SkyWAAtch

The Newsletter of Westchester Amateur Astronomers

December 2024

Jones-1 By Steve Bellavia

Steve imaged this very faint planetary nebula at Custer Institute in Long Island on four nights in early November, capturing 13 hours of signal. For more on this object and another faint planetary discovered by the same astronomer, Rebecca Jones, see page 25.

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 December Meeting

Friday, December 13 at 7:30 pm

Live or on-line via Zoom

Seeing the Invisible: What does a Black Hole look like?

Eliot Quataert, PhD
Charles A. Young Professor of Astronomy
Princeton University

Prof. Quataert is an astrophysics theorist who works on a wide range of problems, including stars and black holes, accretion theory, plasma astrophysics, and how galaxies form, using both analytic calculations and numerical simulations. He received his undergraduate degree at MIT and PhD from Harvard and was a postdoc at the Institute for Advanced Study. After being on the faculty at UC Berkeley, he moved to Princeton in 2020.

The meeting will begin with club news and Bob Kelly's "What's in the Sky" presentation. Come at 7:00 p.m. to meet and greet fellow club members and guests. There will be door prizes!

Starway to Heaven

Ward Pound Ridge Reservation, Cross River, NY

The next star party will be in March.

Also In This Issue

WAA January 2025 Meeting

Friday, January 10 at 7:30 pm

The James Webb Space Telescope: Humankind's greatest space science facility

Jim Beletic
Chief Scientific Officer, Teledyne Imaging Systems

New Members

Alma Bjelic	Harrison
Alfred Farella	White Plains
Haoquan Liang	Flushing
Christine Moundas	Scarsdale
Elizabeth Norton	New Canaan
Stefanie Perillo & Tom Harris	Ossining

Renewing Members

Andrea Anthony	Yorktown Heights
Kevin Bynum	Irvington
Walter Chadwick	Cold Spring
Daniel Cummings	Croton-On-Hudson
William & Edward Duncumb	Tunbridge Wells, UK
Thomas Durkin	White Plains
Sharon and Steve Gould	White Plains
John Higbee	Ophelia, VA
Daniel Intrilligator	Cortlandt Manor
Mark Kleiman	Ossining
Susan Light	Chappaqua
Michael Lomsky	Wilton
The Maida Family	Port Chester
Kathy Ortiz	Port Chester
James Peale	Bronxville
Fredric Perlman	Pleasantville
Bruce Rights	Mount Kisco
Lars Schneidenbach	Bedford Hills
Kathlyn Schwartz	Purchase
Erika Soldano	White Plains
Srikanth Srinivasan	Mount Kisco
Trudy Swan	Yorktown Heights
Roger Woolcott	Brewster

Westchester
Amateur Astronomers

ALMANAC For November 2024

Bob Kelly, VP for Field Events


Bob Kelly


New Dec 1


1Q Dec 9

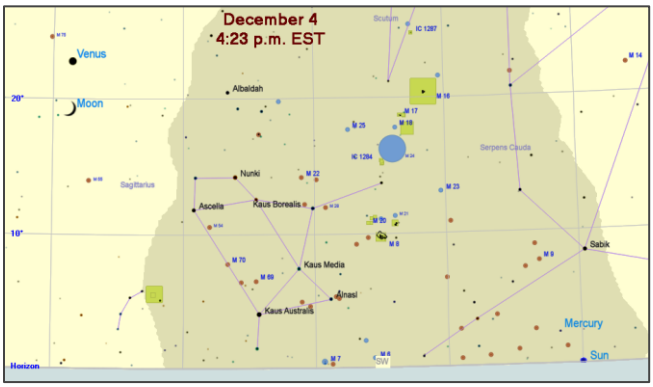

Full Dec 15


3Q Dec 22

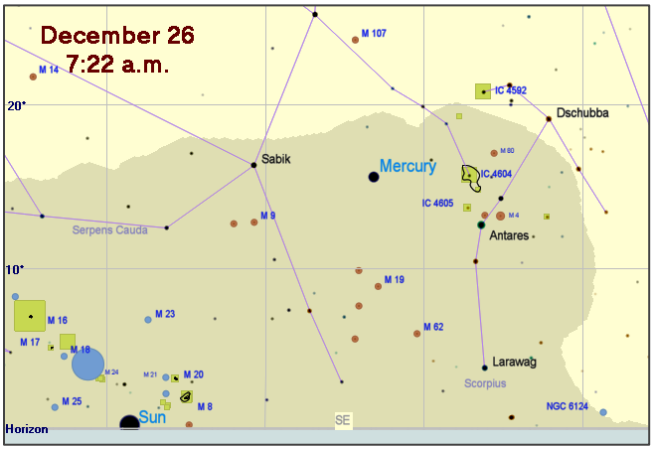

New Dec 30

Size Matters

Venus becomes the second largest planet as seen from Earth in early December as Mercury scoots away from Earth in its orbit around the Sun. Venus gains some altitude in the evening sky, as it moves 45 degrees from the Sun. At sunset, it's far to the left (south) of the Sun. Look for Venus forming the top of a celestial semi-colon with the crescent Moon on the 4th. In a telescope, you may need a filter to detect the Cytherean (Venusian) phase as it changes from gibbous to a bit more than half-lit by the end of the month.



Mercury reaches inferior conjunction (directly behind the Sun) on December 6th, emerging into the morning sky, where it reaches greatest elongation from the Sun on the 25th, but it is still very low in the dawn sky.



Jupiter may not be the largest planet as seen from Earth's point of view, but we get a rockin' good view this month as we reach opposition on the 7th. The banded planet with the not so red not so great but still wonderful spot reaches magnitude -2.3, and is up all night soaring high in our skies. The four brightest moons that made Galileo catch his breath (and ultimately led to a lot of trouble for the poor guy!) are at their brightest this month and viewable even in binoculars. See page 7 for more detail.

Saturn is wonderful in the evening sky, at magnitude +1.0. Lots to see here! The rings are tilted open a bit more toward us than they were at mid-year. Try higher powers on your scope to see the tiny section of the rings blacked out by the planet's shadow. Titan is visible most nights, looking like a tiny star next to Saturn at magnitude +9. Iapetus passes to the north of Saturn on the 10th, brightening to magnitude +10 on its way to greatest western elongation at the end of the month. High power with a larger telescope may show the gaggle of fainter moons nearer the planet.

This would be a great time to download apps that show Jupiter's and Saturn's moons and the times to see Jupiter's Great Red Spot transit the face of the planet. Some apps show when Jupiter's moons cast shadows on the planet. A couple of times this month, two moons at once cast their shadows on Jupiter, about 2:47 a.m. on the 23rd and 5:37 a.m. on the 30th, but Jupiter will have just set when the latter double transit begins.

Mars brightens to magnitude -1.0 this month. It gets a bit larger from our vantage point, with surface features visible at higher powers in the telescope. The ruddy planet rises well after Jupiter, by 8:30 p.m. at month's start, and by 6 p.m. at the end of December, but also gets high in our northern hemisphere skies. This is an extended drum roll for Mars reaching opposition on January 16th. Can you spot Mars just below the gibbous Moon around 5 a.m. on the 18th? Mars starts the month just a few degrees to the west of the Beehive Cluster, but drifts away from the swarm of stars as the month goes on. Together, they are a great sight in binoculars. See the map on page 6.

The Darkest Month

December sunshine is shortest for the year, and that doesn't count the darkening effects of clouds. The earliest sunset and end of twilight occur on December 6th and 7th (4:25:10 p.m.), while sunrise keeps getting later until early January. The solstice occurs on the 21st at 4:21 a.m.

A Vega Sirius Line

Sirius and Vega are almost exactly on opposite sides of the sky.This month, Vega is setting in the northwest, while Sirius rises in the southeast, about 8 p.m. this month. Astronomers on a planet orbiting Sirius would have to look almost through the Sun to examine Vega, maybe looking for Vegan exoplanets. To see this from Vega's point of view, see the graphic at https://skyandtelescope.org/astronomy-blogs/explore-night-bob-king/see-the-sun-from-other-stars/.

Rising Giants

Orion and Gemini are fun to watch rising in the evening, lying on their sides as if waking from a long summer's nap. The Orion Nebula in the sword of Orion can be visible to the unaided eye as a fuzzy spot, and we can see more details with more magnification in binoculars or any telescope. See this month's DSO of the Month on page 8. Some good observing tips for M42 are given by S*ky & Telescope's* Bob King are at https://is.gd/kingM42.

Meteor Showers

The Geminids meteor shower peaks on the night of the 12th- 13th. Maximum numbers of Geminids are visible from 10 p.m. onward, but the almost-full Moon rises at 9:36 p.m. to wash out sighting all but the brightest meteors. If you want to catch a few meteors, face away from the Moon and block it out from your view.

The Ursid meteors peak just before dawn on the morning of the 22nd, but the last quarter Moon will also be out, reducing the number that we can see. Normally, there are 5 to 10 additional meteors an hour, but outbursts can raise that rate to 25 per hour.

Satellites

The International Space Station can be spotted in the evening sky through the 8th, and mornings starting the 12th. China's Tiangong station is visible in the morning from the 4th through the 19th. It's visible in the evenings starting on the 29th.

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

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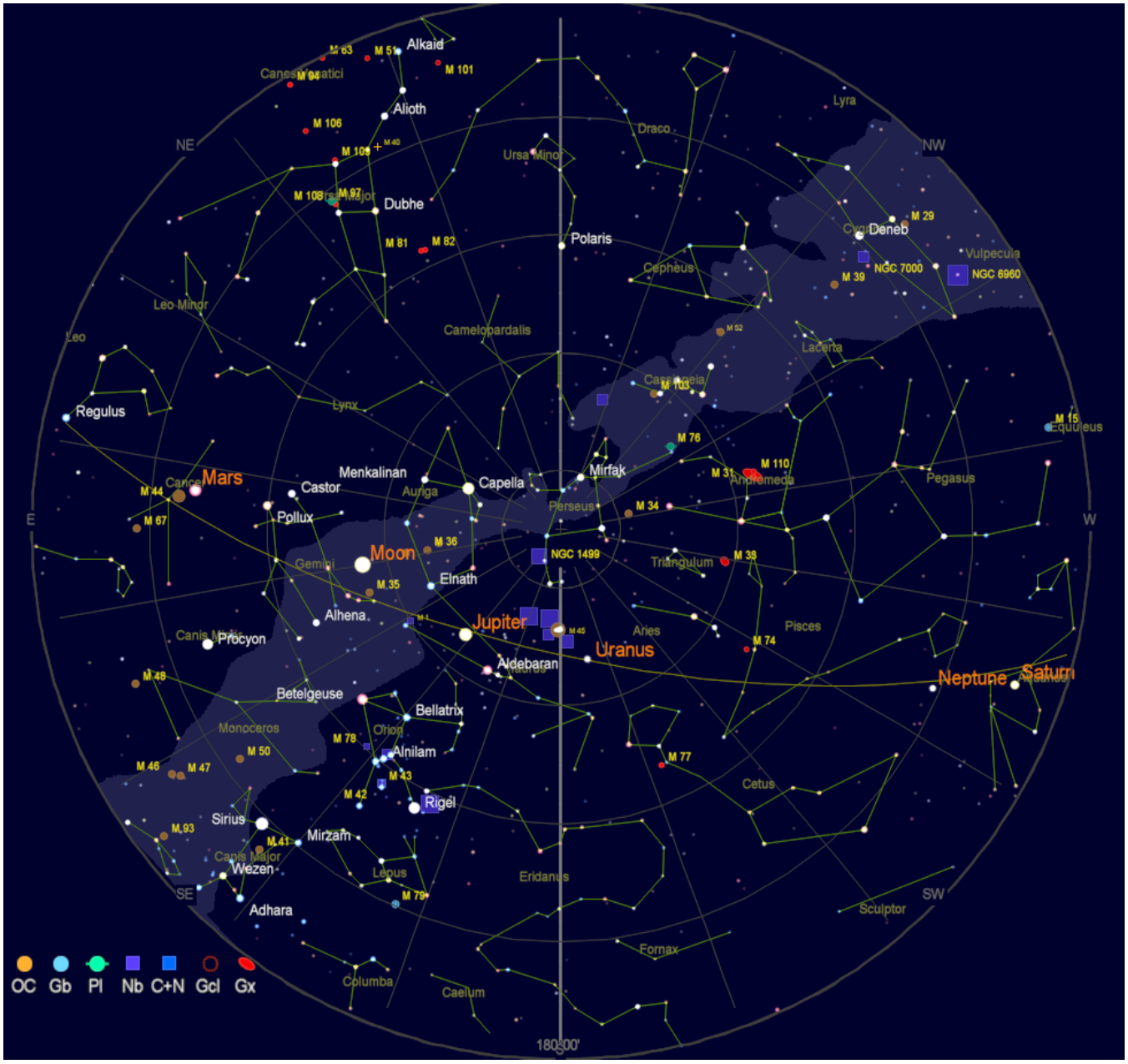
Call: **1-877-456-5778** (toll free) for announcements, weather cancellations, or questions. Also, don't forget to visit the WAA website.

