object.



Another Movie Telescope: *Furiosa*

Given that the action takes place in post-nuclear desert Australia where detecting the enemy at a distance is important, telescopes might be expected to show up in the latest "Mad Max" franchise film, *Furiosa: A Mad Max Saga*. Typical of the genre, there are lots of freaks, bizarre bad guys, mutants, ridiculous stunts with motor vehicles, gratuitous violence and gruesome deaths. We didn't pay close attention to the film, but scanning through it we found a venerable orange tube Celestron C8 with original finder. In another scene we see half dozen smaller telescopes.

In one scene we see an example of Hollywood's frequent inability to understand how a reflector works. They must assume everyone thinks you always look through the "bottom" of a telescope. The prop department placed some type of curved glass in the mirror cell to emulate a lens. Little did they know we'd see the mirror collimation screws.

Our taste doesn't run to these dystopian horrorfests, with characters named Dementus of the Biker Horde, The Octoboss, The People Eater, Rictus Erectus and Scrotus. Anya Taylor-Joy's eyes may be mesmerizing, but the only other beauty in this film is the orange-tube Celestron C8.

The Astronomer at the Museum: An Annular Eclipse

Caspar David Friedrich (1774-1840), *New Moon or Solar Eclipse above the Riesengebirge*. c. 1828. Ink and watercolor over pencil on wove paper. National Gallery of Art, Washington, DC. Shown at the Metropolitan Museum of Art's show "Caspar David Friedrich: The Soul of Nature," which ran from February 8 to May 11, 2025.

This work by the German romantic landscape painter Friedrich is most likely a reimagining of the annular eclipse of September 7, 1820, which crossed western Europe from Denmark to Greece. The Riesengebirge ("Giant Mountains") is a chain of massifs along the Czech-Polish border. Friedrich was fond of setting his landscapes with these peaks in the background. The path of annularity of the 1820 event was actually about 150 km west of the Riesengebirge. A new moon would of course be completely invisible.

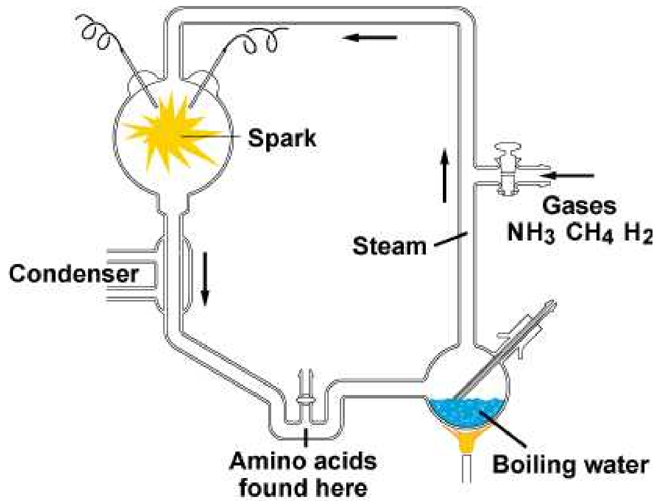
Friedrich was particularly fond of nightscapes showing the Moon, foremost among them the Met's *Two Men Contemplating the Moon*, an oil painting that dates from the same period as the eclipse drawing. See also page 21.

Chemical Evidence of Alien Life? Larry Faltz

When ET lands and phones home, we'll know that alien life exists. Besides noting what will likely be obvious deviations from Terran life forms, we'll be able to check his biochemistry with simple blood tests and his genetics with a small sample of cells (I'd say a scraping of his cheek mucus membrane, but ET might not have cheeks or mucus membranes).

Might alien organisms have unique biochemistry found nowhere on Earth, or is the template for life as we know it the only feasible scaffold upon which living organisms can form and evolve? Some other form of genetic coding, or unique energy metabolism? Or maybe the chemicals are the same but the stereochemistry is opposite.[1] Life on Earth chooses molecules with specific "handedness." Your left and right hands are mirror images of each other, and many organic molecules have opposite partners when reflected in three-dimensional space. We could imagine an anti-biological, mirror image biome, where all the amino acids, the building blocks of proteins, are right-handed and deoxyribose in the DNA backbone is left-handed, opposite to those in Terran organisms. There's currently no reason to think that life would not have evolved had life's initial synthetic steps taken on the opposite handedness, creating a world of "anti-biomatter." Fortunately, if we shook hands (or whatever ET's parts count for hands) with such an organism both of us wouldn't explode, as happens when matter and antimatter, mirror images at the subatomic level, come into contact. Less likely are biomes with silicon replacing carbon (famously illustrated by Star Trek's Horta) or arsenic replacing phosphorus, as was once proposed after examining samples from Mono Lake in California.[2] Another distinct, but unlikely, biome would create organisms whose biological solvent is ammonia rather than water.[3]

The search for the chemistry of life can be either direct or indirect. The chemical compounds of earthly life are found in samples of extraterrestrial origin (meteorites, material returned by space missions), but we still have to account for the possibility that they were synthesized by non-biologic means. For example, many organic compounds, including amino acids, were synthesized in the Miller-Urey experiment, which emulated what was then thought to be the basic atmospheric composition of the nascent Earth. Life arising this way is called "abiogenesis."



The Miller Urey Experiment (Miller, SL., Urey, HC., Organic Compound Synthesis on the Primitive Earth. *Science* 1953; 130: 245–51)

Carbon was detected in meteorites in the 19th century. In 1963, the first unequivocal detection of amino acids in a meteorite was in an analysis of the Murray meteorite, a carbonaceous chondrite that fell in Kentucky on September 20, 1950.[4] The concentration of organic compounds was low, and contamination was a concern. The Murchison meteorite, which fell in Australia on September 28, 1969, provided unequivocal evidence of extraterrestrial organics.[5] Murchison, also a carbonaceous chondrite, weighed over 100 kg and so there was a lot of it to go around for study. Samples were collected quickly, reducing the

[1] For those of you who skipped organic chemistry in college, try this explanation from the Encyclopedia Britannica" https://www.britannica.com/science/isomerism/Enantiomers#ref1015111.

