SkyWAAtch

The Newsletter of Westchester Amateur Astronomers

April 2024

Messier 31 by Justin Accetturi

This stunning image of the Andromeda Galaxy was made at Ward Pound Ridge Reservation over several nights in the fall of 2023, with a William Optics GT81, a WO 0.8x field flattener and ASI294MM camera. Justin combined 4 hours of RGB data, 8 hours of luminance data and 8 hours of hydrogen alpha data, which brings out the star forming areas in the outer spirals of the galaxy. The field of view is 2.78 x 1.85 degrees. The bright star in the upper right is 32 Andromedae, magnitude 5.3. Dwarf satellite galaxies M110 (bottom) and M32 (along the upper edge of M31 to the left of the core) are clearly seen. M32 is slightly closer to us than M31 while M110 is slightly further away. All three galaxies are heading towards us and will collide with the Milky Way in four billion years.

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 April Meeting

Friday, April 12 at 7:30 pm

The History of the Universe, from 1919 to Today

Jeremy Tinker, PhD
Associate Professor at the Center for Cosmology and Particle Physics and the Department of Physics at NYU.

Dr. Tinker will review the discoveries that led to our current understanding of the state of the universe, starting with the confirmation of Einstein's general relativity through the discovery of the expansion of the universe, and the pursuit of the nature of the universe that led to the discovery that the expansion of the universe is speeding up.

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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.

I know that I am mortal by nature, and ephemeral; but when I trace at my pleasure the windings to and fro of the heavenly bodies I no longer touch the earth with my feet: I stand in the presence of Zeus himself and take my fill of ambrosia.

Claudius Ptolemy, *The Almagest*

WAA May Meeting

Friday, May 10 at 7:30 pm

NASA Funding and Future Space Missions

Emma Loudon
Department of Astronomy, Yale University

Starway to Heaven

Ward Pound Ridge Reservation, Cross River, NY

Saturday, April 6 (for those not already on their way to the eclipse). Sunset 7:25 p.m.
Saturday, April 13. Sunset 7:33 p.m.
Saturday, April 27. Sunset 7:48 p.m.

Northeast Astronomy Forum

Saturday April 20 & Sunday April 21
Rockland Community College, Suffern, NY
More information: www.neafexpo.com

New Members

Derek Davis	Bronx
Mary Jane Hales	Montrose
Lissette Marrero	White Plains

Renewing Members

Andrea Anthony	Yorktown Heights
Ramon Blandino	Yorktown Heights
Robert Brownell	Peekskill
David Butler	Mohegan Lake
Marcy Cohen	Croton on Hudson
Howard Fink	New York
John & Maryann Fusco	Yonkers
Robbins Gottlock	Sleepy Hollow
Jonathan Greenfield	Yonkers
Frank Jones	New Rochelle
Edi Lentini	Armonk
Warren Lindholm	Cortlandt Manor
Gary Miller	Pleasantville
Tom Morrissey	Pelham
Hugh Osborn	New Rochelle
Pierre-Yves Sonke	Tarrytown
Oliver E. Wayne and Elizabeth	Cliffside Park
Joseph Willsen	Yonkers
Alexandr Zaytsev	Holtsville

ALMANAC For April 2024

Bob Kelly, WAA VP of Field Events


Bob Kelly


3Q 4/1


New 4/8

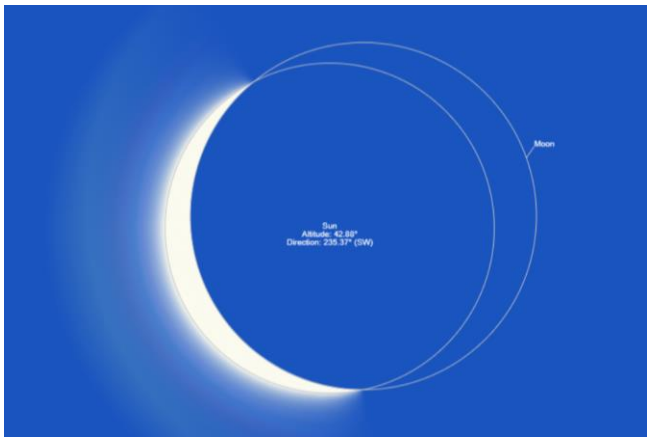

1Q 4/15


Full 4/23

April 8 Solar Eclipse

There are many on-line sources of information about where to go and how to view the solar eclipse of April 8, 2024. If you're not able to get to the path of totality, here are the timings for White Plains, New York, also good for the NYC metropolitan area:

- Partial eclipse begins: 2:11 p.m. EDT
- Maximum eclipse: 3:26 p.m. 89%
- Partial eclipse ends: 4:36 p.m.



Maximum eclipse in White Plains (timeanddate.com)

Remember to use projection methods or *certified* eclipse glasses! The *New York Times* ran an informative and sobering story on eclipse viewing and eye protection on March 20. https://www.nytimes.com/2024/03/20/health/total-solar-eclipse-eye-safety.html. Near the time of maximum eclipse, crescent Suns will be visible via projection through pinholes, under trees, in gaps between overlapping hands, and even through colanders. All weather permitting, of course.

Moon Covers Venus

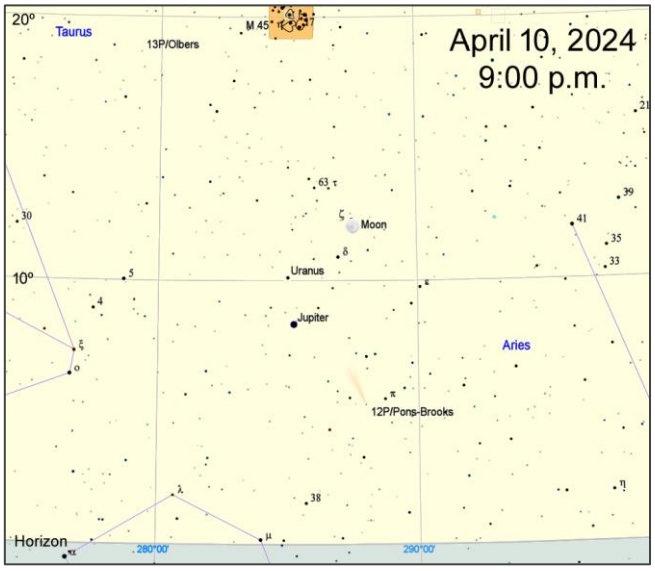
On the afternoon of April 7, the day before the eclipse, the 2%-illuminated Moon will cover up Venus. The occultation will be very hard to see because it is in daylight and very close to the Sun, only 15 degrees away. Venus will be easier to find than the Moon! Perhaps the Moon is using Venus as practice for the next day's eclipse! The bright rim of the Moon will cover Venus at 12:41 p.m., and the planet will emerge from the dark side at 1:51 p.m. To view this occultation you will need to take extreme precautions to ensure that the Sun is outside your field of view. Do not attempt this observation unless you are absolutely sure of what you are doing!

Another Close New Moon

Lunar perigee also occurs on the 7th, 24 hours before new Moon. Be cautious of larger-than-normal tidal ranges for the days following.

Odd-Numbered Outer Planets

Jupiter and Uranus finally line up next to each other on the 20th. That'll be the night when they set together at the end of twilight. So, catch them earlier in the month, a bit further apart, but in a darker sky. A good night for catching the pair of odd-numbered outer planets would be when the crescent Moon is nearby on the 10th.



Mercury Nearly Invisible

Mercury fades quickly to magnitude +1.2 as the month starts, setting during evening twilight. After conjunction with the Sun on the 11th, Mercury comes into the morning sky, rising 45 minutes before the Sun by the end of April. It suffers the same problem as our other planetary friends in the morning sky this year, not gaining much altitude above the horizon

even as it gets distance from the Sun. For a couple of days around inferior conjunction on the 11th, Mercury sets after sunset and rises before sunrise. Technically, Mercury should be visible in both the morning and evening sky then, but it will be so low in the bright twilight that it's not likely to be observable. Since inferior conjunction means Mercury is between the Earth and the Sun, it will have its non-illuminated side towards us, which eliminates the chance of seeing it from Earth.

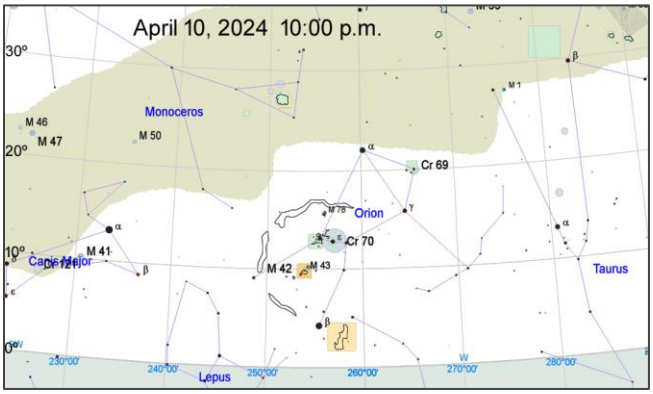
Morning Alignments

Saturn meets Mars on the morning of the 11th. The two planets are just a Moon's width apart. Get binoculars or a small telescope to compare their size, brightness, and color. Both will be about magnitude +1. Saturn will appear three times larger than Mars. As for color, see for yourself! Saturn continues on to a fine showing in the morning sky. It'll become an evening object by late summer.

Mars, despite its ruddy complexion, seems to lack vim and vigor. It struggles to rise before the beginning of morning twilight, not getting out of the twilight sky until mid-May. Neptune is close to Mars around the 29th.

Venus might be visible low in the dawn's eastern sky, looking like a bright light on the mast of a distant ship, rising half-an-hour or less before the Sun.