…Nor when expandingly lifted by your subject, can you fail to trace out great whales in the starry heavens, and boats in pursuit of them; as when long filled with thoughts of war the Eastern nations saw armies locked in battle among the clouds. Thus at the North have I chased Leviathan round and round the Pole with the revolutions of the bright points that first defined him to me. And beneath the effulgent Antarctic skies I have boarded the Argo-Navis, and joined the chase against the starry Cetus far beyond the utmost stretch of Hydrus and the Flying Fish.

With a frigate's anchors for my bridle-bits and fasces of harpoons for spurs, would I could mount that whale and leap the topmost skies, to see whether the fabled heavens with all their countless tents really lie encamped beyond my mortal sight!

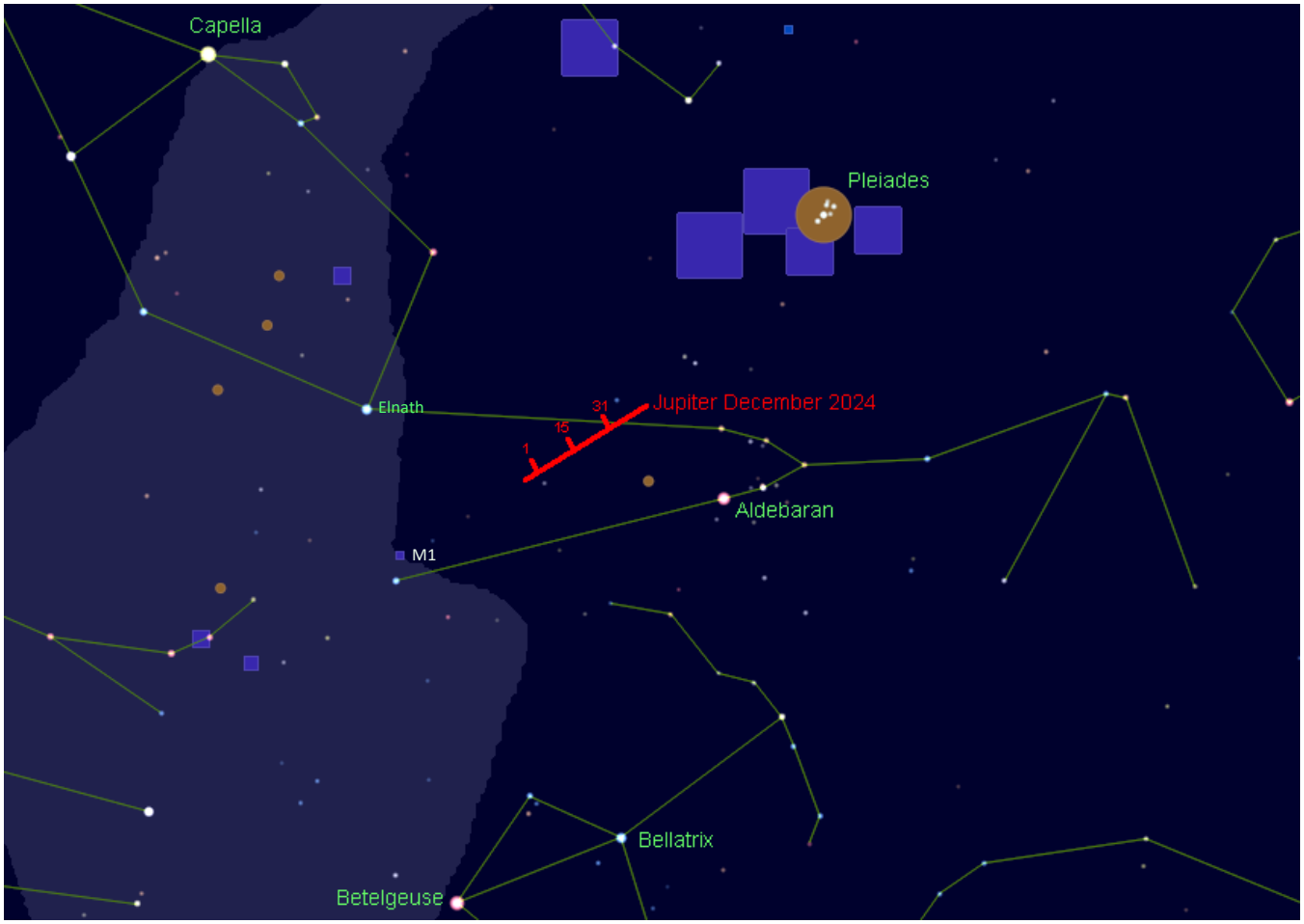
Herman Melville, *Moby Dick*, Chapter 57: Of Whales in Paint; in Teeth; in Wood; in Sheet-Iron; in Stone; in Mountains; in Stars

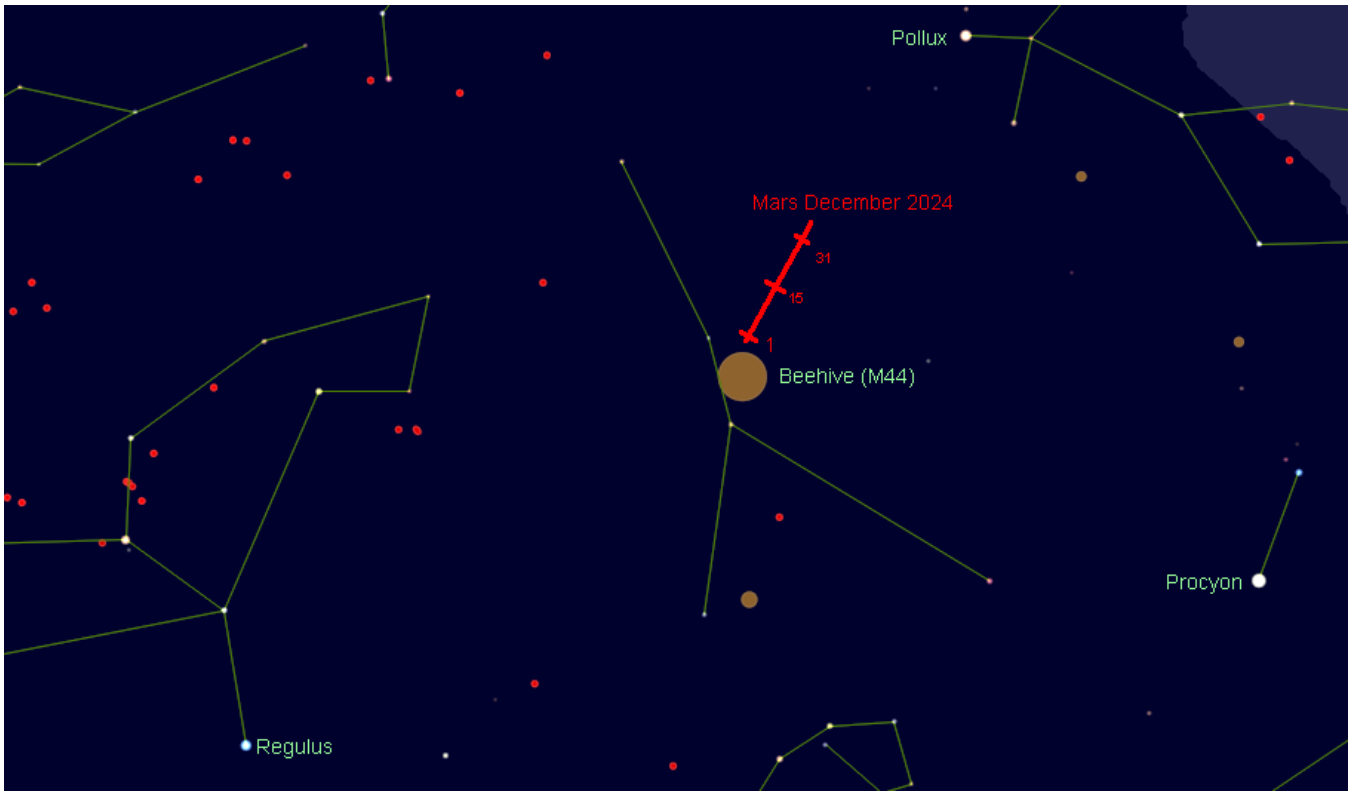
Night Sky Map for December 2024



The night sky from Westchester at around December 1st at 11 p.m. and around 10 p.m. on both December 15th and 31st. The Moon, of course, will vary from night to night. It will be new on both the 1st and 31st, so it won't be in the night sky at all on those dates. It will be full on the 15th, rising at sunset and culminating at midnight.

We make the map with Cartes du Ciel, our favorite (free) Windows planetarium program. You can download it at https://www.ap-i.net/skychart/en/start. Many WAA members also like Stellarium https://stellarium.org/.

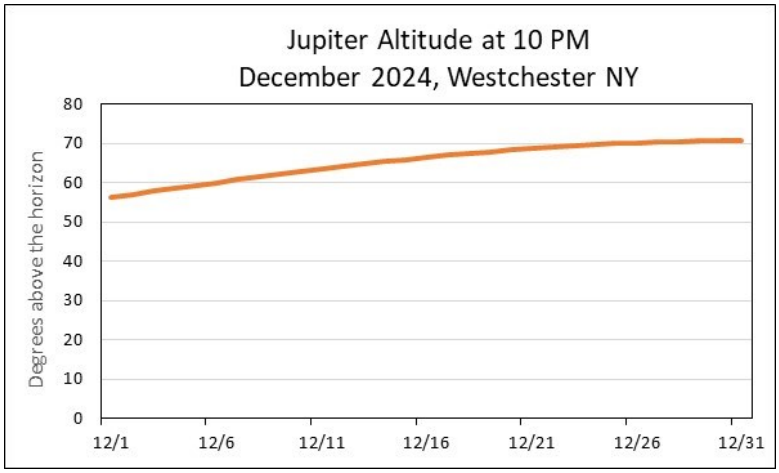

Capella
Pleiades
Elnath
31
15
1
Jupiter December 2024
Aldebaran
M1
Bellatrix
Betelgeuse


Pollux
Mars December 2024
31
15
1
Beehive (M44)
Procyon
Regulus

Jupiter in December

Jupiter will be ideally placed in the after-dinner sky in December. It reaches opposition on December 7th, crossing the horns of the bull halfway between Aldebaran (α Tauri) and Elnath (β Tauri), as shown in the map on page 6. On December 1st, the planet's disk, 48.1" in diameter, will be shining at magnitude -2.8. It is 4.09 astronomical units from Earth. At the end of the month, it will still be at magnitude -2.7, having moved just 0.1 AU further from us. The disk will have decreased slightly to 47.0".

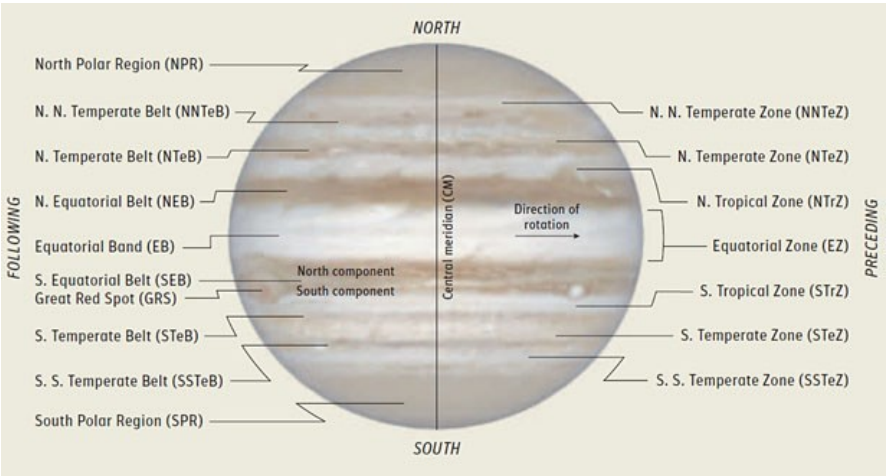
The best shadow transits during evening and midnight hours this month are given in the table. The double shadow transit in the early morning of December 23rd will begin when the planet is in the west at 34° elevation, so still amenable to viewing and imaging.