[2] See "Please Pass the Arsenic" in the February 2011 SkyWAAtch.

[3] See "Life in the Solar System" in the November 2014 SkyWAAtch.

[4] Briggs, MH, Mamukunian, G, Organic Constituents of the Carbonaceous Chondrites, *Space Science Reviews* 1:647-682 (1963).

[5] Kvenvolden, K, et al., Evidence for Extraterrestrial Amino-acids and Hydrocarbons in the Murchison Meteorite, *Nature* 228: 923-926 (1970).

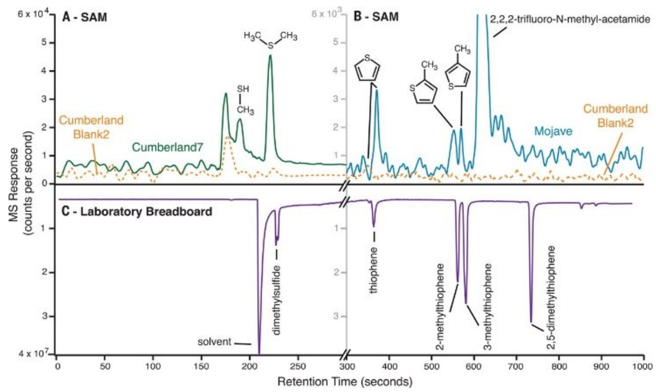
amount of time that weathering and contamination could occur. Many amino acids were detected in a "racemic" mixture (equal amounts of L- and R-isomers) although some later analyses claimed an excess of L-alanine over its D-counterpart. As technology evolved to allow finer discrimination of chemical species from ever-smaller samples, over 14,000 organic compounds were found. The concentration of amino acids in Murchison ranges from 17-60 parts per million.

Samples of the asteroid Bennu returned to Earth by the OSIRIS-REx mission were protected from contamination. The first analytic results were published in early 2025.[6] Mineralogical evidence pointed to the existence of brines (water-rich fluid with dissolved salts) that must have once been present on Bennu. These may well have been environments conducive to the formation of organic compounds. The samples contained 14 of the 20 amino acids that are found in Terran proteins, all five nucleobases in DNA and RNA, many other organic compounds, and about 10,000 nitrogen-bearing chemical species. These may be the building blocks of life, but they are not necessarily the products of life. The Bennu amino acids were both left- and right-handed in equal concentrations. It must be the case that something on Earth triggered the selection of L-amino acids for life chemistry.

If life evolved elsewhere in the solar system, the best bet is on Mars. Viking, Curiosity and Perseverance looked for evidence of biology by similar chemical techniques to those employed for meteorites, albeit on a reduced scale and entirely remotely. In addition, the Viking experiments sought evidence of active Martian life.

The two Viking landers had four on-board experiments that sought evidence of active metabolic processes. The most promising (and controversial) of these was the labeled-release experiment. A sample of Martian soil was incubated with seven ^{14}C labeled organic chemicals, all of which had been products of the Miller-Urey experiment and were expected to be utilized by living organisms. If there were organisms that metabolized carbon, $^{14}CO_2$ should be released and detected in the gas phase. The official scorecard for Viking was 0-for-4, but there are still a few astrobiologists who think something was found.

In 2018, conclusive evidence for the presence of organic compounds—thiophenic (sulfur containing), aromatic (cyclic), and aliphatic (long chain) compounds—were found in drill samples from Mars' Gale crater by the Sample Analysis on Mars (SAM) instrument on the Mars Science Laboratory (better known as the Curiosity rover).



Example of SAM GC-MS identification of S-containing pyrolysis products compared with results from a high-fidelity SAM-like GC run in the same manner on Earth. Eigenbrode, J, et al., Organic matter preserved in 3-billion-year-old mudstones at Gale crater, Mars, *Science* 360: 1096-1101 (2018)

The SAM instrument is composed of three devices: a gas chromatograph (GC), a quadrupole mass spectrometer (QMS) and a tunable laser spectrometer (TLS). Samples of atmospheric gas or vaporized solids are passed through the gas chromatograph, six thin coiled tubes 30 meters in length, along a stream of helium. The lightest compounds emerge first and the heaviest last. The compounds then enter the QMS, which identifies gases by the molecular weight and electrical charge of their ionized states. Molecules are broken up into fragments using high-speed electrons. The fragments are sent through a magnetic field, generating a mass spectrum. This shows the relative amount of each ion at a given mass-to-charge ratio. From this information the identity of the molecules can be established.

Data published this year[7] confirmed the presence in SAM samples of long-chain fatty acids composed of 10, 11 and 12 carbon atoms. Fatty acids are critical to

[6] Glavin, DP, et al., Abundant ammonia and nitrogen-rich soluble organic matter in samples from asteroid (101955) Bennu, *Nature Astronomy* 9: 199-210 (2025)

[7] Freissinet, C, et al., Long-chain alkanes preserved in a Martian mudstone, PNAS 122: March 25, 2025. https://www.pnas.org/doi/10.1073/pnas.2420580122.

living organisms, forming cell membranes and internal structures and contributing to energy storage and metabolism. Like other organic compounds, there are possible non-biologic synthetic mechanisms that might account for these compounds, so their presence does not prove the existence of life on Mars. Fatty acids in Terran organisms are preferentially composed of an even number of carbons because the method of synthesis involves adding two carbons at a time from the donor molecule acetyl-CoA. The fatty acids found by SAM are most likely breakdown products of longer chains, since the samples are heated ("pyrolized") to 850° C as the first analytic step. Finding a prevalence of even-numbered fatty acids might strengthen the argument that they have a biologic origin.