Evening Stars



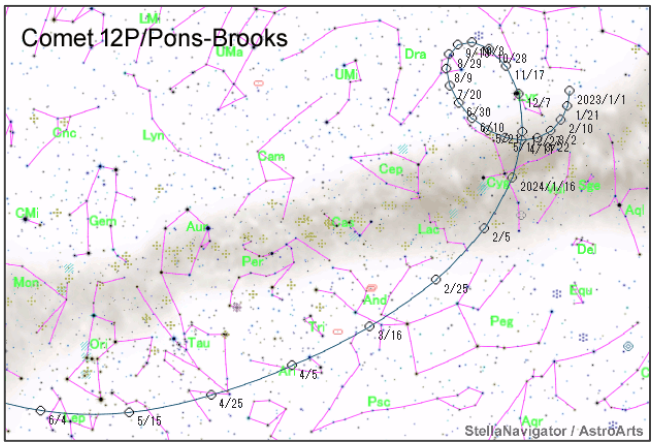
As Leo bounds across the meridian around 10 p.m. EDT, Orion is setting in the west. If you are looking over a body of water, it appears that he's aiming his shield at fish. By midnight, Gemini, the twins, appear to be line dancing along the Milky Way as they set in the west. When the Milky Way sets, we have a view overhead out the top of our galaxy, where there is less dust to dim our views of distant galaxies. The galactic pole is near Coma Berenices, with lots of Messier objects in the area to check out, best to do near new Moon. For a guide to the brightest spring galaxies, see the May 2012 SkyWAAtch, page 3.

Satellites

The International Space Station wraps up March visible in the evening sky. After that our area doesn't get any visible overflights until the ISS shows up in the morning sky on the 19th and makes more passes for the rest of April.

Tiangong is visible in the morning sky through the 12th. China's crewed space station then appears in the evening sky from the 16th through the 29th.

Comet Viewing



Comet 12P/Pons-Brooks is a lovely object in the evening sky. There have been lots of photos with moderate-length exposures (see pages 8 and 22) and people have been viewing it in binoculars and telescopes. Catch it early, as it's getting lower in our skies, starting the month only 7 degrees above the horizon at the end of twilight. The graph on page 22 gives its position one half hour after sunset, which is before the end of nautical twilight. It heads into the southern hemisphere as it approaches perihelion in June.

Next Solar Eclipses for the Continental United States

The next total solar eclipse for the continental United States will occur in Montana in 2044. In 2045, a total solar eclipse shadow will travel from California to Florida. We'll see parts of partial eclipses from our area before then. Tiny partial eclipses in 2026, 2028, 2033, and 2038, and more significant partial eclipses in 2029, 2038, 2040 and 2045. ■

Deep Sky Object of the Month: Messier 85

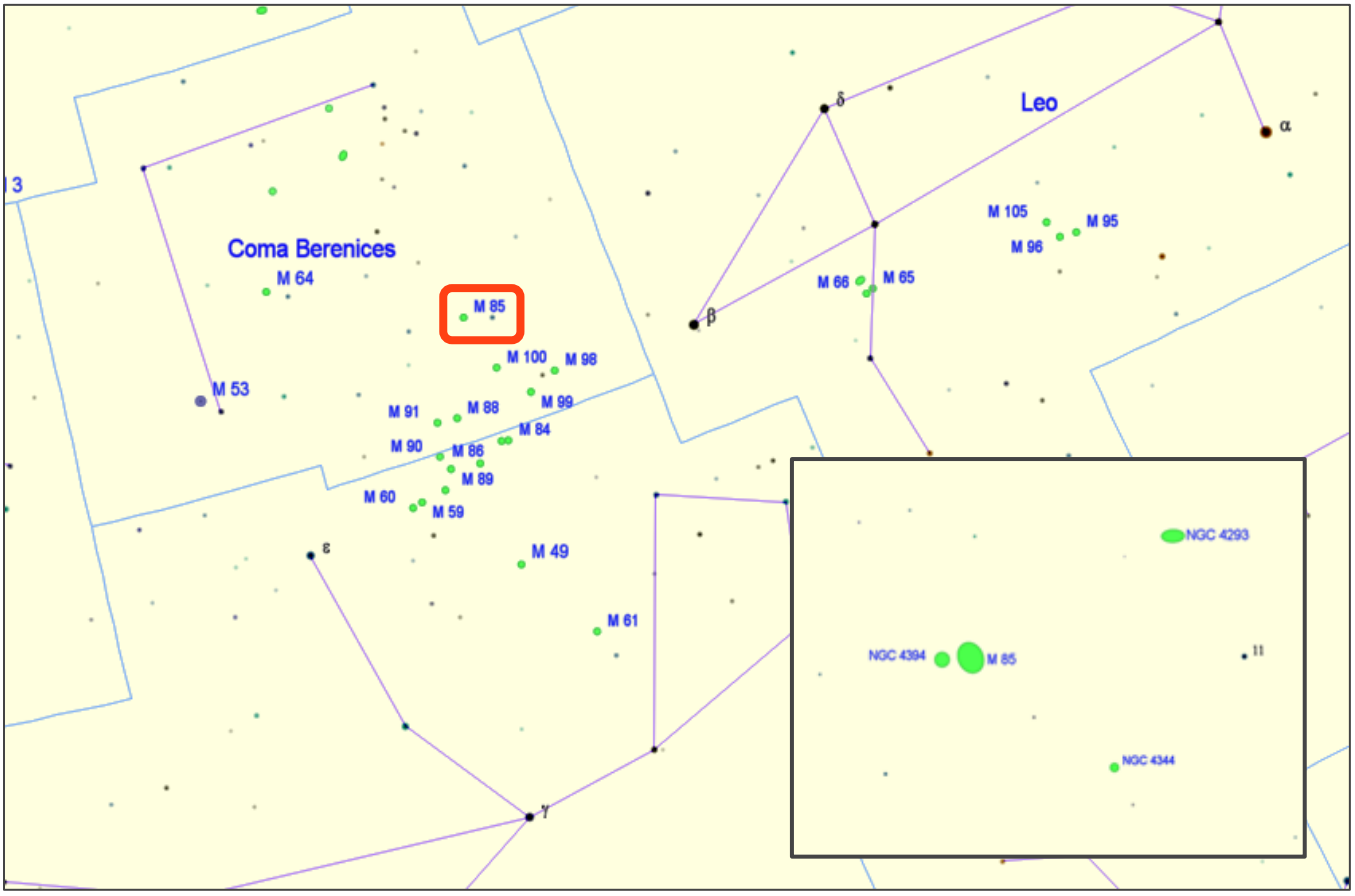
Messier 85	
Constellation	Coma Berenices
Object type	Lenticular galaxy
Right Ascension J2000	12h 25m 24.0s
Declination J2000	+18° 11’ 28”
Magnitude	9.1
Size	7.1 x 5.5 arcminutes
Distance	51.5 million LY
NGC designation	NGC 4382
Discovery	Pierre Méchain, 1781

This hydrogen-poor elliptical galaxy is in the outer suburbs of the Virgo cluster. It is accompanied by spiral galaxy NGC 4394, just 8 arcminutes away. While it looks fairly bland in an amateur telescope, in the radio band there are a series of shells and ripples that formed during mergers with other galaxies.

A substantial number of planetary nebulas have been detected within M85. They are too distant to be resolved but are point sources identified by their characteristic spectra.

Visibility for M85			
22:00 EDT	4/1/24	4/15/24	4/30/24
Altitude	49° 13’	58° 08’	65° 12’
Azimuth	112° 42’	129° 05’	155° 10’

Supernova SN2020nlb was detected in M85 less than 1 day after it exploded, one of the earliest supernova detections on record.



More Movie Telescopes: Barbie!

Three telescopes are seen in last summer's blockbuster film "Barbie." At the beginning of the movie, after the very clever riff on the opening sequence of Stanley Kubrick's *2001: A Space Odyssey,* we are introduced to the vast range of Barbies, one of whom is shown beside what looks like a 130-mm Newtonian reflector on a small EQ mount. She's holding a star map. Is this "amateur astronomer Barbie" or "professional astronomer Barbie"? Either way, she is an example of how the Barbie dolls encouraged young women to strive to compete for formerly masculine roles in society, which is of course the movie's entire argument.

Two small refractors, sadly of the "Hobby Killer" variety, appear near the film's climactic scene dance production number. Ken's (Ryan Gosling) telescope is straight out of the box, while the one being used by Weird Barbie (Kate McKinnon) is also a refractor but it has been splattered with paint. It looks like the lens cap is on the scope (although the finder is uncapped). The EQ-1 mount has been tilted to alt-azimuth mode, which is, frankly, about all those meager EQ-1s are good for, IMHO.

There's no actual "Astronomer Barbie" doll but there is an "Astronaut Barbie," an example of which is on display at the Udvar-Hazy Center, the division of the National Air & Space Museum near Dulles Airport in Reston, Virginia.

We're not quite sure what the device that the Barbie in the middle of the image to the right is holding to her eye, but clearly there's no lens in it, so *she's* definitely not amateur or professional astronomer Barbie. ■

An Observing Report: Sunday, March 3, 2024 — Steve Bellavia

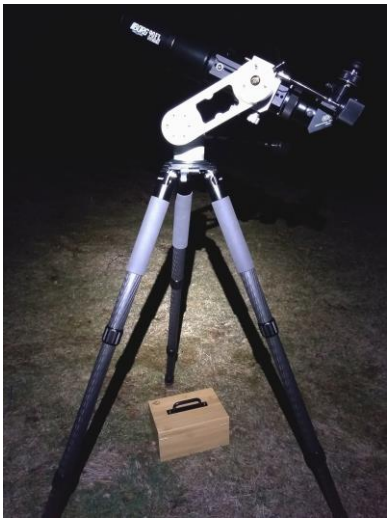
In the November 2023 SkyWAAtch I wrote about new technology telescopes, ending with a plea on behalf of visual observing. We've published a couple of observing reports from Steve, one of our most accomplished astrophotographers, in the past, and this one exemplifies the point I made at the end of the article: "Let's not abandon the eyepiece! Visual observing is still the heart and soul of amateur astronomy." — The Editor.