Date	Moon	Ingress	Egress
12/1	Io	21:13	23:24
12/5	Europa	22:11	00:45
12/8	Io	22:58	01:07
12/13	Europa	00:47	03:21
12/15	Ganymede	21:34	23:49
12/16	Io	00:52	03:05
12/17	Io	19:21	21:33
12/23	Ganymede	01:35	03:50
	Io	02:47	05:00
	Double	02:47	03:50
12/24	Io	21:16	23:29
12/31	Io	23:11	01:24

For visual observation, steady skies and high power always help. As always, aperture is king, larger telescopes having smaller Dawes' Limits. About 40X per inch is as high as you can go in general with a fine refractor; perhaps 30X per inch with an SCT. Filters are useful: break out the ones you bought when you first got into visual astronomy. The Great Red Spot (GRS) and the belts are enhanced with blue filters [Wratten 82A (light blue), 80A (medium blue), 38A (blue)]. Red filters [Wratten 21 (orange-red), 23 (light red), 25 (red)] bring out bluish features, such as the projections and festoons often found on the southern edge of the North Equatorial Belt. Yellow filters [Wratten 12 (medium yellow), 8 (light yellow)] can enhance the polar regions. Wratten 8 is a good general-purpose contrast enhancer with little light attenuation.

Jupiter is an easy imaging target, but it helps to have a fast camera. Since the rotation rate of the planet is a dizzying 9 hours and 50 minutes, there is appreciable movement over the course of a few minutes of exposure. A good rule of thumb is that your video sequences should last less than a minute. You may need to use the free program WinJUPOS to correct for rotation, and it would always be necessary to use it if you are imaging with a monochrome camera and RGB filters. A very good primer on planetary imaging from Roger Hutchinson, an astronomer who images from southwest London, can be found at https://is.gd/planetimaging.



Deep Sky Object of the Month: Messier 42

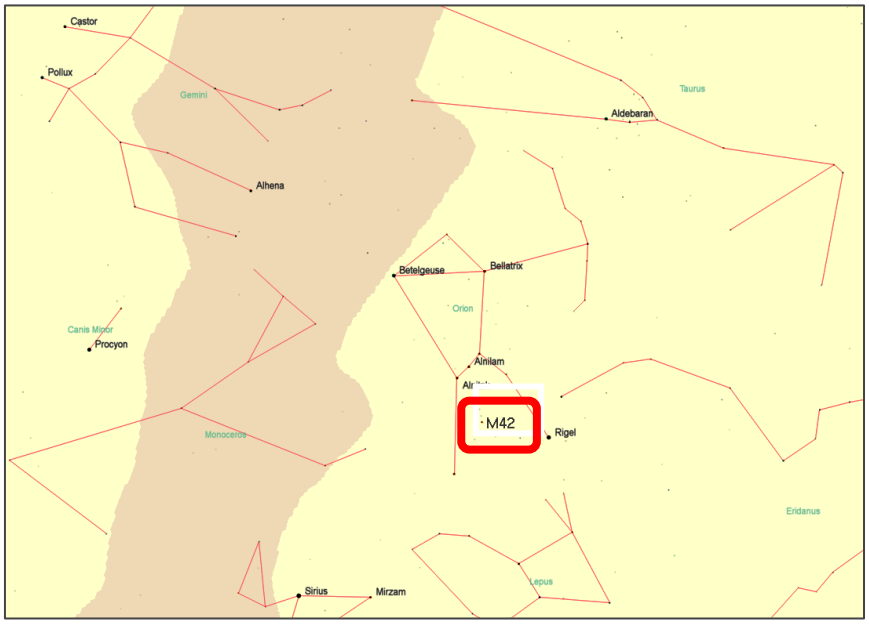
Messier 42	
Constellation	Orion
Object type	Nebula
Right Ascension J2000	05h 35m 17.3s
Declination J2000	−05° 23’ 28”
Magnitude	4.0
Size	60 arcminutes
Distance	1,344 LY
NGC designation	NGC 1976
Other Name	The Orion Nebula
Discovery	de Peiresc, 1610

The most impressive nebula in the northern sky, the Orion Nebula needs little introduction to even casual stargazers, but we felt we ought to include it formally as a DSO of the Month, if only to get you to put on some warm clothes, set up your scope even though it may be cold outside, and view it at least once this winter.

It's easily found in the middle of Orion’s “sword,” although in the many stories about Orion in Greek mythology, including Book 11 of Homer’s *Odyssey*, he was not a swordsman but hunted with a large club.

Visibility for M42			
2200 EST	12/1	12/15	12/31
Altitude	30° 04’	37° 03’	42° 10
Azimuth	130° 40’	144° 54’	164° 13’

Light pollution has dimmed the intensity of M42 for smaller telescopes, but it is still quite visible from Westchester, even in binoculars. The famed Trapezium, the quartet of bright, young O stars first seen by Galileo in 1617 (he only noted three of them) are also easily resolved in small instruments.



Robert Burnham calls M42 “one of the most beautiful objects in the heavens,” and we think it’s rivaled only by the Tarantula and Eta Carinae nebulas, both southern hemisphere objects. Burnham notes that it is “perfectly suited for observation by low-power, wide-angle telescopes,” so that old 6” f/5 reflector or 80-mm f/5 “short tube” refractor that’s been sitting in a closet would be a good choice, with a 32-mm eyepiece to give the widest true field of view.

For more information about the Orion Nebula, read “Orion and His Nebula” in the February 2016 SkyWAAtch. Westchester’s Henry Draper, MD, made the first photographic image of M42 in 1881. It’s since been imaged countless times, and we’ve published quite a few in SkyWAAtch. Give it a try yourself and send it to us.

Another Movie Telescope: *What's Your Number?*

We have an affection for comedies with Anna Farris. Her timing and charming cluelessness illuminate films like *Scary Movie (1 through 4)*, *The House Bunny*, *The Dictator* and even the stoner film *Smiley Face*. In this 2011 RomCom, a small refractor is a prop in the apartment of neighbor and ultimate love interest Chris Evans. The film wasn't well liked by critics, but we think it's clever and has some very funny moments.

October 26th Viewing at Westport Astronomical Society

We couldn't have a star party at Ward Pound Ridge on October 26th because the Meadow Parking Lot was being used for a "Halloween Spooktacular" fund-raising event. The Westport Astronomical Society graciously agreed to host an observing session for WAA members that night. About 40 WAA people made the trip to Connecticut and climbed three flights of stairs to view through WAS's excellent dome-mounted 14-inch Celestron SCT. Westport's Shannon Calvert drove the scope and provided information about the objects. WAS also brought out a 25-inch Obsession Dob which they keep fully assembled in a shed on the grounds. Several WAAers brought their own equipment to view or do astrophotography on what was an excellent night of moderate temperatures, clear skies and great transparency.

Early set-up

The 25-inch Obsession ready to view

A few of the WAA attendees, early in the evening

WAA's Eli Goldfine looking at Saturn

The Westport Astronomical Society is located close to the Merritt Parkway in Westport. They have viewing on clear Wednesday nights from 8-10 p.m. and have a variety of other activities similar to what we do at WAA. You can learn more about them on their web site, https://was-ct.org/.

The Westport dome has an interesting history. In the 1950s two Nike missile batteries were sited in Westport. The event was the basis for the novel "Rally Round the Flag, Boys!" which was made into a 1958 film starring Paul Newman, Joanne Woodward and Joan Collins. The tower was built as an Integrated Fire Control facility. When the military left the area in 1963, the site was turned over to the town's school system. Stairs were built to the top of the tower and a dome was placed to house a 12½ reflector, later replaced by a Meade SCT and most recently by the Celestron SCT. In 1975 WAS formed to manage the facility and do public outreach and education.

Outreach Programs in November

The run of clear skies in October and early November may not have been good for plants and the water supply, but it was great for observing. Besides star parties with perfect conditions at Ward Pound Ridge on October 2 and November 5, and the wonderful experience in Westport on October 26th, three outreach programs scheduled in November could not have taken place under better skies (except for unavoidable light pollution).

Port Chester

The event at Port Chester's Park Avenue School was arranged by WAA President Jordan Webber after his wife Nicole, the membership chair of the Park Ave School PTO which the Webber children attend, suggested an Astronomy night at the school. November 7th was chosen because of a well-placed Moon and Saturn. Nicole coordinated with the school and made fliers which were sent home with all of the students earlier in the week.

We had eight telescopes on the sports field between the Park Avenue School and Port Chester High School to the west. WAA participants were Mike Lomsky (Orion 14" motorized Dob), Bob Kelly (8" Skywatcher GoTo Dob), Tony Bonaviso (running the club's 8" Celestar SCT), Larry Faltz (5" Maksutov on an AZ-GTI mount), Anthony Maida (10" Celestron StarSense Dob) and Jordan Webber (10" ES Newton on an Atlas Pro in Alt-Az mode and a 4" Mak on a SkyView Pro EQ). Nicole helped keep the 4" Mak on track for a bit when things calmed down a little at the entry gate

Over 200 people, including students. their parents and siblings, viewed the Moon, Saturn and Albireo. We received overwhelmingly positive feedback. Nicole said some of the other PTO members commented that it was easily one of the best events that they could remember. The school's science teacher Maria O'Brien reached out to ask if we would be able to do a similar event for some of the other elementary schools in the district. We'll start looking at dates in the spring.

We received this email after the outreach:

Dear Jordan Webber and members of the Westchester Amateur Astronomers,

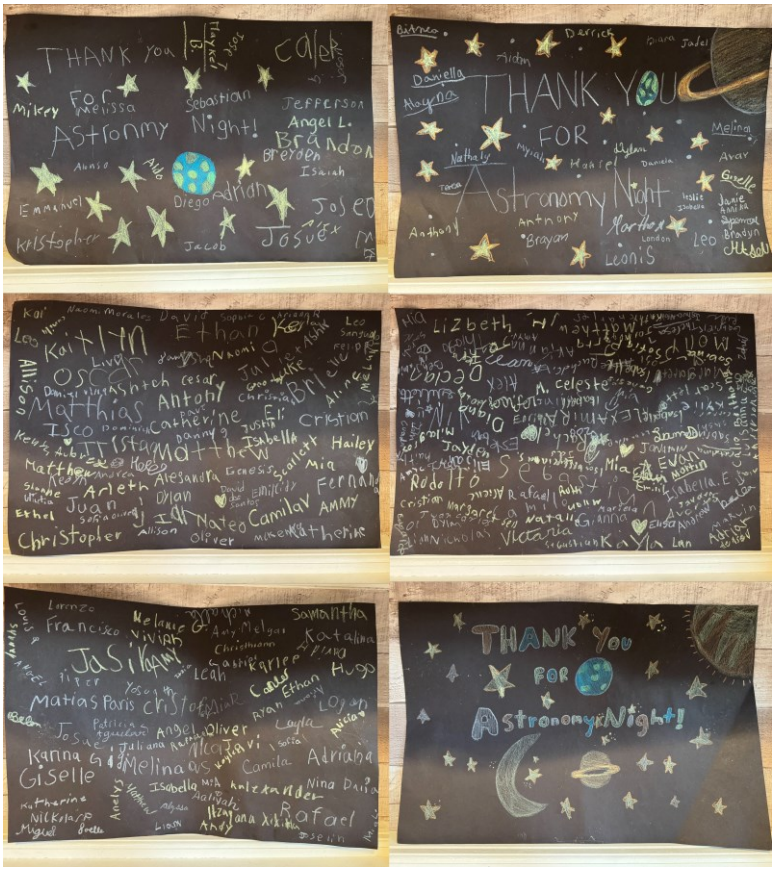
On behalf of all Park Ave families, the PTO would like to personally thank Jordan and Nicole for helping to coordinate, and all who volunteered their time to make Park Ave's 1st Astronomy Night a HUGE success!

We continue to hear such positive reviews from both students and the parents about the night! We hope to have another event again soon!

We truly appreciate each of you volunteering your time and all the knowledge you brought to make it such a memorable night - it wouldn't have been possible without each of you!

Thank you so much!