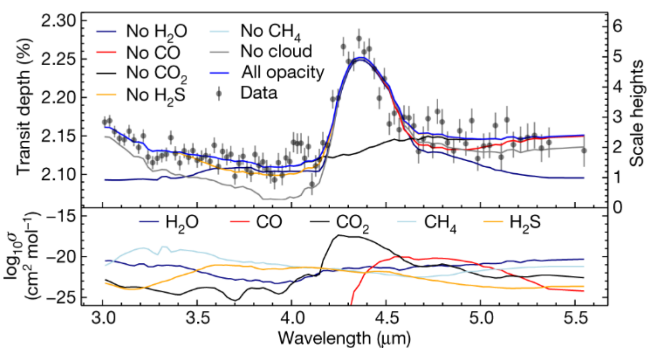
Curiosity also found a seasonal variation in methane. Most (but not all) methane on Earth has a biologic origin. Is it possible that the methane levels rise and fall due to seasonal growth of Martian life?

Venus was always thought to be devoid of life due to its fiery surface temperature and sulfuric acid-rich atmosphere. There is claim of a possible hospitable environment in the dry, acidic clouds of the Cytherean atmosphere. The spectroscopic detection of phosphine (PH_3), a toxic gas that is naturally produced by decaying organic matter and is present in the Earth's atmosphere in tiny amounts, made a big splash in the media when it was announced in 2020.[8] The concentration of phosphine was greater than could be accounted for by abiotic processes and would be unusual in an oxidizing environment. Subsequent studies failed to confirm the finding, although Sara Seager's group at MIT has published new data that claims lower, but still detectable, concentrations of the gas. One of the major problems is that the spectral lines of PH_3 and SO_2 overlap. To resolve the uncertainty, a privately funded mission to Venus, the Venus Life Finder, has been scheduled to launch in 2026 (originally proposed for 2023) aboard a Rocket Lab spacecraft. DAVINCI (Deep Atmosphere Venus Investigation of Noble gases, Chemistry, and Imaging), a NASA lander, is scheduled to launch in 2031 but it could be delayed or canceled due to proposed cuts in NASA's research budget.

Phosphine, like oxygen and possibly methane, could be considered a "biosignature," a compound whose detection (at the concentration proposed by Greaves and her colleagues) can't be explained by anything other than a biologic process.

Biosignature gases in exoplanets might be detected by examining the spectrum of a host star and comparing it with the spectrum taken during a transit, the difference reflecting the constitution of the planet's atmosphere. Spectral lines of small molecules arise from vibrational modes of chemical bonds and are strongest in the infrared. Resolving spectra of exoplanet atmospheres was one of the science goals for the James Webb Space Telescope.

Carbon dioxide was detected in the atmosphere of WASP-39b, a hot Saturn-sized planet orbiting a sun-like G7 star every 4.055 days. The obvious peak in the infrared at 4.3 micrometers had an extremely believable statistical significance of 26σ.

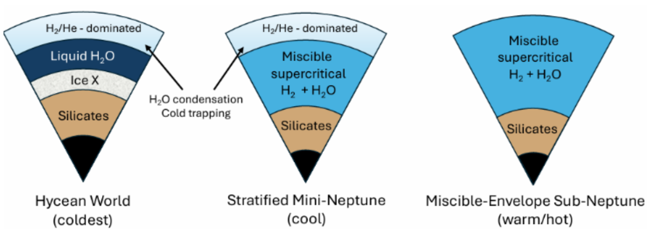


IR Spectrum of WASP-39b compared to models. The detection has a significance of 26σ. (JWST Transiting Exoplanet Community Early Release Science Team. Identification of carbon dioxide in an exoplanet atmosphere. *Nature* 614: 649–652 (2023). https://doi.org/10.1038/s41586-022-05269-w)

The Hubble Space Telescope had earlier been used to detect water on the exoplanet K2-18b, a body midway in size between Earth and Neptune (a "sub-Neptune"). It orbits a red dwarf in its habitable zone. Sub-Neptunes are thought to be the most common planets in the galaxy. K2-18b was discovered in 2015 by the Kepler spacecraft. Its host star is an M2.5 red dwarf, surface temperature 3,457 K, mass 0.359 solar masses, radius 0.411 solar radii, located 34 pc (110.8 light years) from the Earth. The star–planet distance of 0.1429 astronomical units (AU) suggests a planet

[8] Greaves, JS *et al,* Phosphine gas in the cloud decks of Venus. *Nature Astronomy* 5, 655–664 (2021).

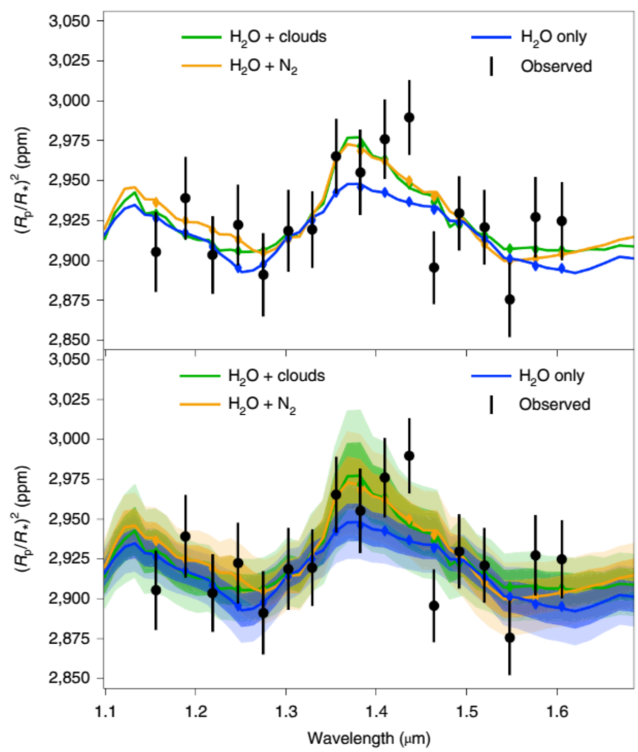
within the star's habitable zone (~0.12–0.25 AU), with an effective surface temperature between 200 K and 320 K, depending on details of the calculations. Measurements of K2-18b's mass (7.96 Earth masses) and radius (2.279 Earth radii) yield a bulk density of 3.3 ± 1.2 g cm^{-3}. These data can be used to model several planetary structures, including a silicate planet with an extended atmosphere or an ocean world with a water mass fraction lower than 50%. The planet may be a "hycean" world, a portmanteau of "hydrogen" and "ocean," meaning it has a liquid water ocean under a hydrogen-rich atmosphere. Life has no problem evolving in such an environment: it did so on Earth. The various models for K2-19b's atmosphere depend on the accuracy of the temperature, which is a model-dependent parameter, calculated not observed.