Steve writes:

I haven't provided an observation report in a long while. But last night was exceptional, so I feel I must share.

After the sunset, in a still-blue sky, Jupiter popped out, much earlier than I remembered in the past. So I looked around, and Sirius was visible too. And then, very quickly, I could see the major stars of Orion - his belt, shoulders and knees. The sky was still blue, and the western sky had much brightness and even some yellow. It was around 6:00 p.m., just 14 minutes after sunset. I knew it was going to be a good night.

As the twilight faded, the sky became the best I have seen in years. I could see all of Orion's shield, which has one star at magnitude 5.3, the fainter of the two at the "bend" to the south.



I set up my 90-mm, f/5. Borg refractor in the farm field across my road [in Mattituck, Long Island], to have an unobscured view of Comet 12P/Pons-Brooks. I could easily see the Andromeda Galaxy, M31, with the naked-eye, and started my telescopic observations there at very low power (18X, with an Explore Scientific 28mm, 68-degree eyepiece). I moved straight down in altitude, and Comet 12P was easily seen. You could see a hint of green color, as well as evidence of a small tail to the northwest (upper left, due to the refractor's left-right inversion, the diagonal preserving the top-bottom orientation).

My neighbor, who lives adjacent to the field, came out, as well as some people from further down the road walking their dog. They also got a great view of the comet and I showed them a whole range of objects at various magnifications. I might have forgot a few, but from memory here's what we saw:

- Comet 12P/Pons-Brooks (18X and 36X, 28mm and 14mm EPs)
- M31, the Andromeda galaxy (18X, 28 mm)
- Jupiter (167X, 3mm)
- M42 (36X and 75X, 14mm and 6.7mm)
- NGC 844-869, Double Cluster (18X and 36X, 28mm and 14mm)
- NGC 457, the ET Cluster (36X, 14mm)
- M81-M82 (36X, 14mm)
- M35, M36, M37, M38, Galactic globular clusters, in Gemini and Auriga (36X, 14mm)
- M45, The Pleiades (18X, 28mm)
- M51, Whirlpool galaxy (36X, 14mm)

All the eyepieces used were Explore Scientific, either 68 or 82 degrees AFOV.

At 6:34 p.m., an extremely bright satellite made a nice near-zenith pass. I thought it was the ISS, but after looking it up, I found it was Tiangong, shining at magnitude -2.2.

Not only was the sky very transparent and steady, but the temperature was comfortable and there was no wind.

Compared to the suffering I experienced when trying to image at McCabe's Beach only a few days prior, this was paradise. On March 1 I tried to park the car to block the wind, but the wind direction was exactly from the comet's direction, and with the comet low in the sky the car blocked the view. The telescope and my laptop got the direct brunt of the wind. I couldn't even sit in the car to stay warm, because I was afraid the table and laptop would be blown to the ground if I were not there to guard it.

I have had more than one night imaging when things did not go well, and I finished the night angry, tired and frustrated. But I don't think that has ever happened while observing visually. Even if clouds came out just after setting up, it was never a big deal. It makes me wonder why so many people want to get into imaging. Maybe the new high-tech equipment will reduce the frustration and number of gremlins that appear while imaging. I hope so, for their sake.

My conclusion:

> **A bad night of observing is better than a good night of imaging. And a good night of observing, like last night, is truly Nirvana.**

Steve's images of Comet 12P Pons-Brooks

Steve was able to capture Comet 12P/Pons Brooks on the nights of February 25th (left) and March 1st (right). The images were taken shortly after sunset, with the comet low in the west. On February 25 the Moon was full, while on March 1 it did not rise until after the comet had set. See also page 22.

From the Editor: A Bit of Generosity — Larry Faltz

Dava Sobel with the Editor at the 2011 WAA meeting

In 2011, the noted astronomy author Dava Sobel, spoke at one of our meetings. She had previously written *Longitude* and *Galileo's Daughter,* both critically acclaimed, and was later to write *The Glass Universe*. At the time of her talk, Dava had just published a book about Copernicus, *A More Perfect Heaven*, and told us about how she went about doing her research. One story stood out: She had been on an eclipse trip a few years earlier, and got into a conversation with a fellow passenger, an amateur astronomer from Poland. She told him of the then-nascent idea for the book, and he invited her to come to Poland, arranging meetings with several Polish astronomers and historians, eventually resulting in access to Copernicus' manuscripts in Krakow. Dava said, "Amateur astronomers are very generous."

That generosity is manifest in all sorts of ways, many of which members of WAA and readers of *SkyWAAtch* are quite familiar, and which from time to time I've written about in these pages as they've affected my own journey in the hobby. Here's the most recent example.

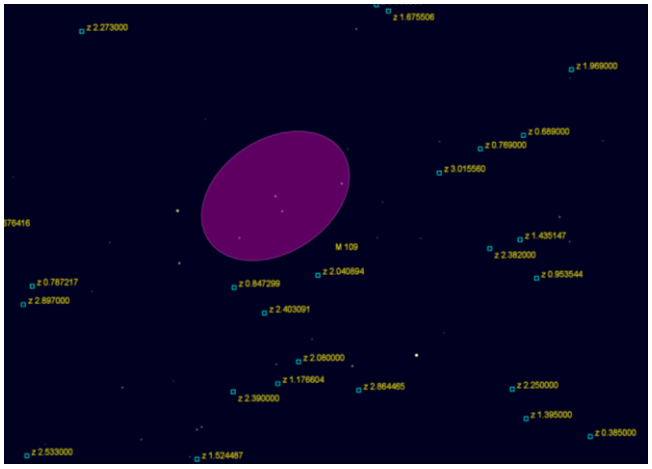
You may also have noticed that most of the sky maps in SkyWAAtch are made with the free planetarium program Cartes du Ciel (en anglais, "Sky Chart"). I've used CdC for about 15 years, starting with its 2.76 version. The current "stable" version is 4.2.1.

In the March 2024 SkyWAAtch, I wrote (and I hope you read) about the most distant quasar imaged by a WAA member. I mentioned how I used CdC to identify more distant quasars in the image sent in by WAA member Bill Caspe.

One of CdC's features is that it can download external databases and catalogs and display the objects on its star map. I downloaded the SDSS quasar catalog, 16th data release, via CdC's connection to the "Virtual Observatory." For these external catalogs, CdC allows you to display position markers in sizes, shapes and colors of your choice, with the name displayed next to each one. You can find other information from the SDSS database (redshift obviously the one of greatest interest) by right clicking the object. This brings up a window with all the fields in the SDSS database, as well as the object's celestial coordinates and even the current sky position (altitude and azimuth), which CdC calculates.

As nice as that is, one still had to click on each quasar and scroll to find the redshift field. Wouldn't it be nice to simply display the redshift? That's of more immediate interest than the name, one would think.

So, at 5:08 p.m. on a Friday in early March, I wrote to Patrick Chevally, the author of Cartes du Ciel, asking him whether it was possible to select one of the redshift fields (there are several in each object's record) for display. In France, where Patrick is located, it was 11:08 p.m. and he was probably getting ready for bed. But early the next morning, at 3:44 a.m. EST (thus 9:44 a.m. CEST in Paris), Patrick wrote back. He said "At the moment CdC only shows in the Name selection the fields of the table that are identified as an object name by the UCD meta.id. But your use case is interesting and I am sure there are a lot of cases where it can help to display other data in the label. I made a change to add all the table fields after the ones identified as a name." He provided a link to a brand-new beta version of the main CdC program, custom made for me, but I expect the change will be a feature of the next stable release. I can select for display any field in the SDSS database. Fortunately, the redshift field is obvious: it's labeled "z" with the description "best redshift available."



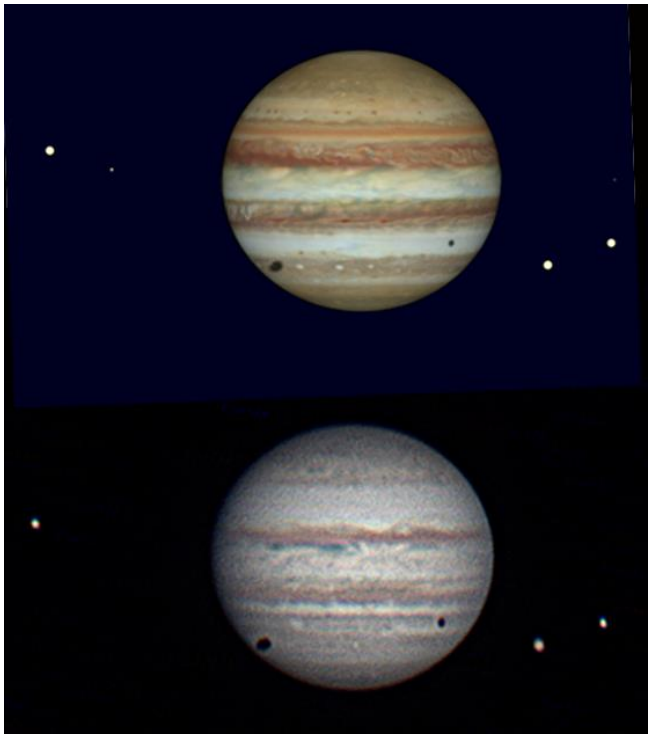
There are several redshift fields in the data because SDSS DR16 includes redshifts from several previous data releases, among its nearly two hundred data fields. The image above is a field in Ursa Major, about 0.65 degrees across, chosen at random and showing one galaxy and the surrounding SDSS quasars identified by redshift.