Laura Ianello, Co-President
Park Avenue PTO



Larchmont and Harrison Libraries

As part of the Ursa Minors, WAAs new program reaching out to interest young people in astronomy, Eli Goldfine arranged for programs at the Larchmont Library on November 12 and the Harrison Library on November 13. Each outreach began with a short, illustrated lecture by Eli about what can be seen in the night sky. Then the attendees and their parents went outside to see the Moon and Saturn. We observed from Constitution Park, across Larchmont Avenue from the Library, and in the small park next to the Harrison Library. At the end of the evening in Larchmont, Jupiter peeked above the roof of French-American School across the street. Scopes were brought to both events by Bob Kelly, Larry Faltz, Josh Knight and Tim Holden, and Jordan Webber came to Harrison. Eli demonstrated the ZWO Seestar 50 "smart telescope" which punched through the light pollution to grab the Andromeda galaxy. There were at least 50 attendees in Larchmont and 40 in Harrison, for almost all their first look through a telescope, with the usual wonderful excitement.

We needed to fill some white space, so what better than a recent spectacular James Webb Space Telescope image.

The spiral galaxies IC 2163 (upper left) and NGC 2207 are in the process of merging, as seen in this mid-infrared image made on October 24, 2024. Go to https://is.gd/22072163 to see the full-size image, a combination image with the Hubble Space Telescope and explanatory information.

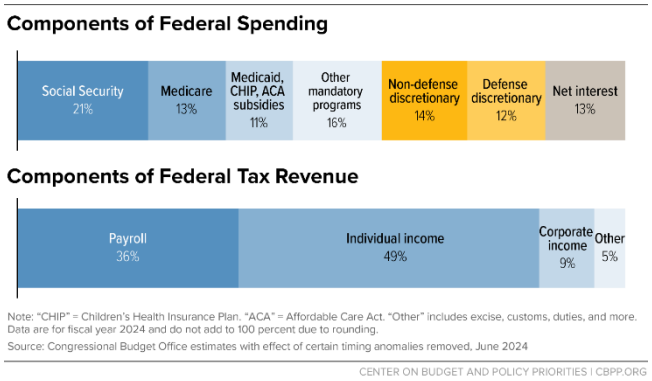
What's Ahead for Astronomy? Larry Faltz

After the election I thought I should write something about how the new administration's policies would affect astronomy. SkyWAAtch, as an astronomy club newsletter, must steer clear of politics (and religion) in spite of your Editor's definite opinions about both (of course, we all have opinions). But I think I can be objective and dispassionate about some of the likely impacts on astronomy, including the space program, astronomical research and even amateur astronomy. It does no good to wait to be surprised when a different philosophy of government, one that has been aggressively articulated and contrasted with the current administration during the campaign, is implemented. And if you have further thoughts or disagree, send me an email and I'll publish it (no invective, please).

A major thrust of the new administration, ignoring both the culture war issues and any personal animosities carried into it by the president-elect, will be on reducing the size of government. A mantra of conservatism and libertarianism, "The government that governs best governs least," has been around since the Goldwater days of the 1960s. Ronald Reagan, in his first inaugural address, famously said "Government is not the solution to our problem. Government is the problem." Reagan was explicitly referring "the longest and one of the worst sustained inflations in our national history" and the growing national debt ("For decades, we have piled deficit upon deficit, mortgaging our future and our children's future for the temporary convenience of the present.") His words became a justification for the belief held by some that by its very nature government is always intrusive, inefficient, profligate and unnecessary. Whether that is never, sometimes or always true depends on your philosophy of the purpose of government. The Declaration of Independence tells us that governments exist to ensure "life, liberty and the pursuit of happiness," a purpose[1] for government perhaps first articulated by Thomas Hobbes in *Leviathan* (1651) and developed by Locke, Descartes and other political philosophers during the Age of Reason. They were direct influences on Jefferson, Madison and the other founding fathers. But the devil is in the details: how to achieve life, liberty and happiness for both individuals and for society at the same time has been the subject of politics ever since.

Although the post-Covid inflation surge has waned, the national debt continues to grow. In 2024, the Federal government took in $4.919 trillion and spent $6.752 trillion, leaving a deficit of $1,833 trillion, which is 6.4% of the GDP. The accumulated national debt at the end of FY2024 was $35.85 trillion. Whether this is a terrible problem soon to be a major disaster or just an accounting number that we can keep in our back pocket depends on which economist you are listening to. There's a reason why economics is called "the dismal science." You can predict the future with physics, but mostly not with economics.

Spending on astronomy, and science in general, is a tiny proportion of the "discretionary" component of the Federal budget. Sixty-one percent of the Federal spending is commanded by entitlements, including Social Security, Medicare, Medicaid, and government and military pensions. Defense is currently 12% of the budget and interest payments on the national debt 13%, leaving just 14% for all other purposes. About 1% of the budget goes for "science," which includes medical research and space.

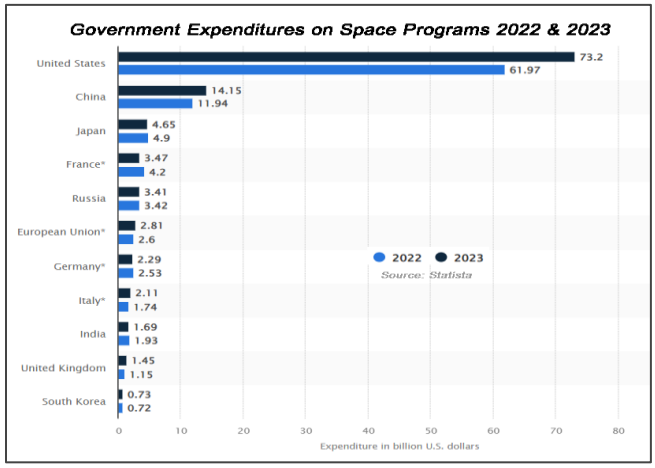


Federal spending for astronomy, whether research, education or space technology is routed primarily through NASA, the Departments of Energy and Defense, and the Nation Science Foundation. The rest of the financial support comes from non-Federal charitable sources directed at academic and research institutions. There may be commercial investment in certain technologies that carries over to astronomy.

[1] Happiness as the goal of life, and the ability to achieve it by being virtuous and seeking the good, was articulated by Aristotle in the *Nichomachean Ethics* and its companion, *Politics* (c. 335 BC).

SpaceX's rocket business is an obvious example. NASA provides the majority of support for SpaceX's non-Starlink missions.

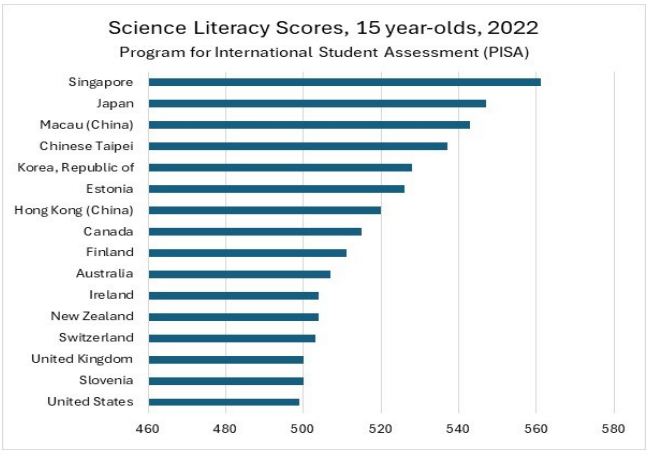
As seen in the chart below, the US far outspends other countries for operational space programs. Included in its budget are expensive deep space probes and other research as well as manned space flight and government-funded satellites. China's growing space program now includes an Earth-orbiting space station and lunar and Mars landers.



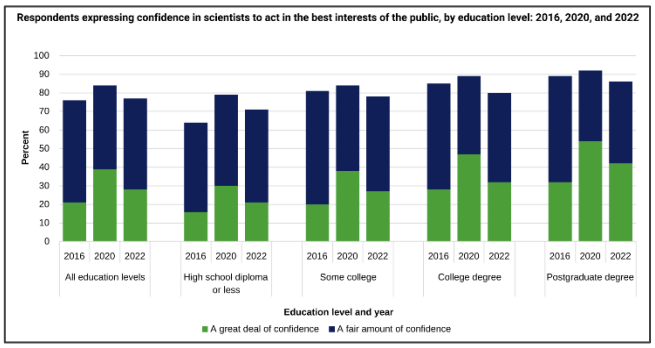
The National Science Foundation spent $9.9 billion on all fields of research in 2023, funding 1,900 institutions through 11,000 competitive awards. Only 29% of proposals are funded. The NSF estimates that 353,000 researchers, postdoctoral fellows, trainees, teachers and students are supported directly by these grants. Over half the basic research performed at US institutions is funded by the NSF. The way the data is presented, it's difficult to tease out exactly how much of this budget goes for astronomy research, but the NSF reports that it provides 36% of total Federal support for "physical sciences." The NSF provides funds for construction, operation and maintenance of astronomical facilities such as the large research telescopes of the National Optical-Infrared Astronomy Research Laboratory (NOIRLab); $73 million was spent in FY2023 on these facilities.

The American Association for the Advancement of Science reported that,

> Government spending on research rose from $161 billion to $200 billion in the first 2 years of [the Biden] administration. But it plateaued this year after a budget agreement capped overall federal spending; nonmilitary research, about half the total, fell by 10%. Spending on civilian science could drop even further as Republicans seek cuts to offset the massive increase in the federal deficit expected to result from Trump's push for lower taxes, says [former Rep. Bart] Gordon, who chaired the House of Representatives science committee from 2007–10.[2]



Science will have to fight to maintain its resources at the Federal level. This is not a new fight. To the extent that science provides tangible and comprehensible outcomes for people in their daily lives, it will get support, while research programs for arcane scientific questions are always at risk. People understand a cancer research program, but hunting for dark matter particles or studying fast radio bursts doesn't mean much to the average Joe. A confounding factor is the dismal state of science knowledge in this country. US students score poorly against their peers in other developed countries in science and math knowledge (see graph above).

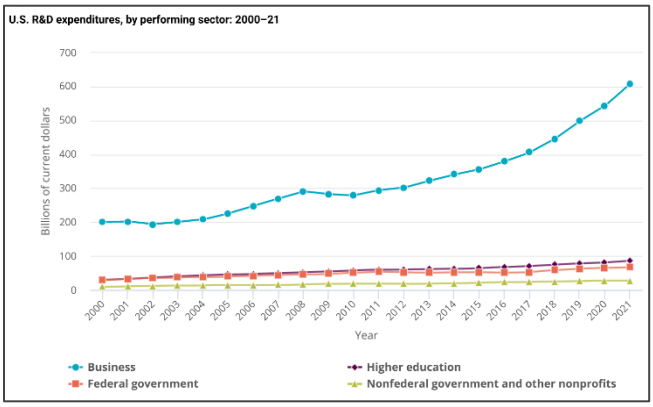


In addition, a proportion of the public does not necessarily think scientists are going to act in their best interests, a trend that also worsened after Covid, as

[2] *Science*, on line 12 Nov 2024,

reported by the National Science Foundation's *Science and Education Indicators 2024*. A Pew Research Center report released on November 15th happily noted an increase of 3% in "fair" or "great amount" of trust in scientists, slightly reversing the post-Covid trend.

We should also distinguish between "science" and "research and development," although they often overlap. Businesses are still substantially funding their own R&D. When a business engages in R&D, its primary goal is to help make profit. Discoveries may have a beneficent impact on individuals (think of R&D to develop safer automobiles, which is a marketable feature) and possibly society as a whole (such as vaccine development), but as desirable as these are, they are secondary considerations.



I found it hard at times to separate "science" from "technology" in many reports and documents. While the two are closely related and at times inseparable, our interest as astronomers is primarily in technology at the service of science. That is, for us the purpose of technology is to help answer scientific questions, rather than just using science to create better technology. We want to Invent new detectors to find dark matter particles, for example. We don't make detectors and then look for something for them to detect (although serendipity can achieve such a result, for example Karl Jansky discovering radio emissions from space while trying to improve transatlantic radio reception). Business does the least amount of "basic research" compared to other sectors, but that shouldn't be a surprise. R&D is generally not "basic research" although some of the things done at Genentech and IBM Watson Labs, among other exceptional corporate R&D facilities, might fit the description.