Possible structures of sub-Neptunes. Benneke, B, et al., JWST Reveals CH_4, CO_2, and H_2O in a Metal-rich Miscible Atmosphere on a Two-Earth-Radius Exoplanet, https://arxiv.org/pdf/2403.03325

Exoplanet transit spectroscopy is a complex process. The raw data are processed through various computer "pipelines" to smooth out the data, reduce noise and correct for limb darkening of the star (since the spectrum can shift at the edges of the transit when less of the star's light is available for subtraction). It is possible that the empirical choices made during data management introduce their own errors. Then, the spectrum is compared to various models of the planet's atmosphere (clouds or no clouds, other gases) and surface. How accurate or complete is the model? Was something left out? Were the concentrations of gases appropriate? The temperature? Was the star experiencing a flare or some other inhomogeneity in its energy output, a frequent occurrence in red dwarfs?

JWST detected methane on K2-18b in 2023. For both WASP-39b and K2-18b, and several other well-studied exoplanets, the finding of carbon dioxide and water seems to be generally accepted, but they are not true biosignature gases, only "biosuggestions."



H_2O in K2-18b's atmosphere. Top: best-fit models only. Bottom: 1σ and 2σ uncertainty ranges. Data are black circles and error bars. Tsiaras, A, et al., Water vapor in the atmosphere of the habitable-zone eight-Earth-mass planet K2-18 b, *Nature Astronomy* 3: 1086-1091 (2019)

Neither H_2O nor CO_2 are true biosignature gases. To be so, the gas would have to be produced solely by living organisms or its concentration would be well above what could be produced by abiotic means. Besides phosphine, gases that could serve as biosignatures include dimethyl sulfide (DMS) and dimethyl disulfide (DMSS). These are simple thioethers that are present in certain plants, particularly cabbage and beets, and also are found in shrimp. They can also be produced by bacteria, especially in sewage. DMS has a distinct odor that people often find offensive (and some people like). Ocean phytoplankton contribute the bulk of atmospheric DMS and has been suggested as the source of the ocean's "bracing" aroma.

DMS: CH_3—S—CH_3

DMSS: CH_3—S—S—CH_3

Atmospheric DMS can be oxidized to sulfur dioxide and sulfuric acid, which can impact cloud formation and play a role in atmospheric homeostasis. There are no known abiotic sources on Earth (outside of artificial synthesis), but DMS was detected on Comet

67P/Churyumov-Gerasimenko, in the interstellar medium and it can arise from "pre-biotic atmospheres" in conditions like that of the Miller-Urey experiment. So it isn't completely obvious that finding DMS and DMSS must signify life.

Following up on earlier studies in 2023, a team led by Nikku Madhusudhan from Cambridge University used the JWST to record a transit of K2-18b across its host star. The authors compared the difference spectrum to several atmospheric models. In a recent paper[9] they concluded that they found "DMS and/or DMDS in the atmosphere at 3σ significance, with high abundance (≳10 ppmv) of at least one of the two molecules." The authors also noted that "more observations are needed to increase the robustness of the findings and resolve the degeneracy between DMS and DMDS. The results also highlight the need for additional experimental and theoretical work to determine accurate cross sections of important biosignature gases and identify potential abiotic sources."

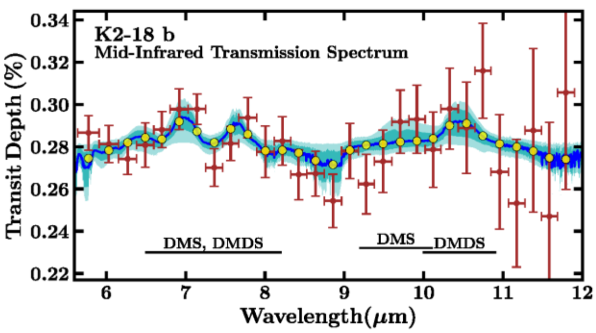


Fig 2 from Madhusudhan, et al., showing the derived spectrum.

A press conference was held to announce the findings a few days in advance of the formal publication. Lead author Madhusudhan was clear about the difficulties obtaining and processing the data, developing models and drawing their conclusions (which hinged on a number of arcane statistical tests), but their enthusiasm for a possible dramatic discovery couldn't be suppressed. At the conference, Madhusudhan said "This is a revolutionary moment. It's the first time humanity has seen potential biosignatures on a habitable planet." The *New York Times* headline on April 16th read "Astronomers Detect a Possible Signature of Life on a Distant Planet" and the BBC reported "Scientists find 'strongest evidence yet' of life on distant planet."

Some of the lay press articles included more restrained viewpoints ("It's a hint. But we cannot conclude it's habitable yet," noted Stephen Schmidt of Johns Hopkins University in the *Times*.) More critical analyses came from other sources. Ethan Seigel, the well-known astronomy writer and podcaster, analyzed the paper[10] and wrote "Unfortunately, nearly every aspect of this claim is almost certainly wrong." A paper by Oxford physicist Jake Taylor, posted on arXiv[11] a few days after Madhusudan's paper was published, utilized the same data and concluded "there is no strong evidence for detected spectral features in K2-18b's MIRI transmission spectrum." Dr. Becky (Smethurst) was likewise unconvinced on her May 1 YouTube podcast.