The redshifts are given to six decimal places, which is more than one really needs for display purposes. It would be nice to be able to reduce the redshifts to, say, two decimal places, but it might require a lot more programming to pull that off. What Patrick has done is simply open the "name" field on the display to any field in the SDSS database, which the user chooses when setting up the catalog display. The various SDSS fields contain a diversity of information, data types, lengths and purposes. To trim the redshift field, Patrick would have to add logic and perhaps additional controls to the name field itself, which I think might be a very substantial undertaking, not doable overnight. Anyway, one doesn't want to look a gift horse in the mouth, and Patrick's ultra-timely response was gratifying enough.

In addition to its mapping and display capabilities, Cartes du Ciel can control telescopes through a variety of interfaces, particularly suitable via ASCOM. There are versions for Windows, MacOS, Linux, Raspberry Pi and Free BSD, and the source code is available. There's no version for iOS or Android however. What with all of the new hand-held devices that control instruments and display images, you may not need it in the field, but it's a great program to plan observations. It's extremely useful for making finder maps if you are looking for a faint object (I used it to pick out Pluto from among a field of brighter stars) or seeing what the sky was like in the past or will be in the future, or from different locations on the Earth. It is extremely accurate and configurable, and has a variety of features for planning, including a calendar function that we use to construct our star party schedule. As an example of its power, CdC will accurately show the position and shape of the umbra of Jupiter's moons on the planet's surface during a shadow transit (see image on the right). It can display comets and asteroids, easily updating the ephemerides from the Minor Planet Center. It can even be configured in 37 languages, so if you want to make your sky maps in Marathi, Slovak or Occitan, you can.

CdC's main freeware competitors are Stellarium and HNSky, the latter billing itself as "semiprofessional." For smartphones, there are free planetarium programs, but to avoid advertisements in most of them you have to make an investment. Ad-free SkySafari with several levels of features is very capable at reasonable price points. More advanced programs for Windows, Mac or Linux such as TheSkyX aren't inexpensive, but they offer enhanced features and have even more sophisticated graphics. Like any other software, if you want to get the most out of it, pick one and learn its features.

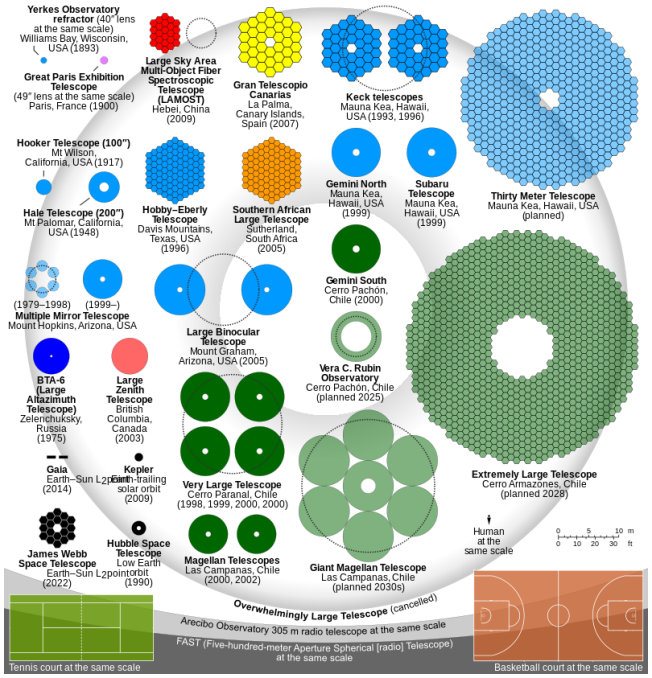
I could go on for pages listing free software and free web sites for observation planning, telescope control and astrophotography. That so many people take the time and effort to write useful, modern and powerful software and make it available at no charge is proof of Dava's observation, and my experience, that amateur astronomers are generous. One is tempted to say that in amateur astronomy we can "depend on the kindness of strangers."



Top: CdC's visualization of the double shadow transit of Ganymede and Europa on 11/2/22 at 20:33. Bottom: My image, made at exactly the same time. Note the ovoid shadow of Ganymede on both the simulation and the image, resulting from Ganymede's umbra being obliquely projected on the trailing limb of the planet. Io is on the left. The extra dot just interior to Io on CdC's plot is Amalthea, which was too faint to be recorded on my image. ■

More From the Editor: Big Telescopes

Larry Faltz



Progress in astronomy depends on advances in technology and improvements in resolution, which means larger telescopes. Although several ideas have been floated for space-based instruments larger than the 6.5-meter James Webb Space Telescope, JWST will be the largest instrument in space for at least two decades, perhaps longer. So "larger telescopes" inevitably means bigger instruments on Earth.

Operating telescopes in space does have certain advantages (no atmosphere, above most satellites, open spectral window), but there are cogent arguments to continue ground-based astronomy. The lifetime of space telescopes is limited compared to ground-based instruments. Although Hubble has been doing great work for 33 years, it is operating with marginal guidance redundancy and another repair mission is unlikely. JWST may last as long as 20 years, but there's no possibility of repairing or reconditioning it. The 5-meter Hale telescope at Mt. Palomar is still doing important research work at age 75. Space telescopes, observation for observation, are perhaps an order of magnitude more expensive than ground-based instruments, which can be outfitted with new instrumentation as technology advances.

The largest telescope on Earth is the segmented-mirror 11.4-meter Gran Telescopio Canarias (although one could argue that the Large Binocular Telescope on Mt. Graham in Arizona is larger because the two 8.4-meter cast mirrors can be combined for an effective 11.8-meter aperture). Segmented mirrors, also used on the 10-meter Hobby-Eberly Telescope at McDonald Observatory in Texas, the 9.2-meter South African Large Telescope and the twin 10-meter Keck telescopes on Mauna Kea, have now been scaled up for two of the new "30-meter class" instruments, the Thirty Meter Telescope (TMT, 30-meter primary), and the European Extremely Large telescope (E-ELT, 39.3-meters) in Chile. The Giant Magellan Telescope (GMT, 25.45 meters), also in Chile, uses seven 8.4-meter cast mirrors, made at Roger Angel's Mirror Lab at the University of Arizona. It is already under construction, as is the E-ELT.

(L) Giant Magellan Telescope. (R) Thirty Meter Telescope

European Extremely Large Telescope

The TMT is to be built on Mauna Kea but has been delayed for nearly a decade by protests from native Hawaiians and there has been no construction activity at all. The Canary Islands have offered to host it if the anti-science contingent has their way on the Big Island. The Extremely Large Telescope, sponsored by the European Southern Observatory, is not far from the Very Large Telescope, ESO's quartet of 8.2-meter instruments. The E-ELT has a first light date of 2028

but current predictions are that it may miss that date by a couple of years.

While the TMT and GMT have separate consortia of academic and research sponsors, they are both part of the U.S. Extremely Large Telescope (USELT) program, which gets additional financial support from the National Science Foundation. The third component of the USELT program is the NOIRLab (National Optical-Infrared Astronomy Research Laboratory), the oversight organization for all the other US "nighttime" optical and infrared astronomy programs, including Kitt Peak, Cerro Tololo, Gemini (North and South) and the Vera Rubin Observatory.

Both the GMT and TMT were endorsed in the *Pathways to Discovery in Astronomy and Astrophysics for the 2020s* (referred to as Astro2020), the "decadal survey" that prioritizes astronomy research programs for the coming decade.[1] The document notes that the USELT program will provide "observational capabilities unmatched in space or the ground and open an enormous discovery space for new observations and discoveries not yet anticipated." Astro2020 also noted "the biggest risk for both projects is the large gap between commitments in-hand from the partners and what is required to complete the projects, even with a significant federal investment by NSF of $0.8 billion per project." In light of this concern, Astro2020 made the following two recommendations:[2]

> Recommendation: The National Science Foundation (NSF) should achieve a federal investment in at least one and ideally both of the two extremely large telescope projects—the Giant Magellan Telescope and the Thirty Meter Telescope, with a target level of at least 25 percent of the time on each telescope. [3] If only one project proves to be viable, NSF should aim to achieve a larger fraction of the time, in proportion to its share of the costs and up to a maximum of 50 percent.
>
> Recommendation: The National Science Foundation (NSF) should conduct an external review of the U.S. extremely large telescopes, with a target completion date of 2023. If only one of the Giant Magellan Telescope or the Thirty Meter Telescope can meet the conditions enumerated above by the time of NSF's review, NSF should proceed with investment in that project alone.

In other words, Astro2020 worried that there may not be enough money, and that both projects might not be able to be funded.

Public support for basic research in the natural sciences comes through the National Science Foundation (NSF), an independent Federal agency. Its annual budget for fiscal year 2023 was $9.54 billion. In effect, all the basic sciences, except medicine (NIH) and some physics projects (DOE, DOD), compete with each other for recognition and funding by NSF. The National Science Board establishes the policies of the NSF, in addition to making reports to Congress and the Executive Branch.