Research done by academic institutions is primarily funded by the Federal government through grants and contracts from the previously mentioned agencies. Reductions in Federal support will directly impact colleges and universities, their faculty, students and employees. Grants for research not only include the direct costs of research salaries and equipment, but have a significant "overhead" factor that provides for the institution's infrastructure and management costs (the security department, insurance, administration, building maintenance, etc.)

To try to tease out the next administration's view on science, I read through some of *Project 2025*, the Heritage Foundation's blueprint for remaking the government. While the president-elect has disclaimed knowledge of the document, it surely will form the philosophical and perhaps practical basis for making changes in the Federal government during his administration. Among its 887 pages, which contain a vast number of recommendations for reconfiguring and downsizing the Federal bureaucracy, there is no mention of "astronomy," nor is NASA mentioned. The only reference to the National Science Foundation is to criticize "the ill-advised attempt to expand the [NSF's] mission from supporting university research to supporting an all-encompassing technology transition," (p. 371) a criticism in the context of conservative opposition to clean energy programs. *Project 2025* is very anti-green.

The chapter in *Project 2025* on the Department of Energy contains the most mentions of "science." Science is (appropriately) portrayed as playing an important role in energy policy and progress, with statements such as these:

> The next conservative Administration should prioritize energy and science dominance to ensure that Americans have abundant, affordable, and reliable energy; create good-paying jobs; support domestic manufacturing and technology leadership; and strengthen national security. (p.363)

> …should focus on fundamental science and technology issues, particularly in relation to cyber and physical threats to energy security, (p.369)

> The next conservative President should commit the United States to scientific dominance to support national and economic security, especially in light of similar efforts by China. (p. 393)

> The United States is losing its dominance in scientific discoveries and technological development. China and other adversaries have been stealing American science and technology for years and are now on the verge of dominating science—a development that is fraught with negative strategic and economic implications for the United States. The next Administration must commit itself to ensuring that the U.S. continues to dominate scientific discovery and technological advancement. (p.394)

Although not specifically addressed, science education may be at risk if the Department of Education is "eliminated" and "education is publicly funded but education decisions are made by families." (p. 319) In such circumstances the pre-college science curriculum might be compromised. Some faith-based schools, subsidized with public funds, might resume teaching intelligent design and other debunked subjects, alleging them to be scientific. The arguments for science in the DOE chapter suggests the authors of *Project 2025* understand that rigor in science education is needed, but it's not clear which initiative would dominate.

Whether the specific recommendations in *Project 2025* are appropriate or feasible is not the subject of this essay. Suffice it today that there is nothing explicit in support of "basic" research in the document, although it may be implied in the Department of Energy chapter. Science is linked to achieving discrete goals, primarily "energy security" and advanced nuclear weapons for defense, rather than for the general expansion of human knowledge and increased understanding of the world. This is consistent with an expectation that if you spend the taxpayer's money, the taxpayer ought to see and feel a benefit.

In Europe, several democracies have moved to the right as populist parties opposed to immigration gain legislative seats and roles in government. Parliamentary governments in Italy, Slovakia, Hungary and Croatia now include far right parties. Although the German Alternative für Deutschland (AfD) party lost seats in the Reichstag in 2021, it still has substantial support, representatives in the Bundestag and delegates to the European Parliament. The latest polls show AfD to now be the second most popular party in Germany. An article in November in the British science journal *Nature* reported that "the [right-wing] parties…care little about research, say policy experts." As an example, the Party for Freedom, led by the anti-Muslim activist Geert Wilders, entered the coalition government in the Netherlands in July and proposed at €1 billion cut in the country's research budget, the equivalent of closing one of the country's 14 universities. The cuts will be particularly hard on early-career investigators. Green hydrogen projects and medical research will get €6.8 billion in cuts. About €300 million in grants for international students is also being eliminated. A justification advanced by the Dutch Ministry of Education, Culture and Science is that people should have "more money in their wallets" after a proposed tax cut. This is language analogous to elements of *Project 2025*, as well as core conservative anti-tax policies, so we might expect similar proposals in the next administration's FY2026 budget.

The article noted, "Neglect of science isn't always confined to the far right. France's new center-right government has disappointed scientists by scrapping long-term budget increases [for research] as it tries to lower government debt." Left-wing governments (the UK under Labour for example) facing similar fiscal constraints will end up with the same limited options.

Some of the European parties share with many of the most conservative Republicans a disbelief in climate change. AfD has explicitly denied climate change as part of its platform. In its recommendation to "dismantle" the NOAA, *Project 2025* refers to the "climate change alarm industry," (p. 675) a revealing description. Given the vast amount of scientific evidence for climate change, this denial of evidence poses an obvious concern, but because it has roots in powerful business interests as well as the voracious appetite of the public for energy, its conspiratorial anti-science quality may not bleed into other areas of scientific reasoning. A not-insignificant number of people acknowledge anthropogenic climate change but feel the costs and disruption of fixing it, both economically and socially, are impossible. This is distinct from the broad disdain for scientific evidence expressed by Robert F. Kennedy, Jr., who appears will play a major role In the biomedical research and public health fields.

The most tangible astronomy-related impact of the new administration will likely be on the space program, because of the participation of Elon Musk in the new administration. Like him or hate him, he's

going to have considerable sway over space policy and operations even as he takes a broader role in eliminating government "inefficiency." Even had he not donated $132 million to the Trump campaign (via Musk's America PAC), the success of SpaceX and the ever-increasing focus on commercialization of space will give his views substantial weight in both the Executive and Legislative branches of government.

In September 2024, the National Academies of Science, Engineering and Medicine published *NASA at a Crossroads: Maintaining Workforce, Infrastructure, and Technology Preeminence in the Coming Decades*.[3] In the first chapter, after noting recent successes of the Chinese space program, the report comments,

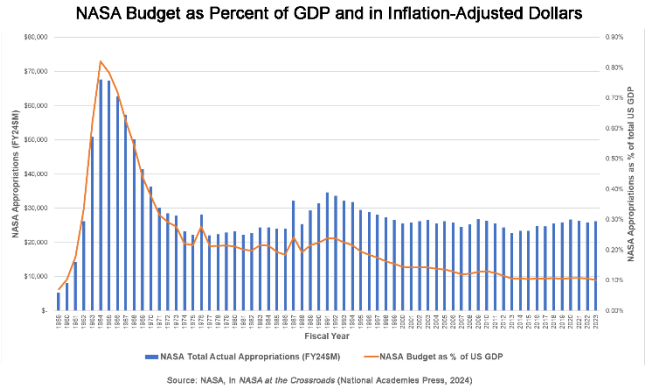
> The matter at hand is one that commonly threatens businesses, governments, and universities alike, and comprises the tendency to focus resources on near-term accomplishments and problems at the expense of longer-term viability. In an opportunity-rich environment, such as NASA has confronted over the years, the choice has too frequently been to pursue near-term missions at the expense of investing in the ostensibly invisible foundational assets of the organization. The inevitable consequence of such a strategy is to erode those essential capabilities that led to the organization's greatness in the first place and that underpin its future potential.

The document concludes that

> NASA must rebalance its priorities, even if it means investing more in people, facilities, and cutting-edge technology at the expense of initiating new missions—as unattractive as that choice may be. Also in the category of difficult choices, if recent funding trends prevail, the United States—and NASA—will be required to make some definitive but inevitable decisions about the cost-benefit relationship between human and robotic spaceflight.

New Horizons, Juno, the Mars rovers and of course the James Webb Space Telescope make it hard for us to conclude that the latest missions aren't both technologically advanced and very successful. On the other hand, the Artemis project to return to the Moon has been plagued by delays and postponements. Cost increases and delays incurred by JWST can easily be cited as evidence of problems somewhere within NASA, even if JWST has exceeded its scientific and engineering expectations. One of the "core findings" of the report acknowledges that,

> Although NASA has successfully carried out many extraordinarily challenging missions over its lifetime, the agency has had a continuing failing in conveying to external stakeholders accurate cost, schedule, and technology readiness estimates, as well as estimated levels of budgetary reserves needed for complex major development projects. The profoundly negative consequences of this are felt far beyond the specific projects producing the delays and unanticipated funding demands.



Contrast this with NASA's performance between 1961 and 1972, from President Kennedy's announcement of his plan to place a man on the Moon to Apollo 17. Innovation, daring, and rapid progress characterized every aspect of the space program. Kennedy rammed large appropriations through Congress, explaining to the American public that they were paying "50 cents a week" to beat the Russians, reassert national pride and show technological dominance after Sputnik and Yuri Gagarin.[4] After the space race of the 1960s, NASA's budget as a percent of GDP has slowly eroded, as can be seen from the graph above.

Manned space flight is among the world's most "macho" activities, something confluent with the Republican campaign's successful appeal to male voters. Although there hasn't been any polling that I've seen on the matter, I suspect that for the average voter astronauts would be viewed as "strong," a quality ascribed to Trump by many who voted for him, while research astronomers might be seen as members of a disdained "elite." I think space travel will get

[3] Free download at https://nap.nationalacademies.org/download/27519.

[4] An excellent history of NASA in these years is Douglas Brinkley's *American Moonshot: John F. Kennedy and the Great Space Race* (Harper Collins, 2019)

substantial support, but fundamental research into the cosmos will have to fight for dollars.

Will a huge investment in reforming and rebuilding NASA along the lines suggested by the National Academies be feasible, especially within a philosophy of small government and privatization? Might we expect a proposal to essentially privatize NASA, giving SpaceX the responsibility for the totality of space missions, manned or not? Replace (or at least merge) the faded old with the dynamic new? Such a scenario is consistent with the privatization and deregulation mantras that have been a regular Republican policy proposal for decades (recall efforts to privatize Social Security and calls in *Project 2025* to privatize the TSA (p. 134), the Fannie Mae and Freddie Mac housing finance agencies (p. 706) and the National Oceanic and Atmospheric Administration (p. 664).[5]

While the Europa Clipper is a NASA device, it was propelled into space by a SpaceX Falcon Heavy. With the embarrassing failure of Boeing Starliner (and coming rescue of the stranded astronauts by SpaceX), SpaceX looks like it might be the only reliable bet in town. SpaceX as a rocket company certainly doesn't have the broad expertise and experience of NASA, but radical solutions will be very attractive for the incoming administration.

We've already commented in SkyWAAtch on the coming shutdown of the Chandra X-ray satellite,[6] reductions in the Hubble Space Telescope budget,[7] the likelihood that only one of the two telescopes in the Extremely Large Telescope program (US-ELT) will be built,[8] and reduction in the scope of the CMB-S4 project.[9] The Mars sample return mission has been postponed and may never come to fruition. On November 12, JPL announced it would terminate 5% of its workforce as a result, and that followed an 8% reduction in February. The fully built lunar rover VIPER (Volatiles Investigating Polar Exploration Rover) was cancelled in July. It will be disassembled and its instruments stored for possible use in the future. Delays and cost overruns that could threaten future missions were cited. Given the incoming president's charge to Musk to improve government efficiency, NASA might seem to him an obvious place to start, and the National Academies' report would give him license.

Space and astronomy programs need Congressional oversight and budget approvals. The new Chair of the House Science Committee is likely to be Brian Babin (R–TX). He represents Houston and has been a big supporter of space operations because of the Manned Space Flight Center is in his district. The Senate Committee on Commerce, Science and Transportation will be Chaired by Ted Cruz (R-TX), known more as a culture warrior than a science advocate, but we can hope that in a leadership position his focus will change and he will become less of a bomb-thrower.

Even had Vice President Harris won the election, the fiscal challenges would still be there, but they will be amplified if the Trump administration succeeds in its promise to lower taxes (or even just extending the 2017 tax cuts) and trying to reduce the deficit with income from tariffs, a strategy that did not work during the first Trump presidency and that many economists disdain.

Grants for more arcane research in fields such as astrophysics and cosmology will be at risk if appropriations for NASA (or whatever follows it) and NSF are further reduced. While there are a variety of charitable foundations that fund astronomical research (the Simons Foundation is an example) they can only provide a small proportion of the resources needed by the many astronomers and facilities that are engaged in research.

Science has a tradition of international collaboration. Even if basic astronomy research maintains its funding, there may well be some restrictions on international cooperation in the form of fewer visas for foreign scholars to work in the United States.

How does this affect amateur astronomy? We are not immune from the fiscal impact of new government policies. Amateur astronomers use equipment that these days is mostly manufactured in China. Many components for the small number of US-made telescopes, mounts and eyepieces also come from China.