JWST may simply not have the resolution and sensitivity required for unequivocal detection of trace biosignatures (or technosignatures, chemicals that are uniquely produced by industrial activity). In a paper accepted by PNAS,[12] Sara Seager and colleagues discuss JWST's capabilities to elucidate biosignatures. They write,

> We conclude with the sobering realization that with JWST we may never be able to definitively claim the discovery of a biosignature gas in an exoplanet atmosphere. This realization is largely motivated by the challenge of the interpretation of false positives amidst the unknown planetary environments. But it is also exacerbated by the limited number of targets, the likelihood that the spectral feature signals will be weak for small planet atmospheres, and the limitations of the inference methods required to wrestle sparse data of a spatially and vertically unresolved planet into useful constraints on underlying planet atmosphere gas abundances.

Perhaps in the future a larger IR-sensitive instrument will provide an answer. Or maybe ET will arrive. ■

[9] Madhusudhan, N, et al., New Constraints on DMS and DMDS in the Atmosphere of K2-18 b from JWST MIRI, *Astrophysical Journal Letters* 983:L40 (21pp), April 17, 2025.

[10] https://bigthink.com/starts-with-a-bang/evidence-biosignatures-k2-18b-flimsy/. But what does "almost certainly" really mean?

[11] Taylor, J, Are there Spectral Features in the MIRI/LRS Transmission Spectrum of K2-18b?, https://arxiv.org/abs/2504.15916

[12] Seager, S., et al., Prospects for Detecting Signs of Life on Exoplanets in the JWST Era, posted April 17, 2025. https://arxiv.org/pdf/2504.12946 (2025).

Images by Members

First Light for a Seestar S30 by Scott Mellis

Imaging from Larchmont, Scott captured Messier 51 with an hour-long exposure of 10-second subs. The shorter Messier 13 image was a test shot from inside his house, through a glass patio window!

For the M13 image, Scott noted, "The device automatically found and tracked the target, acquired 10 second subs for 5½ minutes and stacked. My contribution was to touch the "AI De-noising" button and move a few sliders for brightness, contrast, and such. It was interesting that even before the stacking began, one could see the fuzzy blob of the cluster amidst the noisy live image."

As we alluded in the article "Amateur Astronomy Evolves. Should It?" in the November 2023 SkyWAAtch, "smart telescopes" challenge the dualism of process versus outcome. As Scott noted in an email exchange with the Editor, "At one level it's very cool to see these images emerge. At another level, it seems 'too easy' and delivering a reward that has not been earned." How much of the pleasure of amateur astronomy is about fussing (and/or struggling) with the equipment and how much is just getting a view?

The Leo Triplet by Leandro Bento

Leo writes,

After an almost four-year hiatus, I am ready to get back into stargazing. In April I made this image of the Leo Triplet from my backyard in Yonkers. I purchased a new scope in November but this was its first light.

I like to say my sky is "Bortle 11" because NYC is next door to the south, and next door to the east are Cross County Mall and Yonkers racetrack. To make it even worse, my house is on the corner, meaning the backyard is not hidden but is exposed to a streetlamp that sits right below Polaris. I used a photographer's backdrop support with 2 stands to support a tarp to block the light from the lamp but not high enough to block Polaris, but they kept falling in the lightest breeze, since I don't have counterweights. I then tied one end to a table and held the other one until 3 AM. Fun night.

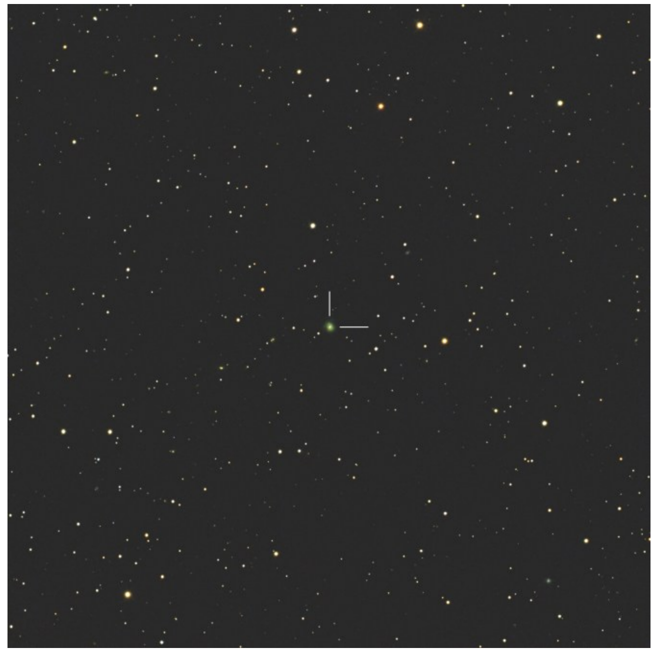
Taken with Askar71F f/6.9 flat field refractor and ZWO ASI533MC camera. 30 x 5 minutes exposures to a total of 2.5 hours (no filters).

I have also reprocessed all of my earlier photos published in SkyWAAtch in the past. I think they are way better now than the originals to the point that some seem to be completely different photos. They are at https://www.feathersandthingsphoto.com/space-things/.

This is a very slightly cropped (top and bottom) version of Leo's original. The field shown is 79.5 x 57 arcminutes, from an original

A Steve Bellavia Comet Parade

Comet C/2021 G2 ATLAS



Comet P/2010 H2 Vales

Comet 29P/Schwassmann–Wachmann

Captions next page.

Steve has now imaged 61 comets.

Comet C/2021 G2 ATLAS was in Libra, at magnitude 13.8 when this image was made on the night of May 6-7. The fan shaped tail is a little hard to see in this color image, but it ends at near fourth star to the upper left of the coma and is about 2 arc minutes wide at that position. The comet passed perihelion in September 2024.

Comet Comet C/2021 G2 ATLAS was captured on the same night. It was discovered in 2010 when it underwent an enormous outburst to magnitude of 7.5 magnitudes shortly after it was discovered in 2010 when it was at perihelion. P/Vales is most likely a temporarily captured comet in which conductive heating of subsurface ice triggered the 2010 outburst, perhaps through exothermic crystallization from the amorphous state. It is now at magnitude 15.4 in Virgo.