On February 27, 2024, the National Science Board released the following statement:

> The top recommendation for NSF's ground-based initiatives is the investment in the U.S. Extremely Large Telescope (USELT) program, and the Board stands ready to help the agency meet this important, ambitious, and visionary goal for U.S. science and leadership. However, the Board is concerned that the USELT alone would require about 80% of the historical Major Research Equipment and Facilities Construction (MREFC) budget even under the Astro2020-recommended $1.6 billion investment. The Board recognizes there are compelling MREFC needs across a wide range of science and engineering fields, as well as other astronomy needs expressed in the Astro2020 decadal survey. Moreover, the priorities of the astronomy and astrophysics community must be considered in the broader context of the high-priority, high-impact projects for the many disciplines that NSF supports.
>
> Therefore, in recognition of NSF's other strategic priorities and out of concern that "the large gap between commitments in-hand from the partners, and what is required to complete [the Giant Magellan Telescope (GMT) and Thirty Meter Telescope (TMT)]" risks ELT and, thus, U.S. science and engineering, the Board recommends that:
>
> - The USELT Total Project Cost to NSF does not exceed the $1.6 billion MREFC investment proposed by Astro2020.
> - NSF discuss with the Board during the May 2024 meeting its plan to select which of the two candidate telescopes the Agency plans to continue to

[1] You can download a free copy from https://nap.nationalacademies.org/download/26141. You might have to register as a user with the National Academies Press (free).

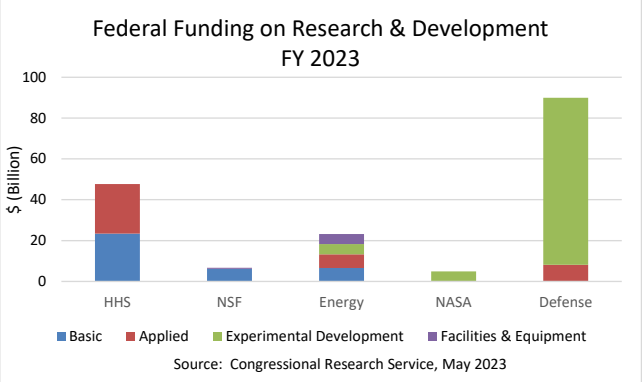
[2] Astro2020, p. 210.

[3] The proportion of scope time not reserved for astronomers from the consortia of sponsoring institutions.

support, including estimated costs and a timeline for the project.

- NSF discuss with the Board during the May 2024 meeting its progress in developing a long-term agency strategy for MREFC projects.

In other words, at its May 2024 meeting, the NSF may have to exercise the judgement of Solomon, in a sense, over the USELT. Although the GMT is partially built, it's in the southern hemisphere, where the E-ELT is located, so a northern hemisphere site like Hawaii (or the Canaries) might strengthen the case for the TMT. How much TMT's troubles with Hawaiian natives will influence the decision isn't known. But it would be bad for astronomy if both can't be built. JWST has to reject almost 90% of proposals for time on the instrument and other large scopes are similarly oversubscribed. There are many smart, dedicated astronomers with important research interests, and only ground-based instruments with superior light-gathering capacity and resolution will meet their needs.



Federal spending for research is never enough, of course. Although $9.54 billion for basic science seems like a lot, it represents a tiny sliver of the $6.134 trillion in total Federal outlays in 2023, $200 billion of which went for research and development. More than 80% of the Federal budget is spent on defense, mandated entitlement programs (primarily Medicare, Medicaid, Social Security) and interest on the national debt. Only about 17% of the entire Federal budget is available for non-defense discretionary spending, the entire range of programs necessary to run the country. The various political factions have strongly differing views on spending, but the bottom line is that there's never enough money for everyone and its unlikely there will be much more for science, especially when the electorate is by-and-large scientifically naive and has little interest in esoteric cosmic questions. It should not be a shock that the NSF may be forced to make a choice.

Is there another solution? I think so. The answer lies in a grand tradition of observatory construction. Recall that many 19th and 20th century observatories were privately funded. Lick, Yerkes, and McDonald Observatories were named after their donors. The Carnegie Foundation and Rockefeller Foundation supported Mt. Wilson and Mt. Palomar, along with individual donors like John D. Hooker who endowed the 100-inch reflector at Mt. Wilson. Both the GMT and TMT were initiated with funding from their consortia and from a few private individuals.[4] The GMT is a $2 billion instrument; the TMT is expected to cost $2.8 billion. Neither project has a major private backer, like the Keck Observatory had in the 1980s when the Keck Foundation funded almost the entire cost of two 10-meter telescopes. Is there a single generous donor who could match the NSF's support so that both projects of the USELT could be completed?

Of course there is, and it ought to be obvious who that person is. It would require a donation of much less than 1% of his vast fortune for Elon Musk to supplement the NSF and guarantee the construction of both the GMT and the TMT, ensuring a productive future for astronomy research. Musk's interest in space surely must go beyond just building rockets or sending people on one-way trips to Mars. Although his Starlink satellites create problems for astronomers and astrophotographers, we accept his presence. Astronomers persevere despite satellite streaks on deep space images. It would be a constructive form of apology for the trespass of Starlinks over our heads and onto our images, and a gift to all of us who love space and want to learn more about it, for Mr. Musk to be generous. He can provide the needed support for the love of space, for the thrill and value of discovery and because "no profit grows where is no pleasure taken."

■

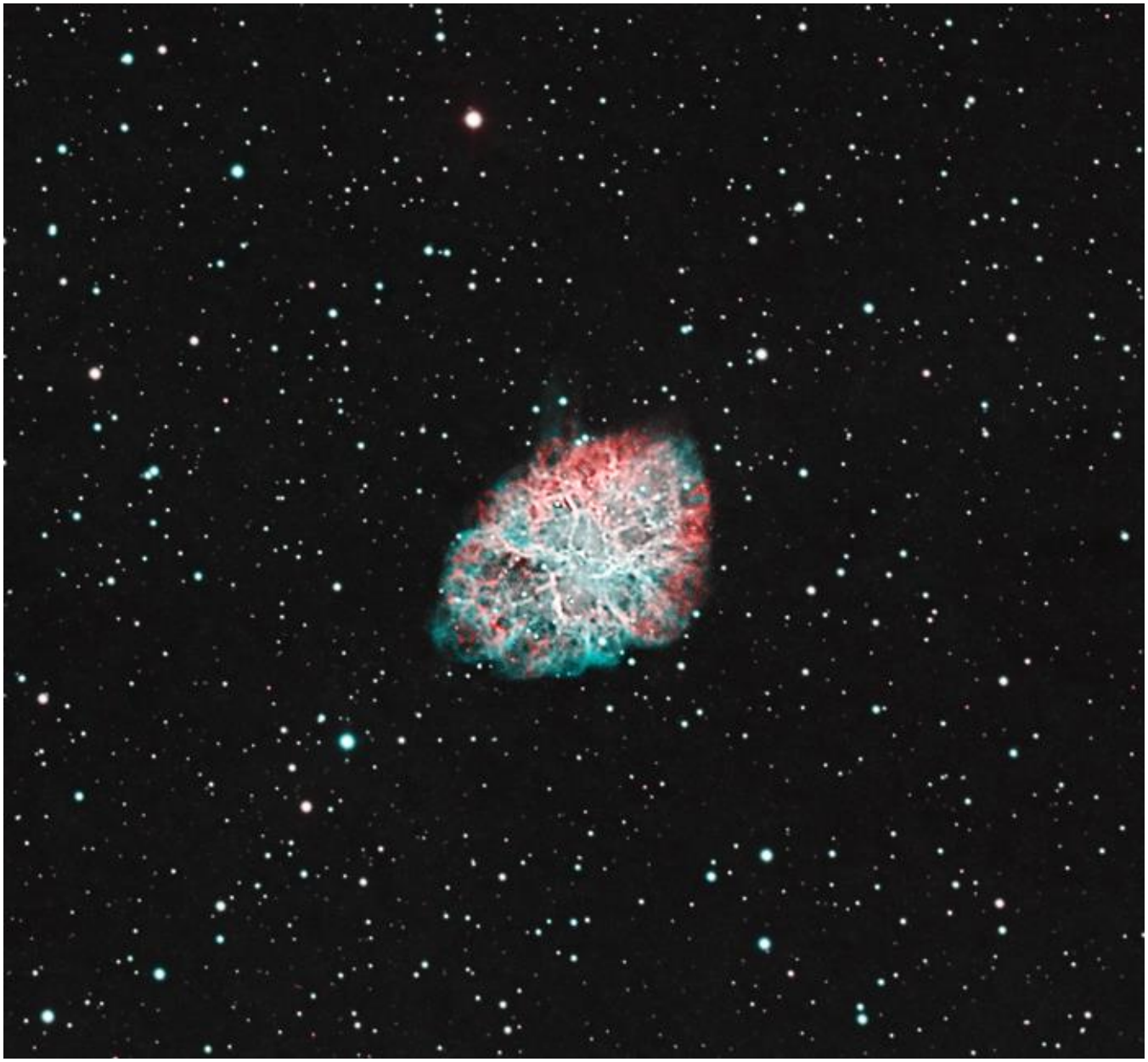
[4] I made a $250 donation to the GMT after a fundraising presentation in 2014 at the Morgan Library by the Harvard-Smithsonian Center for Astrophysics, a member of the consortium. See "Size Matters" in the December 2014 SkyWAAtch, p. 5. They declined to name the telescope after me.

Images by Members

Seagull Nebula by Steve Bellavia

IC 2177 straddles the border of Monoceros and Canis Major. It consists of a large HII region and several open star clusters. The full nebula was found by astrophotographer Isaac Roberts in 1898 with his 20-inch Grubb refractor, now in the collection of the Science Museum in London. The brighter "head" of the seagull is NGC 2327, which was actually first seen by William Herschel on January 31, 1785 and listed as "IV 25." Steve made this image on January 21, 2024, with four hours of data. The Moon was nearly full. See https://www.astrobin.com/xiq4u0/ for full technical information. The field is 2.07 x 2.07 degrees.