[5] Consistent with the conservative approach to government and its belief that private enterprise is more efficient than government, *Project 2025* proposes to "privatize as much as possible." (p. 83)

[6] See the August 2024 SkyWAAtch, p. 12.

[7] See the August 2024 SkyWAAtch, p. 16.

[8] See the April 2024 SkyWAAtch, p. 11.

[9] See the July 2024 SkyWAAtch, p. 11.

The new administration has campaigned on imposing a major increase in tariffs on Chinese goods, designed to encourage US manufacturing and to punish China for unfair trade practices, intellectual property theft and other transgressions. Section 301 of the Trade Act of 1974 (Public Law 93-618) gives the President of the United States vast authority to impose tariffs and take other unilateral actions when a determination of unfair or discriminatory trade practices is made.

The Harmonized Tariff Schedule of the United States (HTS) sets out the tariff rates and statistical categories for all merchandise imported into the US. It is based on the international Harmonized System, the global nomenclature applied to most trade in goods. The level of detail is astounding: 1200 headings in 96 chapters grouped under 21 sections. Fortunately there is a web site, https://hts.usitc.gov/, which you can query to find the tariff on an item and which countries of origin get tariff waivers or have higher rates imposed (countries with which the US does not have regular trade relations, currently Belarus, Cuba, North Korea, and Russia). The HTS site lists an 8% tariff on optical telescopes with exemptions for certain countries with whom the United States has negotiated special trade relations (most of which don't make telescopes…you can import a Jordanian telescope without duty).

But the situation is more complicated. New tariffs on Chinese products were implemented in 2018. On January 15, 2020, the US and China signed the Phase One Economic and Trade Agreement, cooling off what had become a significant trade war between the two countries. This created four lists of products for which tariffs would be modified. Telescopes were on List 4B; tariffs on the products in that group were suspended. That appears to still be the status at the end of November, although to find current information one must wade through vast lists of products, updates and entries in the Federal Register and track down arcane cross references. It ultimately took me almost half a day to write the above two paragraphs!

Section 301 tariffs currently cover approximately 40% of U.S. imports, including 70% of textile and apparel imports from China. In September, the current administration further raised tariffs to 100% on electric vehicles, 50% on solar cells and 25% on electrical vehicle batteries, critical minerals, steel, aluminum, face masks and ship-to-shore cranes. Tariff hikes on other products, including semiconductor chips, are set to take effect over the next two years. It's not clear what the tariff would be on astronomical equipment under the new administration's as-yet to be drafted rules. A rate of 60% for many Chinese products was suggested during the presidential campaign. Once the new administration comes into power, the exemption for telescopes might be removed. What is now an $800 telescope would cost $1000 at the 25% level and $1280 at the 60% level. How much of a disincentive would these prices be to buyers? Will the used telescope business pick up dramatically? Perhaps, but the radical change in telescope technology (computer-driven mounts, cameras, "smart telescopes") may make older equipment much less attractive even at a lower price point.

If you are contemplating the purchase of a new piece of astronomy gear that's made in China or has many parts made in China, you may want to accelerate your purchase and beat the imposition of a possible steep tariff early next year. Goods already on US soil when a tariff increase goes into effect are not subject to additional fees, but prices for those goods may rise anyway. On the other hand, vendors might try to clear their inventory in anticipation of an eventual slowdown in sales, and so offer good end-of-year prices. I tried to get one major on-line astronomy vendor to tell me their strategy, but not surprisingly they preferred to remain mum. Tariffs are supposed to stimulate the development of domestic manufacturing, but it doesn't seem likely that "consumer-grade" instruments (as distinguished from high-end products like those made by PlaneWave or AstroPhysics) will be crafted in the US any time soon. Astronomy vendors and importers may very well petition the Office of the United States Trade Representative to maintain the exemption for telescopes and other products on List 4B if it is not automatically extended. At this point it is hard to know how broad an anti-Chinese tariff structure will be.

Astronomy may be out-of-this-world, but it must deal with complex earthly situations. As Yogi Berra was reputed to have said (but probably didn't), "It's difficult to make predictions, especially about the future." One thing is certain, however: you'd better be paying attention! ■

Images by Members

The Double Cluster by Manish Jadhav

Last month's DSO of the Month was the Double Cluster. Manish sent this image in even before the November issue went to press.

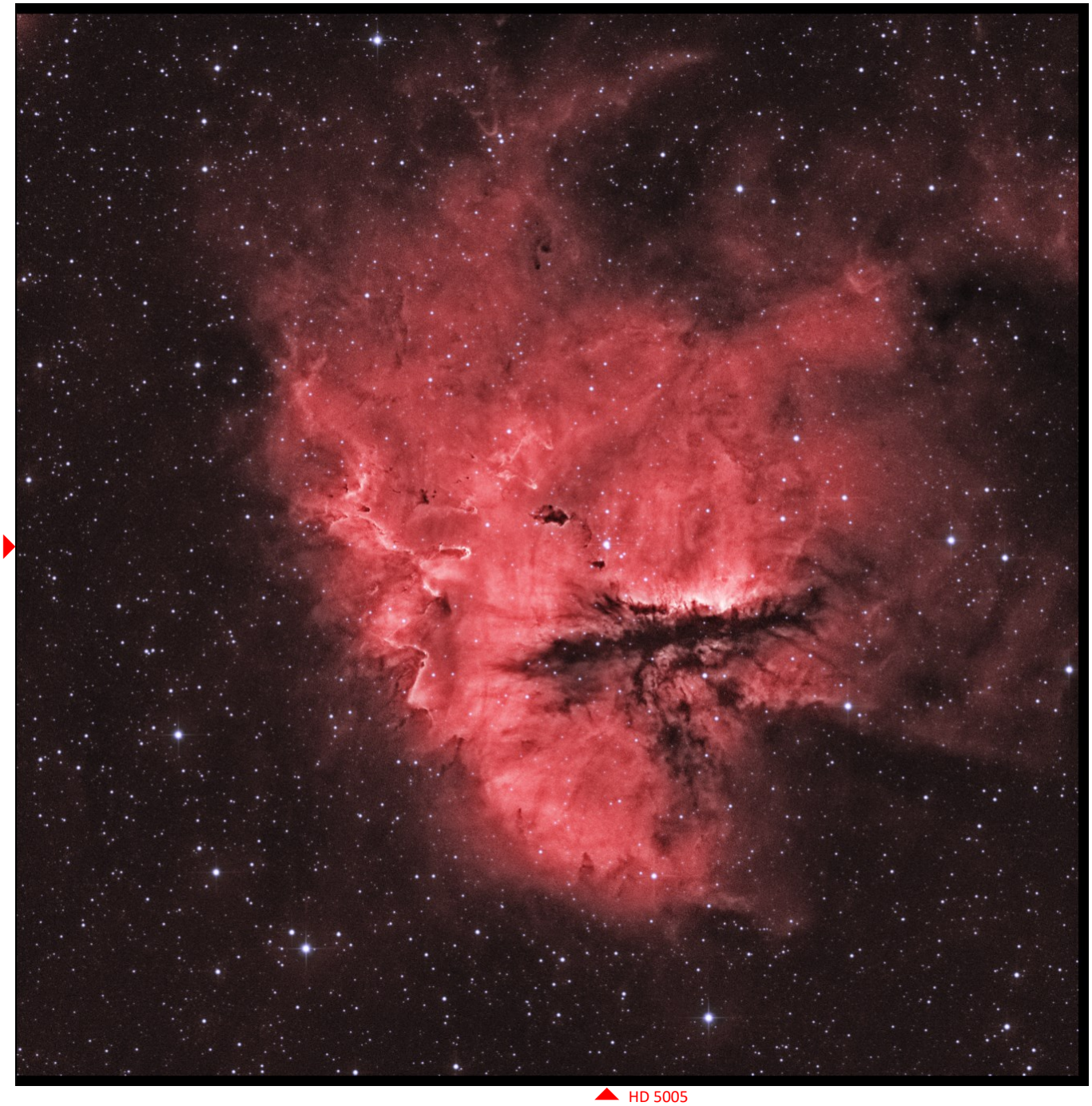
The Double Cluster consists of NGC 884 (on the left) and NGC 869. William Herschel first catalogued them on November 1, 1788 as VI-33 and -34, respectively (VI, the "Sixth Class" is the group of "Very compressed and rich clusters of stars"). The entries in his second catalog (1789) describe the nebulas as:

- VI-33 (NGC 884): A very beautiful and brilliant cluster of large stars, very rich. The middle contains a vacancy.
- VI-34 (NGC 869): A very beautiful, brilliant cluster of large stars, irregularly round, very rich, nearly ½ degree in diameter.

Why were these two impressive and easily seen clusters not included in Messier's catalog? In an appendix to his *Deep Sky Companions: The Caldwell Objects,* Stephen James O'Meara argues that "Messier was a comet-hunter and not a celestial tourist." The Double Cluster lies too far from the usual places in the sky where serious 18th century comet hunters would be looking for new discoveries. Messier's list was, for all intents and purposes, a professional publication, to be used with a standardized search method that probed locations in the sky, focusing on areas close to the ecliptic and near the Sun. That he included in his catalogue some objects that were far from the ecliptic was simply to acknowledge the discoveries of other contemporary astronomers.

Technical information on Manish's image is at https://www.astrobin.com/bir7aj/0/.

PacMan Nebula by Rick Bria



NGC 281 was an early discovery of Edwin Emerson Barnard, who saw it on November 16, 1881 (not August 1883 as reported in the Wikipedia article on NGC 281) as a "large faint nebula, very diffuse" in Cassiopeia. He announced the finding in “New Nebulae - Small black hole in the Milky-Way - Duplicity of β^1 Capricorni” in *Astronomische Nachrichten* 108: 369-372 (1884), a report of five visual discoveries made over two years. Eighteen eighty-one was a momentous year for Barnard, already known in Nashville as an astute observer with the 5” refractor he purchased when he was 19. He had just turned 23 when he married the Englishwoman Rhoda Calvert in January. On May 12 he discovered his first comet, and another on September 17, for which he won a $200 prize offered by H.H. Warner, who had established a private observatory in Rochester, NY (directed by Lewis-Swift). Warner wanted to encourage astronomical discovery in America, whose astronomy capabilities

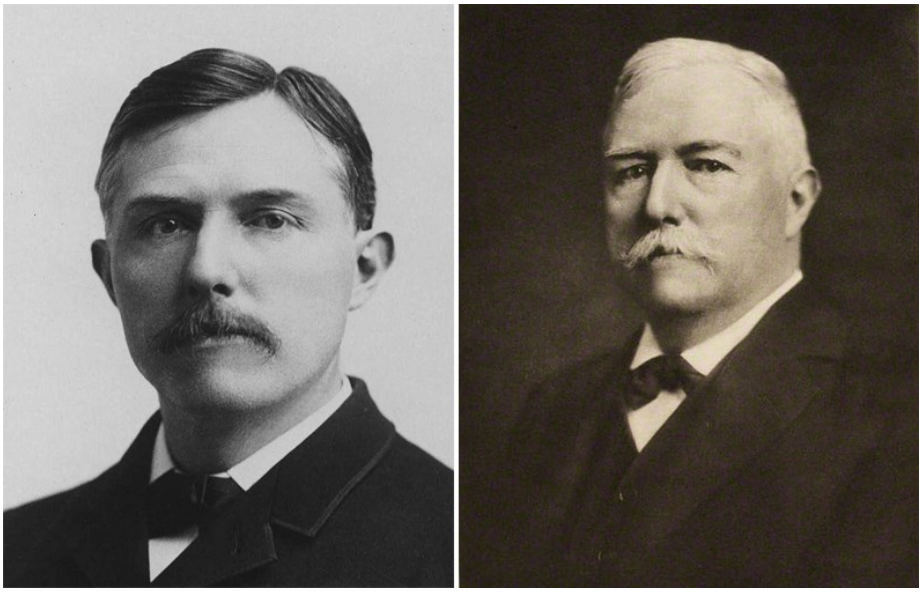
were beginning to rival those in Europe. With four additional comet discoveries, each rewarded with $200, Barnard was able to pay off loans on a small house he was building for his family (he, his wife, and his mother). This nebula was Barnard's second deep sky discovery. In July 1881 he was the first to see NGC 5584 in Virgo, a magnitude 11.4 galaxy (of course, there was no NGC catalog yet).