Steve made the image of **Comet 29P/Schwassmann–Wachmann** on the night of March 20. He writes,

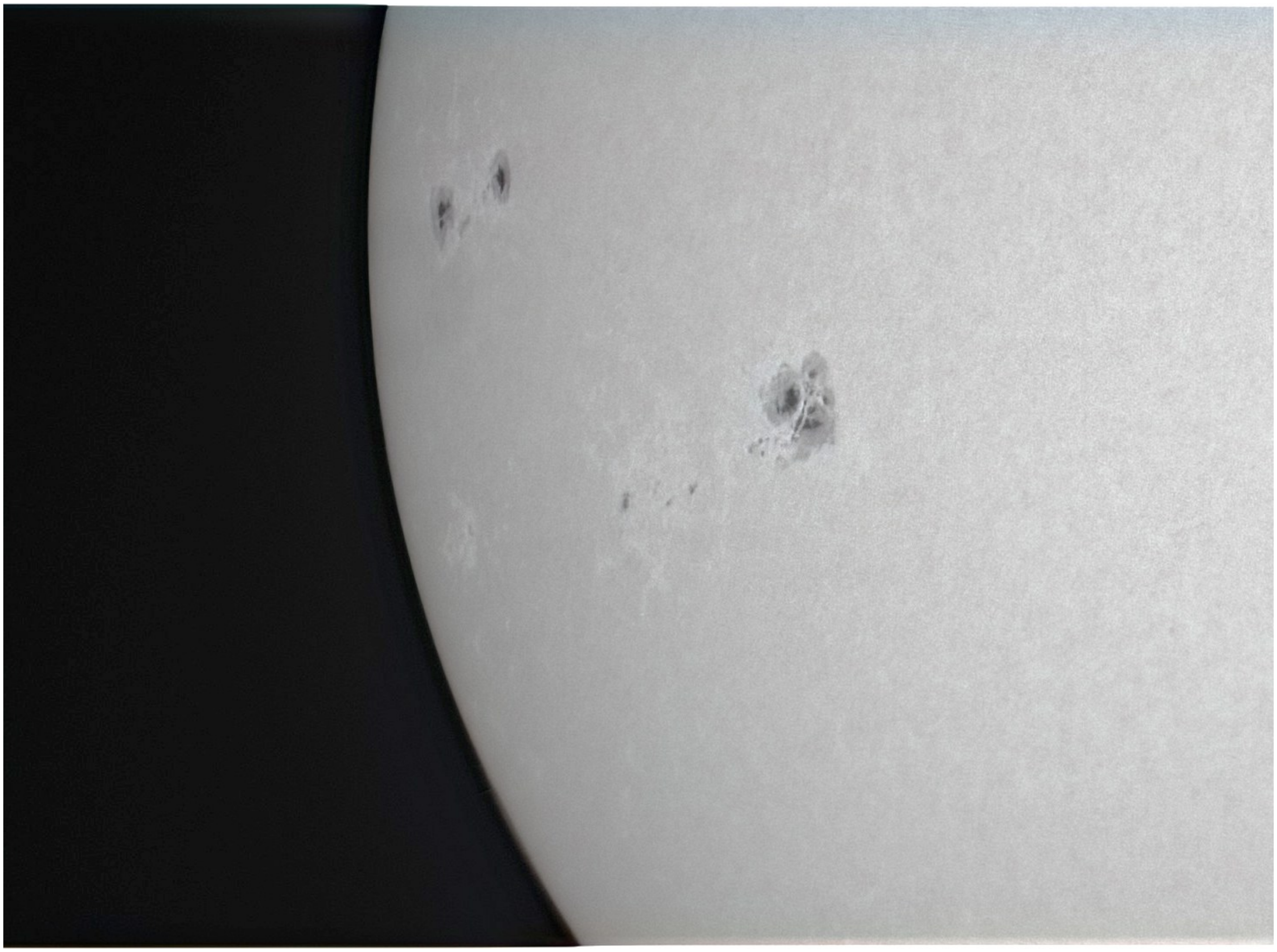
> I got another 2 hours on the comet at f/2, using the C6 Hyperstar with no Moon and a very clear sky. Note that this is equivalent to 18 hours at f/4.9.
>
> The comet is now more prominent, partially due to the longer exposure, but also because of aligning and stacking the stars and comet separately and reducing the brightness of the stars before recombining. I believe it is still in a "dim phase" and not experiencing an outburst.
>
> Comet 29P/Schwassmann–Wachmann was discovered on November 15, 1927, by Arnold Schwassmann and Arno Arthur Wachmann at the Hamburg Observatory in Bergedorf, Germany. It has an orbital period of 14.87 years. The comet is unusual in that, while normally hovering at around 16th magnitude, it suddenly undergoes outbursts. These cause the comet to brighten by 1 to 5 magnitudes, fading within a week or two. This happens with a frequency of 7.3 outbursts per year. The comet's magnitude has been found to vary from 18th magnitude to 10th magnitude, a more than thousand-fold increase in brightness, during its brightest outbursts. [Trigo-Rodríguez, JM, et al., A continuous follow-up of Centaurs, and dormant comets: looking for cometary activity. *European Planetary Science Congress Processdings* (2008)].

The bright star is Subra, Omicron Leonis, magnitude 3.52, type A5. The field is 1.69 x 1.12 degrees. The telescope is Steve's 6-inch SCT with Hyperstar (f/2). Full technical information at https://app.astrobin.com/i/tyvs9d.

First Light for a ZWO Seestar S30 by Larry Faltz

In anticipation of a trip to a truly dark site in the Colorado Rockies this summer, I bought a Seestar S30 to complement the visual telescope I'll be using. I felt it would be too expensive and risky to ship my high-end imaging equipment. Setting up the S30 is ridiculously easy and takes just a couple of minutes, with basically one written instruction ("Press the on-off button for 1 second, then press it for two seconds"). The rest of the setup is guided by the app and an encouraging female voice from inside the tiny device. I put it on the sidewalk and told it to find the Moon. It obeyed. (Maybe the voice should say "Yes, Master."). The left single-frame image is at 1X and the right at 2X (there's also a 4X mode). The resolution is limited by the 2 MB sensor and short focal length, not great for the Moon, but it works. It's fun and seductively simple to use.