The Crab Nebula by Rick Bria



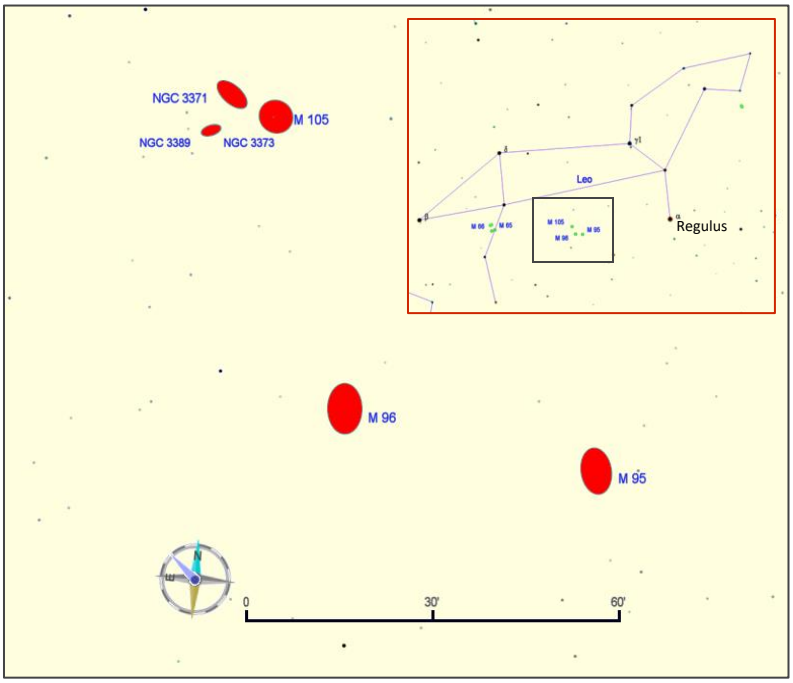
Rick made this narrowband image of Messier 1 with the Mary Aloysia Hardey Observatory's 14-inch CDK telescope and SBIG STX 16803 CCD camera. He combined 45 4-minute exposures through a hydrogen-alpha filter and 51 4-minute exposures through an oxygen III filter, a total of 6.4 hours of data.

The Crab is the detritus of the supernova seen by Chinese astronomers in 1054 CE. The nebulosity was first seen telescopically by English physician and astronomer John Bevis in 1731, and then independently by Charles Messier in 1758. In 1921 Lowell Observatory astronomer Carl Otto Lampland described changes on a series of images made with the observatory's 40-inch reflector (Lampland, CO, Observed Changes in the Structure of the "Crab" Nebula (NGC 1952), *Publications of the Astronomical Society of the Pacific*, 33: 79-84 (1921), https://articles.adsabs.harvard.edu/pdf/1921PASP...33...79L). He compared the images using the blink comparator that Clyde Tombaugh later employed to find Pluto. In 1939, Nicholas Mayall connected the Crab Nebula with the Chinese observation of 1054 (Mayall, N, The Crab Nebula, a Probable Supernova, *Astronomical Society of the Pacific Leaflets*, 3, 145-154 (1939), https://articles.adsabs.harvard.edu/pdf/1939ASPL....3..145M).

Messier 96 by Arthur Miller

Messier 96 (NGC 3368) is a 9th magnitude double-barred spiral galaxy in Leo. It has a highly condensed core and somewhat irregular spiral arms, spanning about 7.6 x 5.2 arcminutes. It is 31 million light years distant. It is thought to be about the same size and mass of the Milky Way. It has a supermassive black hole of 15-48 x 10^6 Mʘ.

M96 is just 45 arcminutes east of another spiral galaxy, Messier 95, and 48 arcminutes southwest of the bright elliptical galaxy Messier 105 and two fainter NGC galaxies. This collection of gravitationally bound objects, the M96 group, lies halfway between Regulus, to the west, and the Leo Triplet group (M65, M66, NGC 3628).



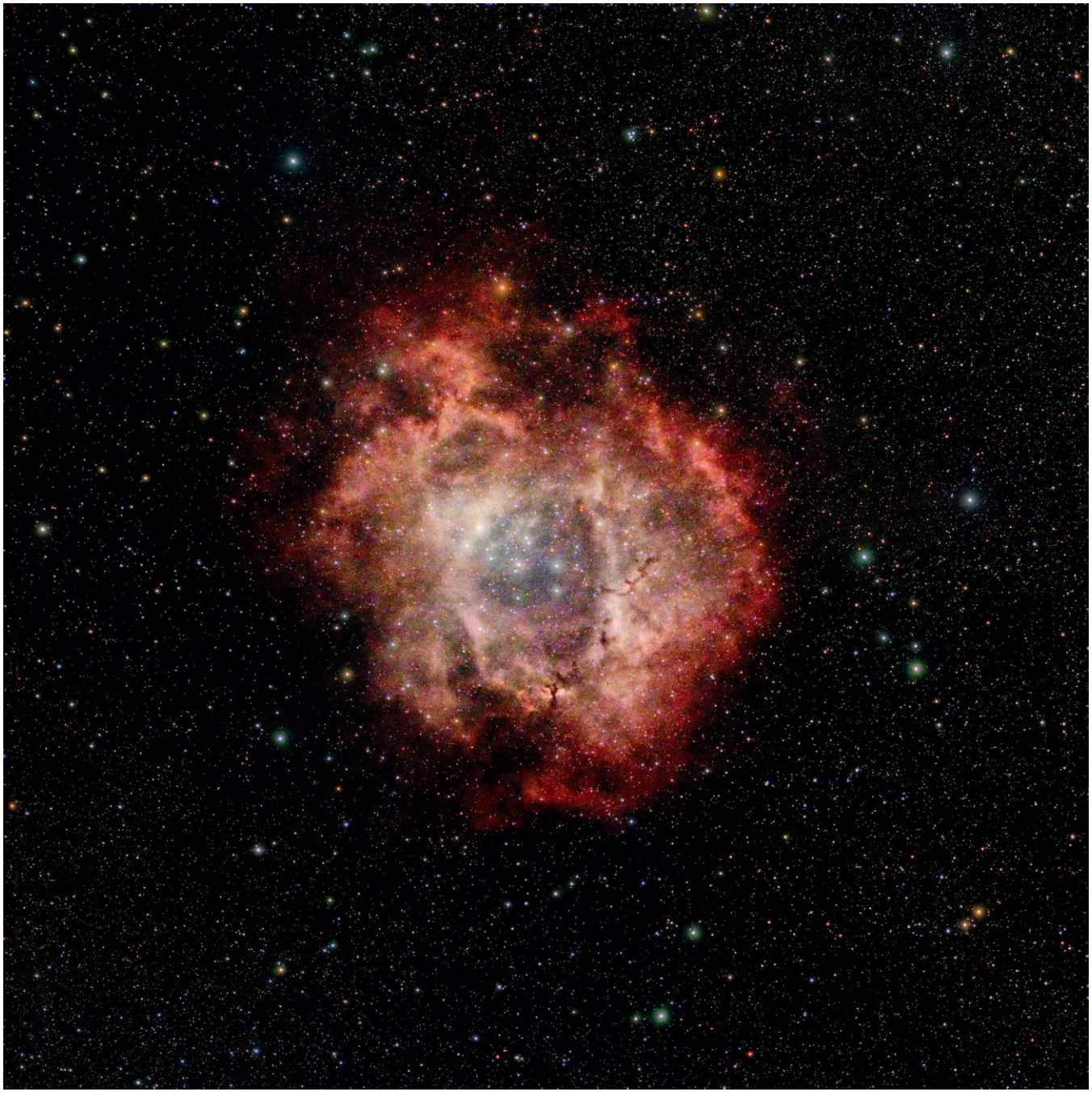
Vaonis Vespera Images by Jordan Solomon

Flame Nebula (NGC 2024) in Orion. The bright star is Alnitak (ζ Orionis)

The Orion Nebula, Messier 42

Both images were made at Ward Pound Ridge Reservation.