Barnard had worked at a photography studio since childhood in the days when photographers had to make their own emulsions. He was an astrophotography pioneer, and we described his photographic work in the April 2023 SkyWAAtch article "The History of The Horsehead Nebula and Barnard's Loop." After several years at Lick Observatory he spent the remainder of his career at Yerkes Observatory in Wisconsin. He is remembered today for Barnard's Loop, his 1919 catalog of dark nebulae, and for Barnard's Star, a magnitude 9.6 class M4 red dwarf in Ophiuchus that has the largest known proper motion (10.3 arcseconds per year). In the constellation Ophiuchus, it is the fourth closest star to the Sun, 5.96 light years distant.

NGC 281 is a star-forming region, an emission nebula excited by ultraviolet radiation from hot young stars. It lies at a distance of 9,400 light years in the Perseus arm of the Milky Way. It is associated with the star cluster IC 1590, which was discovered a few years later by Guillaum Bigordan using the 12-inch refractor at the Paris Observatory. Stephen James O'Meara, in the *Deep Sky Companions: Hidden Gems* article on NGC 281 says that the cluster is "a visual bonus—like the inlaid gems and precious stone that adorn the Taj Mahal's majestic white edifice." Modern astrophotography processing tends to emphasize nebulosity over stars. Programs such as StarNet++ even allow the imager to separate the two and recombine them with intensities subject to the imager's taste. The star cluster is somewhat diffuse within and around the nebula. The hydrogen in NGC 281 is energized by emissions from the class O6 star HD5005. You can find it by triangulating the two red markers on the edges of Rick's image. (Your Editor prefers not to place anything on original images).

The overall intensity of the PacMan nebula is said to be around 7th magnitude but the nebula is diffuse enough to have escaped the Herschels and other observers with instruments larger than Barnard's 5-inch equatorially mounted refractor. Since the nebula is the size of the full Moon, it may not have been evident in the older instruments, which had small fields of view (Herschel's "20-foot" instrument at Slough only had a 15 arcminute field).

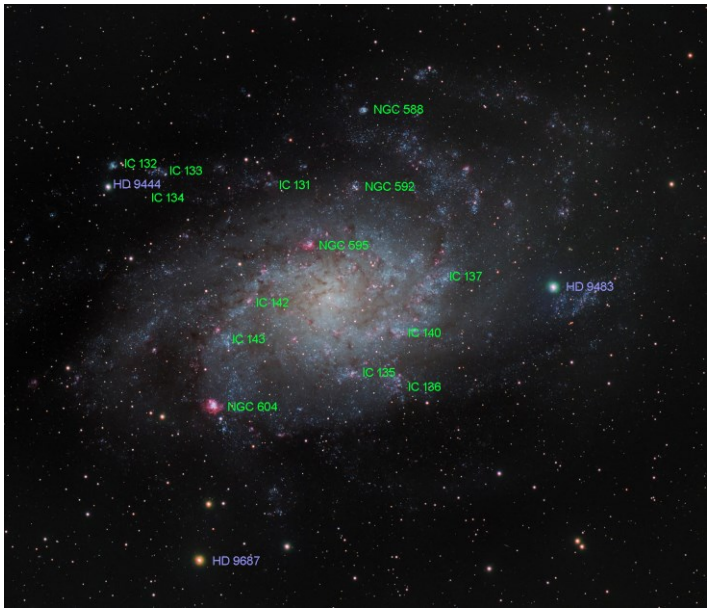
The dark lane of dust that crosses the nebula gives a vague similarity of the nebula to the PacMan of ancient video game fame. By ancient video games, we mean 1980.



E. E. Barnard (1857-1923) as a young man and in his most famous portrait.

Messier 33 by Olivier Prache

Like Bill Caspe's image that we published last month (November 2024 SkyWAAtch, p. 29), Olivier made this image at the Medomak Astronomy Retreat and Seminar in Washington, Maine, during the first week of September. He used an Astro-Physics 130GT (130-mm f/6.3) telescope on a ZWO AM5 mount, obtaining 2½ hours of data.



We labeled Olivier's image to show the major NGC and IC objects within Messier 33 (the whole galaxy is NGC 598). Obviously if astronomers wanted to separately identify every knot of stars and swirl of gas, the labels would obscure the image!

M33 has been tidally disturbed by interactions with other galaxies, but astronomers are not yet sure which objects disrupted its disk and outskirts. A recent paper on the subject is Smercine, A., et. al., The Panchromatic Hubble Andromeda Treasury: Triangulum Extended Region (PHATTER). V. The Structure of M33 in Resolved Stellar Populations, *Astrophysical Journal* 957: 1-24 (2023) https://iopscience.iop.org/article/10.3847/1538-4357/acf3e8 (Open Access).

December 2024 Cover Image: Jones-1 by Steve Bellavia

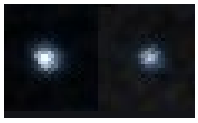
Steve's remarkable image of the very faint planetary nebula PK-104-29.1, sometimes referred to as Jones 1 (abbreviated Jn 1) was made at the Custer Institute over four nights, the last of which was cold enough for Steve to send us a photo of his car's temperature display: 31° F at 12:23 a.m. on the 4th. Steve even sent a photo of the frost on his car.

A Google search on "Jones 1" brings up both this object and Jones-Emberson 1 (JnEr 1), another faint planetary nebula. Both were discovered by Rebecca Jones. We told the stories of each of these objects to accompany images by Gary Miller in the October 2020 SkyWAAtch, p. 23 and the January 2022 SkyWAAtch, p. 26. Finding out about the discovery of Jones-1 took some real scholarly spelunking.

Steve's set-up at Custer Institute. The scope is a TSO-115mm triplet f/7 refractor with a TSO 1.0X field flattener. An ASI294MM camera was used with narrowband filters.

SDSS images of PK 104-29.1 (Jones 1) and PK 164+36.1 (Jones-Emberson 1) at the same scale (13.78 arcminutes across). From Aladin/CDS.

In the professional databases (CDS, Simbad) Jones-Emberson 1 is listed as visual magnitude 17.128. This must be an error and is most likely the magnitude of the central white dwarf and not the whole nebula. Extended objects like this don't get magnitudes to three significant digits. From the SDSS images above, both at the same scale and with the same exposures, Jones-Emberson 1 is clearly brighter than Jones 1, whose magnitude is listed as 15.62. This also must refer to the central star. In the DSS images, the central star of Jones 1 does seem to be brighter than that of Jones-Emberson 1.



Central stars of Jn 1 (L) and JnEr 1 (R) from the DSS images.

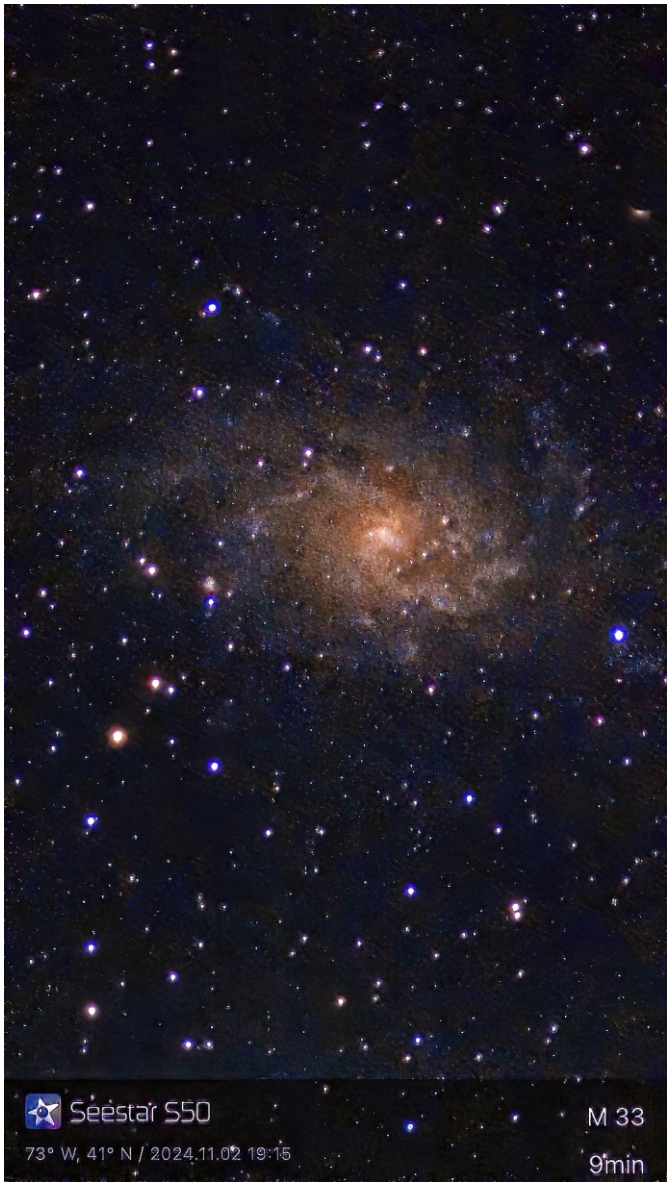
Steve's image captures the very elusive hydrogen-alpha signal just below the main body of the nebula, as well as often-missed (even by DSS) OIII inside the nebula.

Object	PK catalog #	V mag	Constellation	RA	Dec	Distance
Jones 1	PK 104-29.1	15.62 (?)	Pegasus	23h 35' 53"	+30° 28' 9"	2500 LY
Jones-Emberson-1	PK 164+31.1	17.128 (?)	Lynx	07h 57' 51"	+53° 25' 19'	1600 LY

North American and Pelican Nebulas by David Parmet

David made this image of the North American and Pelican nebulas at Cherry Springs State Park in Pennsylvania on the night of October 8-9. Three hours of integration (60 x 180 second light frames, 20 darks, flats and biases) using an ASI533MC Pro camera on a William Optics Redcat 51, carried on a SkyWatcher Star Adventurer GTi mount with ASIAir Plus and an Optolong L-eXtreme dual bandpass filter, which has 7-nm bandpasses at just two wavelengths (Hα at 656.28 nm and OIII at 500.7 nm), with essentially zero transmission elsewhere in the visual spectrum. The result is extremely close to what can be achieved with a monochrome camera and single-band-pass filters, without the need for a filter wheel.

Galaxies from New Rochelle by Arthur Miller



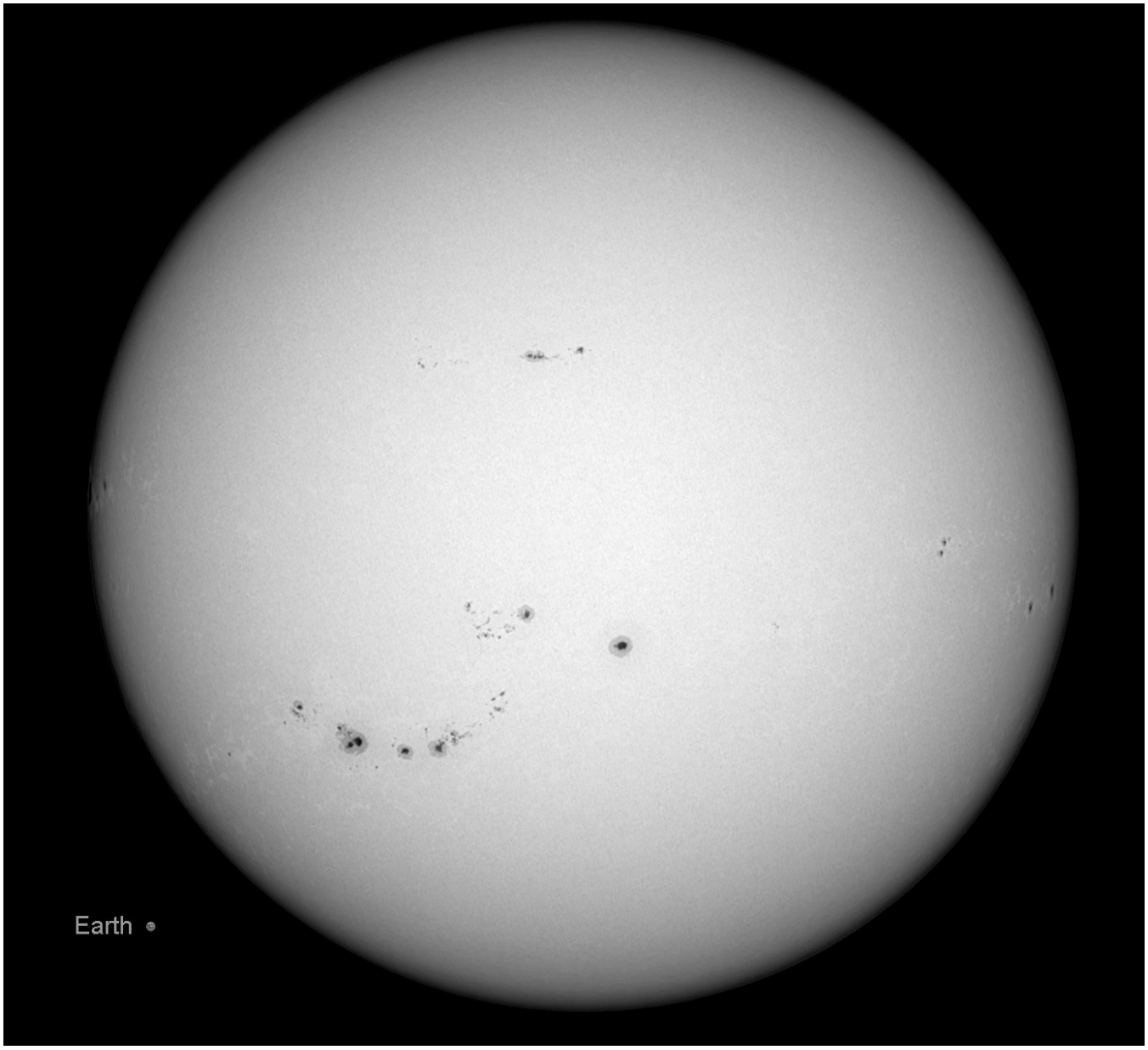
Here are images of our two closest neighbor galaxies imaged with the ZWO SeeStar 50 from light-polluted New Rochelle. Arthur used Affinity Photo 2 to post-process the images.