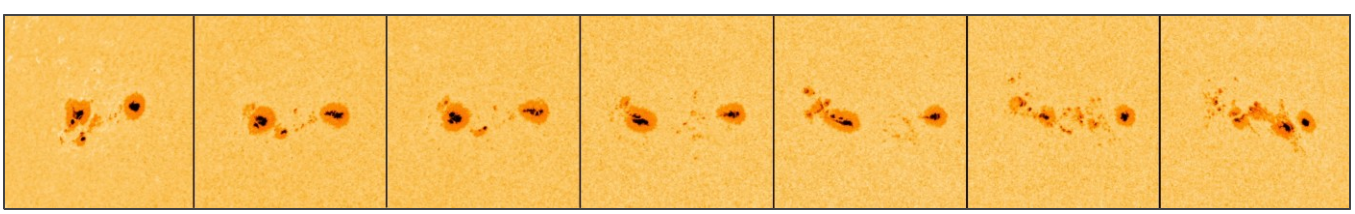
White Light Sun through Tasco 8v by John Paladini



In the April 2025 SkyWAAtch, John Paladini detailed his experiences with the Jones-Bird type reflector, a Newtonian telescope with a spherical mirror and a corrector lens that compensates for spherical aberration. He noted that J-B scopes with the corrector between the primary and secondary mirrors, the original design, gave better images than those with the corrector lens in the focuser. Here's a solar image made on April 17, 2025 with a Tasco 8v, a 5-inch aperture f/8 original J-B design telescope.

The large sunspot complex is Active Region 4062. The two sunspots close to the solar limb bear the common designation AR 4064. AR 4062 is a single sunspot of the "alpha" class (according to criteria developed by the Mt. Wilson Observatory), meaning it is unipolar, while AR 4064 is a "beta" class group consisting of 12 individual sunspots that have positive and negative polarity (bipolar) with a simple division between the polarities. Magnetograms of the Sun can determine the spots' polarity.

Over the seven days, unipolar AR 4062 didn't change much and just faded away, but bipolar AR 4064 evolved.



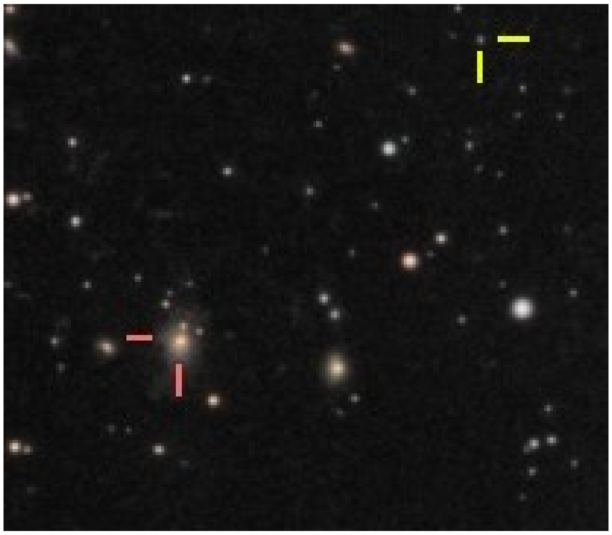
The sequence is from the excellent Canadian solar site https://solarham.com/.

Two day-old Moon by Larry Faltz

April 29, 2025, 8:20 p.m. Boynton Beach, Florida. Moon age 2d 4h 49m, 6% illuminated. Altitude 23°. iPhone 16.

More Detail in Olivier Prache's Cover Image

We compose SkyWAAtch in Word. The issues can sometimes be 150 megabytes depending on the size of the image files. The conversion to pdf format gets the file down to a manageable 5-8 MB but compresses the images a bit, so enlarging them on your computer inevitably shows pixelation. To show the depth of Olivier's image, above is the central area at the original scale. To further highlight the image's depth, we blew up a still smaller section (red rectangle), on the right. The *brightest* object in this field (red markers) is the galaxy 7C 113032.10+532404.00, g-magnitude of 18.54, z=0.254. It is the brightest member of a distant galaxy cluster. The yellow markers show the quasar SDSS J113304.23+530551.5, g-magnitude 21.15, z=1.80. The other objects in the image are not specifically identified in CdS (https://cds.unistra.fr/). Many are fainter than 21.15.



Research Highlight of the Month

Baycroft, T, et al., Evidence for a polar circumbinary exoplanet orbiting a pair of eclipsing brown dwarfs, *Science Advances* 11, eadu0627 (2025) (Open access: https://www.science.org/doi/10.1126/sciadv.adu0627)

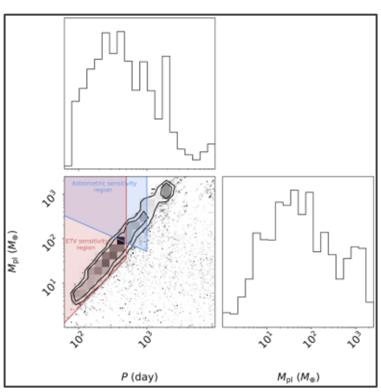
Abstract: One notable example of exoplanet diversity is the population of circumbinary planets, which orbit around both stars of a binary star system. There are, so far, only 16 known circumbinary exoplanets, all of which lie in the same orbital plane as the host binary. Suggestions indicate that circumbinary planets could also exist on orbits highly inclined to the binary, close to 90°, polar orbits. No such planets have been found yet, but polar circumbinary gas and debris discs have been observed, and if these were to form planets, then those would be left on a polar orbit. We report strong evidence for a polar circumbinary exoplanet, which orbits a close pair of brown dwarfs that are on an eccentric orbit. We use radial velocities to measure a retrograde apsidal precession for the binary and show that this can only be attributed to the presence of a polar planet.