Rosette Nebula by David Parmet

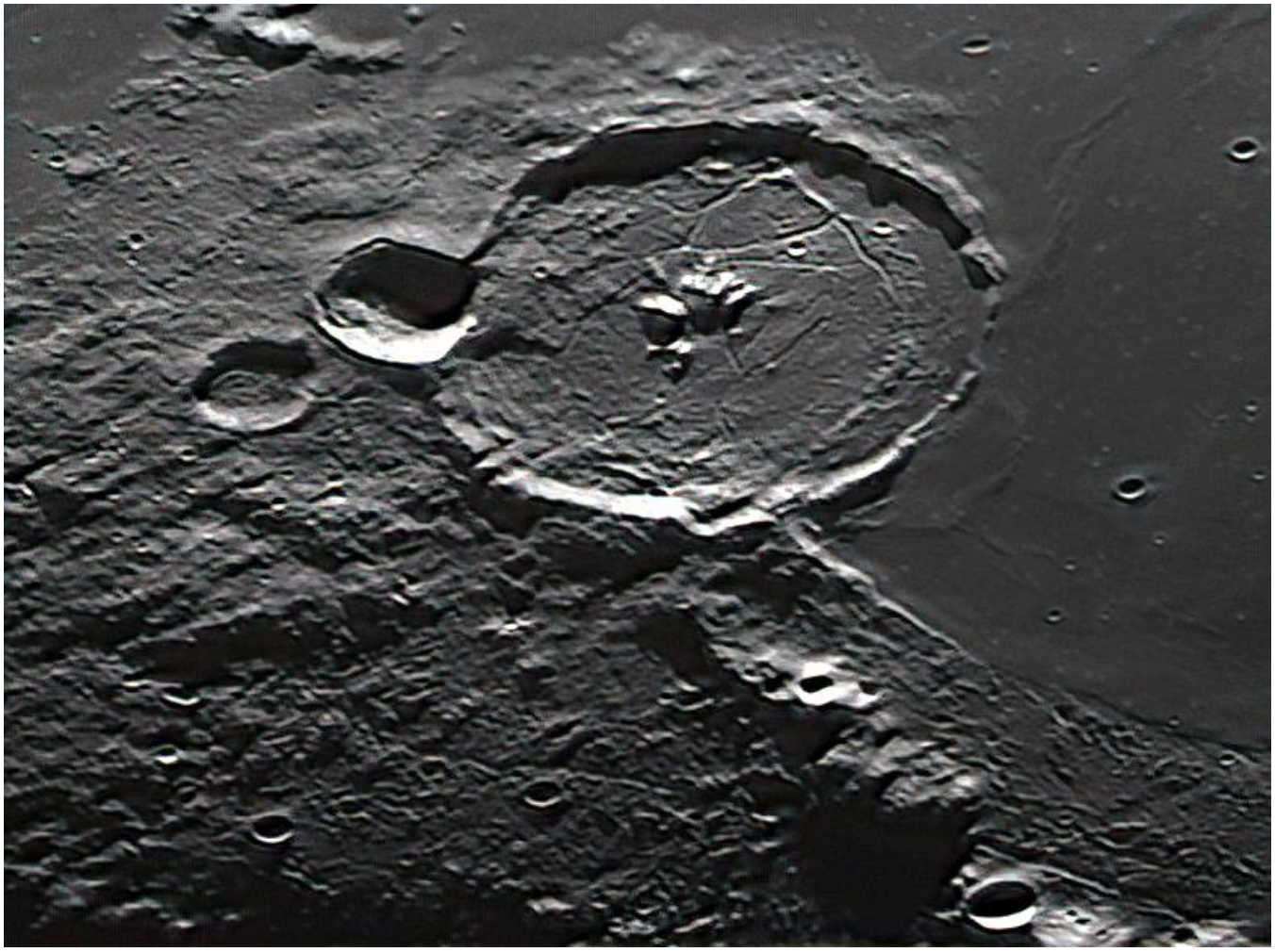


David wrote:

I went to the Mid-Hudson Astronomy Association star party on Friday night, March 8 at Lake Tagkhanic State Park. Decent enough skies and everything was working smoothly until the meridian flip, when my guiding went south. I tried troubleshooting for a half hour or so but couldn't get it going. I figured the problem was with the ASIAir so I did a factory reset yesterday and I'm hoping it was a fluke.

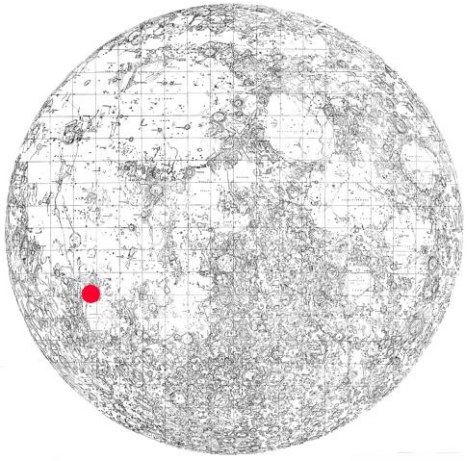
I managed to salvage this five minute sub of the Rosette. It was shot with an ASI533 MC Pro, RedCat 51 on a Star Adventurer GTi mount. Processed in Pixinsight.

Lunar Crater Gassendi by John Paladini



John captured this image of the 110-km (67-mile) wide crater Gassendi on February 20th with an eight-inch SCT. Lunar east is up, north to the left. Moon age 11 days.

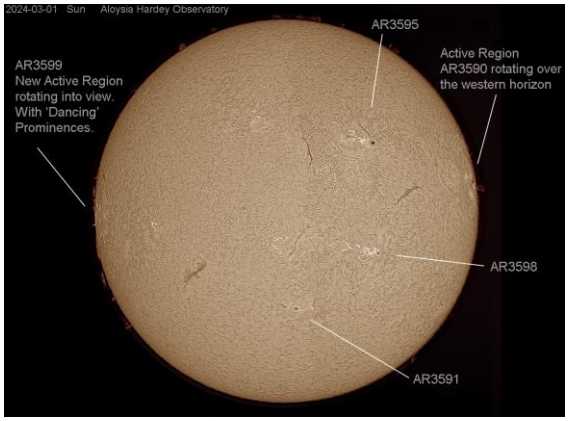
Gassendi is situated on the northern edge of the Mare Humorum. Gerald North, in *Observing the Moon* (2000), calls it a "ringed plain" but it is clearly an impact crater into which lava flowed in the distant past. The central mountain is 1200 meters high. The crater floor is irregular, and to the southwest the Rimae Gassendi are prominent. The large crater on the northern edge is Gassendi A, 33 km across, and just beyond it the slightly smaller Gassendi B. North notes that Gassendi is "one of the Moon's 'hot spots' of Transient Lunar Phenomena, with many reliable reports of bright flashes and red glows seen in the crater. Significantly it turns out that it is also one of the sites of enhanced radon emissions."



Pierre Gassendi (1592-1655) was a prominent French theologian, mathematician and astronomer who supported Copernicus and corresponded with Galileo and Kepler. On November 7, 1631, he was the first person to see a Transit of Mercury, which had been predicted by Kepler in his Rudolphine Tables.

The name Gassendi was applied by Riccioli in his 1651 map. Langrenus (1645) named it Annulus Neptuni, while Hevelius (1647) called it Mons Cataractes.

The Sun on March 1, 2024 by Rick Bria

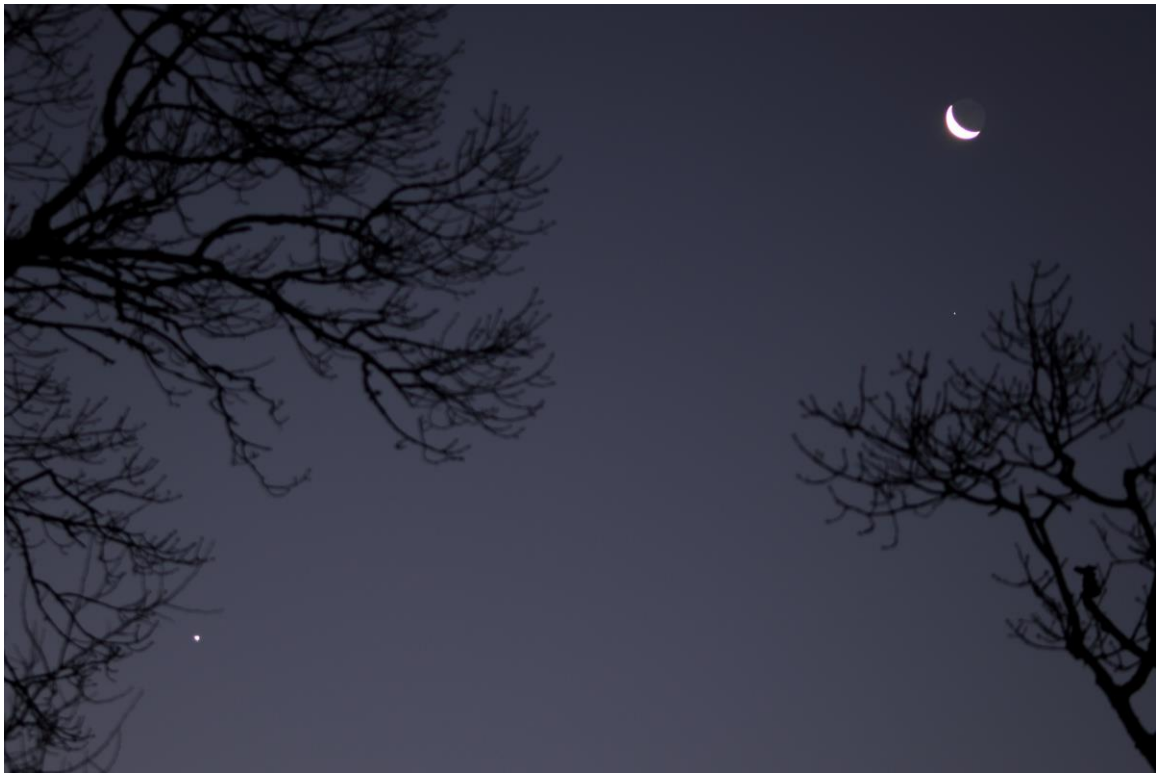


Lunt 80-mm Hα scope, ASI 290MM. Rick writes:

Active regions on the Sun are given a number. The AR before the number stands for 'Active Region'. The Sun rotates in 25 days at the equator. Numbering active regions helps track them as they traverse the Sun's surface as seen from Earth.

On March 1st, Active region AR3590 was seen rotating over the Sun's western horizon and out of view. For several days prior, AR3590 was extremely active. As large as Earth, it produced many large solar flares that resulted in spectacular aurora displays up north. I had hoped to image AR3590 when it was centered on the Sun's disk but the weather did not cooperate.

The Moon and Venus by Steve Bellavia



12/8/23
~6:30 a.m.

Spica can be seen below the Moon and just above the tree.