ZWO is apparently developing a mosaic mode for the SeeStar that would be helpful for objects as large as the Andromeda galaxy. As of this writing it is still in beta testing and may only be available at first for Android systems.

Galaxy	Distance (Million LY)	Apparent Magnitude	Mass (M⊙)	Number of stars	Apparent Size	Red Shift (z)
Messier 31	2.50	3.44	$1.5x10^{12}$	$1x10^{12}$	3.167° x 1°	−0.001004
Messier 33	3.2	5.72	$5x10^{10}$	$4x10^{10}$	70.8'x41.7'	-0.000607

Both M31 and M33 are moving towards us, but simulations show that M33 may not participate in the merger of the Milky Way and M31 that will occur in about five billion years.

The Sun on October 27th by Larry Faltz



On October 15th, NASA, NOAA and the members of the Solar Cycle Prediction Panel announced that we had arrived at solar maximum for cycle 25. The maximum is not a single date, but a range of several months during which the Sun's magnetic field flips and sunspots and solar activity stay at high levels. This will continue into 2025. It is possible that more coronal mass ejections will occur, amplifying the likelihood of auroras being visible in Earth's temperate regions, as they were in May and October this year. Sign up for alerts from NOAA's Space Weather Prediction Center at https://pss.swpc.noaa.gov/ProductSubscriptionService/.

Your Editor made this image at 11:28 a.m. on October 27th using a Stellarvue 80-mm f/6 doublet refractor with a mylar solar filter and ASI533MC Pro camera on a SkyWatcher AZ-GTI alt-az mount. Best 50% of 3150 frames, 0.534 milliseconds each, stacked in Autostakkaert!3, mild wavelets applied in Registax 6.1, rotated to correct alignment (north up) and contrast/brightness adjusted in Photoshop Elements 2.0. The resolution is 1.62" per pixel, which translates into about 1166.9 km/pixel. The diameter of the Sun is 1,391,400 km, so we are resolving features just 0.084% of its diameter. A properly sized image of the Earth is shown. The Sun is BIG!

Saturn by Larry Faltz

Your Editor made this image at the November 2nd star party. It took just a few minutes to focus, make a video, stack in Autostakkert!3 and sharpen in Registax. I was able to show people the live image of the planet in one window on my laptop and the finished image on the other.

The image was obtained at 7:35 p.m. The planet was only 25 degrees above the horizon. Seeing was about 5/10. Celestron CPC800 with 3X Celestron Barlow, so the optical system was 6,096 mm, f/30. Mallincam DS287, best 25% of 8,000 frames.

Visually, I could see four of Saturn's satellites, but it's hard to capture them on an image without overexposing the planet.

You can see the shadow of the planet on the ring behind and to the left of the planet's disc.

Saturn will be visible throughout the month of December early in the evening. Take advantage of early sunsets.

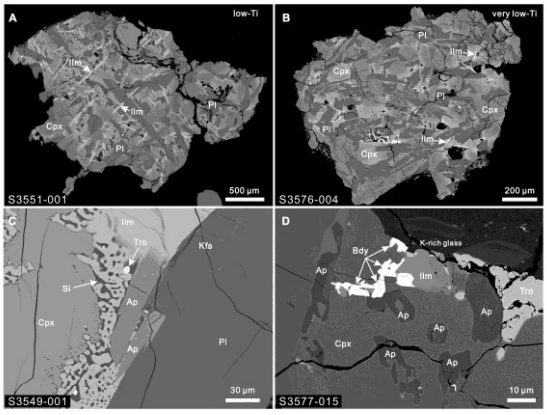
Date	Sunset	Observing Time	Location	Disc Size	Magnitude
12/1/2024	4:26 p.m.	6:00 p.m.	Alt 40° Az 176°	17.5"	+1.0
12/15/2024	4:26 p.m.	6:00 p.m.	Alt 39° Az 194°	17.1"	+1.0
12/31/2024	4:35 p.m.	6:00 p.m.	Alt 35° Az 211°	16.6"	+1.1

Research Highlight of the Month

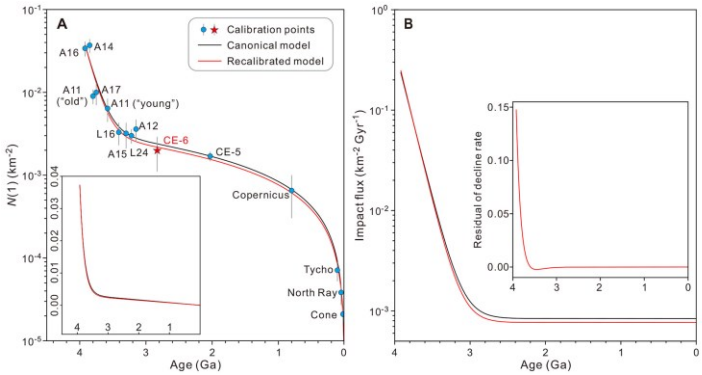
Zexian Cui, et. al. (27 authors), A sample of the Moon's far side retrieved by Chang'e-6 contains 2.83-billion-year-old basalt, *Science,* on-line release 15 November 2024, https://www.science.org/doi/10.1126/science.adt1093.

Abstract: Remote sensing observations have shown that the far side of the Moon (lunar farside) has different geology and rock composition to the near side, including the abundances of potassium, rare earth elements, and phosphorus (collectively known as KREEP). The Chang'e-6 (CE-6) spacecraft collected samples from the South Pole-Aitken (SPA) basin on the farside and brought them to Earth. We use lead-lead and rubidium-strontium isotope systems to date low-titanium basalt in a CE-6 sample, finding a consistent age of 2830 ± 5 million years. We interpret this as the date of volcanism in SPA and incorporate it into lunar crater chronology. Strontium, neodymium and lead isotopes indicate the volcanic magma was from a lunar mantle source depleted in incompatible elements and containing almost no KREEP component.

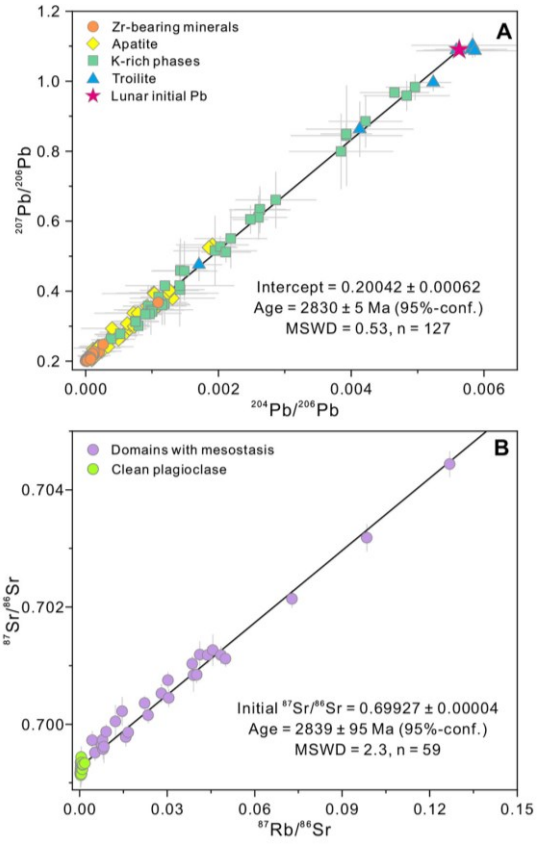
Isotopic dating provides absolute ages for locations on the Moon from which samples have been retrieved (the six Apollo missions, two Russian Luna missions and the Chinese Chang'e-5). The ages of other locations are indirectly estimated from the number and size of impact craters, calibrated to the locations with measured absolute ages. Chan'e-6 returned nearly 2 kilograms of lunar soil for analysis. It landed in a large impact basin. The authors note that "The giant impact basins on the nearside, such as Imbrium, Serenitatis and Tranquillitatis, are all flooded by mare basalts, whereas the SPA basin, the largest lunar impact basin, contains few volcanic deposits." Yet the samples are younger than those returned by Apollo and Luna. The difference may be due to the intensity of the SPA impact, which may have excavated to a depth of 100 km. Subsequent radioactive heating may have redistributed the various KREEP elements, depleting them at the surface.



(Fig 2) Back-scattered electron images of two clasts,



(Fig 5) (A) Density of craters larger than 1 km, as a function of age. Inset is a linear scale. (B) Impact flux.



(Fig. 3) Radioisotope dating of the CE-6 low-Ti basaltic clasts.

Member & Club Equipment for Sale

Item	Description	Asking Price	Name/Email
NEW LISTING Explore Scientific 10-inch f/5 Hybrid Truss Tube Dobsonian.	25-mm and 10-mm eyepiece s, red dot finder, collimation rod, two 2.5 lb counterweights for using heavier 2-inch eyepieces. Just a few months old. Excellent condition, optically and cosmetically. Have the original box and packaging. Image at https://is.gd/XPwDUh.	$600	Manish Jadhav manish.jadhav@gmail.com
iOptron IEQ45Pro equatorial mount head	Traditional German equatorial mount. Includes Go2Nova 8407 hand control (358K objects), counterweight, QHY PoleMaster for easy polar alignment, but no tripod. Payload 45 lbs (without counterweight). Mount weighs 25 lbs. This model is also discontinued by iOptron. The current very similar mount (GEM45) lists for $2,598 (plus $269 for the PoleMaster). A 1.75" iOptron "Lite-Roc" steel tripod costs $350; piers and other tripods are available. Specs for the IEQ45 are still on iOptron's web site. Donated to WAA.	$400	WAA ads@westchesterastronomers.org
iOptron CEM25P equatorial go-to mount	A complete IOptron "center-balanced" equatorial mount. Includes Go2Nova 8408 hand control with >50,000 objects, 4.7 kg counterweight, heavy-duty tripod, QHY PoleMaster for easy polar alignment (laptop required). Low periodic error. Payload 27 lbs (without counterweight). The mount weighs 10.4 lbs. Excellent condition. Although this model is discontinued by iOptron, the current very similar mount lists for about $2,097. Details of the CEM25P and an image are still available on iOptron's web site. Donated to WAA.	$350	WAA ads@westchesterastronomers.org
1.25" Filters	Thousand Oaks LP-3 Oxygen III (2 available)	$50	Eugene Lewis genelew1@gmail.com
	Astronomic UHC (2 available)	$75	
	High Point Neutral Density (2 available)	$10	

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

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

Magnetic and Adhesive Stickers

We made vinyl magnetic and adhesive stickers with the WAA logo and web site address. The magnetic stickers are 4.7" x 3.2" and the adhesive stickers are 3.5" x 2.4".

The magnetic stickers are intended for display on your vehicle. Just remember to remove the magnetic sticker if you are at the car wash.

We'll bring them to the December meeting.

Support WAA and spread the word!