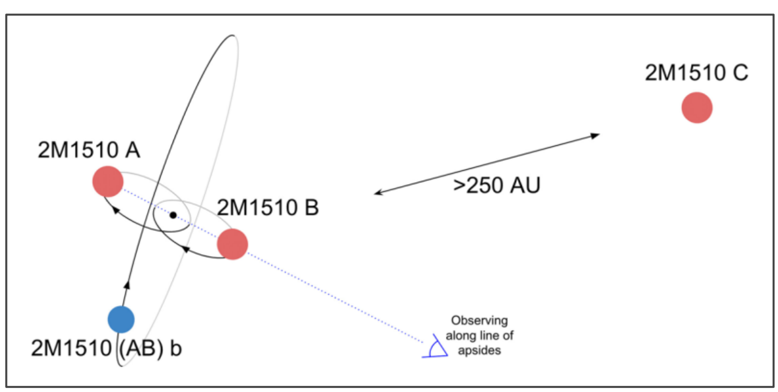
Since the detection of the first exoplanet in 1992, astronomers have encountered a plethora of distinct planetary configurations around host stars. Only about 10% of the over 6,000 known exoplanets are in solar systems that reasonably resemble our own, with small rocky planets closer to the star and gas giants further out, all in a stable configuration. It might not be surprising to find that there are exoplanets orbiting each of the stars in a binary system. Some 230 of these are currently catalogued. Much rarer are single planets that orbit *both* the stars of a binary system, the two stars creating a single gravitational well for the planet. Only 15 of these peculiar arrangements are known. They have been dubbed “Tatooine planets,” after the home planet of Luke Skywalker, where two suns are seen in the sky.

Of those 15 Tatooine planets, all orbit in the same plane as the binary. In contrast, the planet in the 2M1510 system (formally 2MASS J15104786-2818174) appears to be in a polar orbit. Not only that, the two stars are in fact not stars at all, but brown dwarfs, with masses below that necessary to sustain hydrogen fusion. They have masses of about 35 Jupiters, in the middle of the range brown dwarf masses (15-70 Jupiters). The planet is just 0.06 astronomical units from the two brown dwarfs, which exhibit eclipses, and are only the second eclipsing binary brown dwarf system known. Fortuitous alignment of the system relative to Earth allows astronomers to time the eclipses and measure the orbital periods, which revealed the existence of the planet. The plane of the dwarfs’ orbit is precessing due to the planet’s polar orbit. Over time, the dwarfs’ orbital plane will no longer point to Earth and the eclipses will no longer be detectable. This should happen in about 95 years.

A third brown dwarf is gravitationally bound to the system in a distant orbit 250 AU away. It may be responsible for creating and stabilizing the binary’s tight orbit and may be in the process of being ejected from the system.

The data for this study came from spectroscopic observations by the Very Large Telescope at Cerro Paranal in Chile. Spectroscopic data was deconvolved, analyzed and fitted to N-body solutions using the principles of classical Lagrangian and Hamiltonian mechanics.





Left:
Fig 3:
Planet masses and periods.

Right:
Fig 5
Configuration of the system

Member & Club Equipment for Sale

Item	Description	Asking Price	Name/Email
NEW LISTING Questar 3.5” f/14.6 Maksutov-Cassegrain	A classic. This scope was made in 1979 and has had the same owner since new. Fully reconditioned, including new Pyrex mirror by Questar in April 2025. Broad-band and low reflection coatings. Sliding dew shield with sky map. Brandon 8, 16, and 24 mm eyepieces, 2X Barlow, camera coupling set, table-top tripod (this has been customized to also be used on a regular tripod). Motor drive on RA axis. Includes oak surveyors tripod.	$4200	Richard Rubin rrubin5@gmail.com
NEW LISTING Meade 2080 8” SCT	A complete, nearly mint condition 8” Meade SCT dating from the 1980s. These were rivals of the Celestron orange tube telescopes and were nearly identical optically and mechanically, with a better RA gear system. 110-volt motor drive on the RA axis, tangent arm on the declination axis. Wedge, excellent Bausch and Lomb tripod (better than the fixed height tripod that Celestron used). Aluminum dew shield. Telrad finder. This is a non-go-to scope of classic vintage. Image here. If the non-go-to fork mounting is a disincentive, consider deforking the optical tube and mating it with a new strain-wave drive. A Celestron 8” OTA lists at $1,299. An alt-az go-to 8” Celestron CPC is $2,600. You could put this OTA on a ZWO AM5n (does both alt-az and EQ) for about the same total price and have a scope that’s great for both visual and imaging (which the CPC is not).	$400	WAA ads@westchesterastronomers.org
8-inch f/5 reflector optical tube	Celestron-branded Newtonian OTA with tube rings and Vixen style dovetail plate. Can take 1 1/4 or 2” eyepieces. Like new condition. Image here. Donated to WAA.	$100	WAA ads@westchesterastronomers.org
Steel 2” tripod	Standard tripod with post (removable) for azimuth adjustment during polar alignment. Complete with spreader bar. Image here. A new one is $235. Perfect for an upgrade from an aluminum mount. Donated to WAA.	$25	WAA ads@westchesterastronomers.org
6-inch f/5 reflector optical tube	Orion-branded scope. 1.25” rack and pinion focuser. Excellent condition optically and mechanically. New 6” f/5 OTAs cost over $300. Donated to WAA.	$100	WAA ads@westchesterastronomers.org
EQ-4 type German Equatorial Mount (Orion branded)	Little used, if at all. Solid EQ4-type non-go-to equatorial mount with an electric RA drive, 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. Counterweights, gold-colored aluminum tripod (missing tripod tray, but you can make one easily enough, or even better, buy the steel tripod listed above). Donated to WAA.	$50	WAA ads@westchesterastronomers.org
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 our members. All receipts for items owned by WAA goes to support club activities.

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