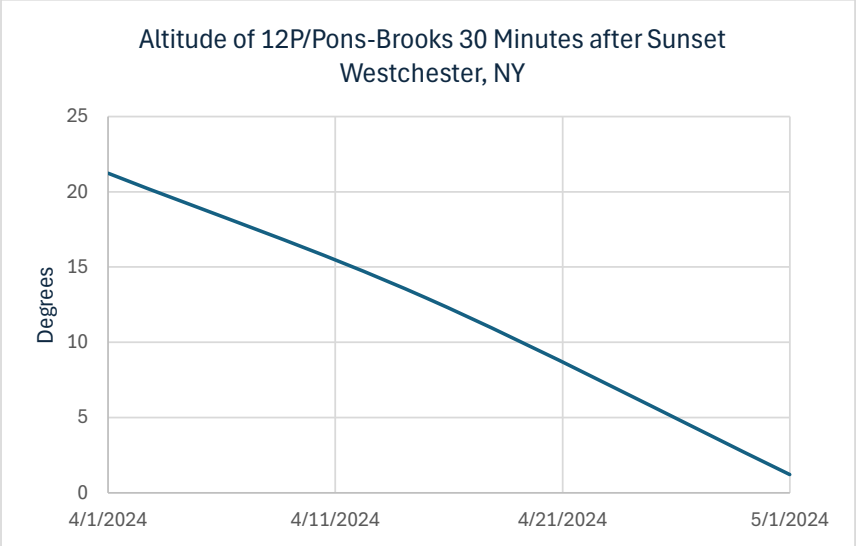
12° 17’ apart

12/9/23
6:49 a.m.

3° 50’ apart

Comet 12P/Pons-Brooks and Messier 31 by Steve Bellavia

Steve made this terrific image on March 11 in eastern Long Island with a Sigma Zoom lens and Canon DSLR. He captured 30 two-minute frames. The comet was about nine degrees from the core of the Andromeda galaxy. 12P/Pons-Brooks was shining at magnitude 5.4 according to TheSkyLive. By the time you read this, the comet will be very low in the west at sunset and hard to see in the twilight, but during the first two or three weeks of the month it might be bright enough to catch with binoculars if you have an excellent western horizon. It may be too low after that even though it will brighten throughout the month.



Research Highlight of the Month

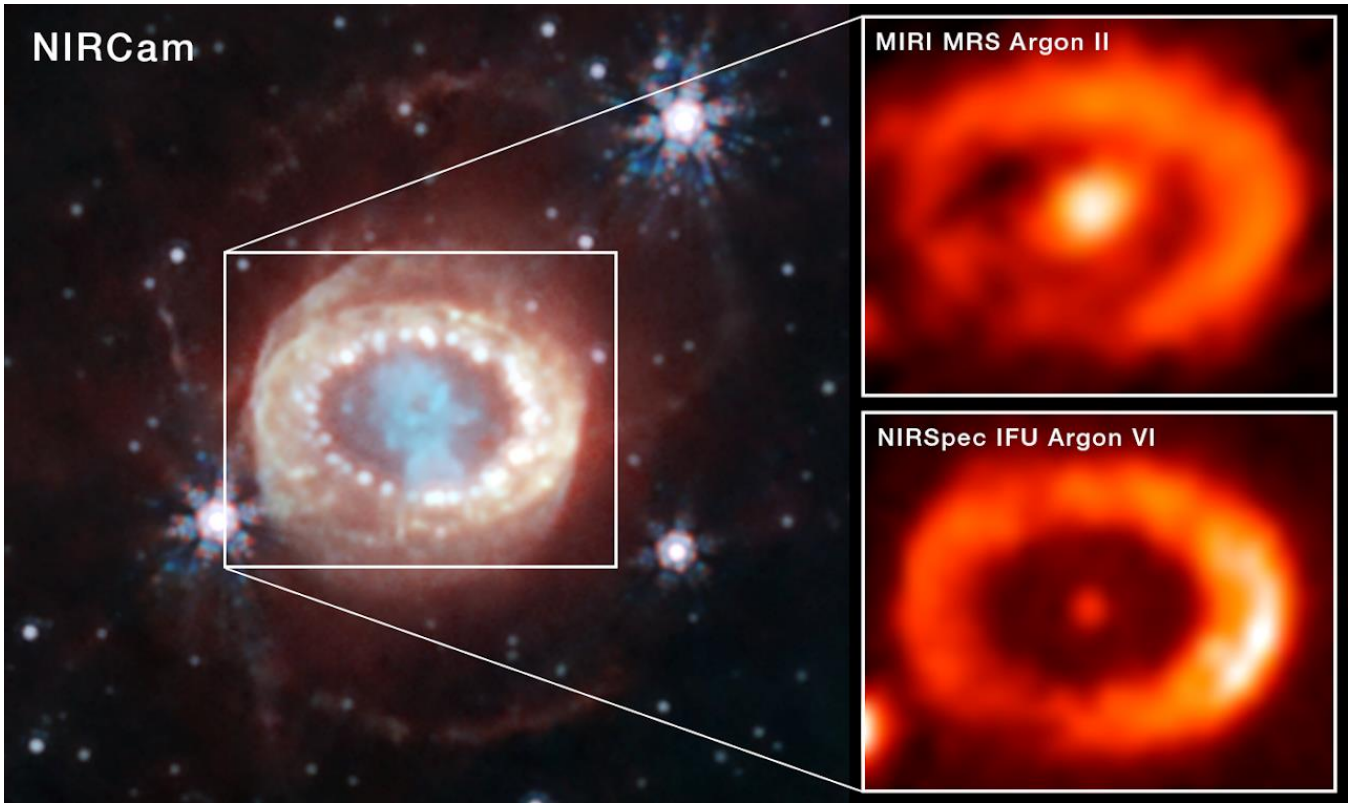
Fransson, C, et. al. (34 authors), Emission lines due to ionizing radiation from a compact object in the remnant of supernova 1987A. *Science* 383:898-903 (Feb. 23, 2024)

Supernova 1987A was the first naked-eye supernova since Kepler observed one in 1604. Located in the Large Magellanic Cloud, its light reached earth on February 23, 1987, preceded two hours earlier by a burst of neutrinos, 25 in total. The progenitor star was found to be Sanduleak −69 202, a B3 supergiant of some 20 solar masses. Since the event, SN 1987A has been followed with telescopes in the southern hemisphere and in space. Material from the outer layers of the star thrown off prior to the supernova have been ionized by ultraviolet light from the cataclysm, resulting in an expanding halo of matter (see https://tinyurl.com/SN87A). Although the Hubble Space Telescope saw ejecta within the ring, the remaining central object had not been visualized. Evidence that it was a neutron star and not a black hole was strongly suggested by studies with ALMA and from X-ray satellites, but the central object was not unequivocally resolved.

The James Webb Space telescope was turned to SN1987A for nine hours on its fifth day of scientific operations in July 2022. Spectroscopy found argon and sulfur in the middle of the remnant, ionized by photons from the central object. These high energy photons must be produced by a neutron star, rather than a black hole. The authors fitted the data to models of supernova explosions to provide support for or against various hypotheses.

The authors suggest that the central object is either a central cooling neutron star (CNS) or a pulsar wind nebula (PWN) powered by the spin-down power from a rapidly rotating neutron star with a strong magnetic field.

If a CNS, the neutron star would have a temperature of $\geq 10^6$ K and a luminosity of $\geq 10^{34}$ erg s^{-1} (about 10 times that of the Sun) at the current time. This amount of energy is sufficient to ionize the inner part of the ejecta. In a PWN, the strong magnetic field lines accelerate particles which emit synchrotron radiation, which in turn ionizes the ejecta.



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Item	Description	Asking price	Name/Email
NEW LISTING AstroPhysics Mach1 GTO mount	AstroPhysics Mach1 GTO mount with every accessory including right angle polar alignment scope, hand control, but no tripod. In excellent condition. Will deliver. Description here. The new version of this mount sells for over $11,000.	$4250	Bill Caspe wbcaspe@mindspring.com
Celestron Nexstar 5SE	Mint condition white Celestron 5-inch f/10 (1250-mm) Schmidt-Cassegrain. Go-to alt-azimuth, single fork arm. Only used a couple of times. Complete with hand control, tripod, finder, eyepiece, diagonal. Picture here. Celestron lists this instrument for $799. Weight 17.8 lbs complete, including tripod. Runs on 8 AA batteries or external 12-volts. A fantastic telescope for lunar, planetary and bright DSO observing.	$400	Heather Morris heathermorris4381@gmail.com
Celestron StarSense auto-alignment	Automatically aligns a Celestron computerized telescope to the night sky. Includes finder camera, hand control (substitutes for the original HC), two mounting brackets, cables. Works with any computer controlled Celestron scope that has a hand control. Like new condition, in original box. Image here. Celestron's description and FAQ are here.	$220	Manish Jadhav manish.jadhav@gmail.com
Orion 6-inch f/5 reflector on EQ mount	Little used, if at all. Solid EQ4-type non-go-to equatorial mount with an electric RA drive as well as slow-motion stalks. The setting circles are large and very readable, unlike most EQ mounts for scopes of this size. An image of the mount head is here. 9 and 25 mm Plössl eyepieces, polar alignment scope with reticle, Orion flashlight, finder, counterweights, gold-colored aluminum tripod (missing tripod tray, but you can make one easily enough). Good intro scope for a bright young person. A 6" f/5 OTA alone costs at least $300. Donated to WAA.	$150	WAA ads@westchesterastronomers.org
ADM R100 Tube Rings	Pair of 100 mm adjustable rings with large Delrin-tipped thumb screws. Fits tubes 70-90 mm. You supply dovetail bar. Like new condition, no scratches. See them on the ADS site at https://tinyurl.com/ADM-R100. List $89.	$40	Larry Faltz lfaltzmd@gmail.com
Tiltall photo/spotting scope tripod	TE Original Series solid aluminum tripod with 3-way head, center stalk. Very solid. 3-section legs. Height range 28.5"-74". Can carry up to 44 lbs. Folded length 29.6". Weighs 6 lbs. Carry bag. Image here. List $199.50. Great for a spotting scope, camera. Donated to WAA.	$75	WAA ads@westchesterastronomers.org

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.

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