Observations

A Monthly Publication Of The
CHESTER COUNTY ASTRONOMICAL SOCIETY

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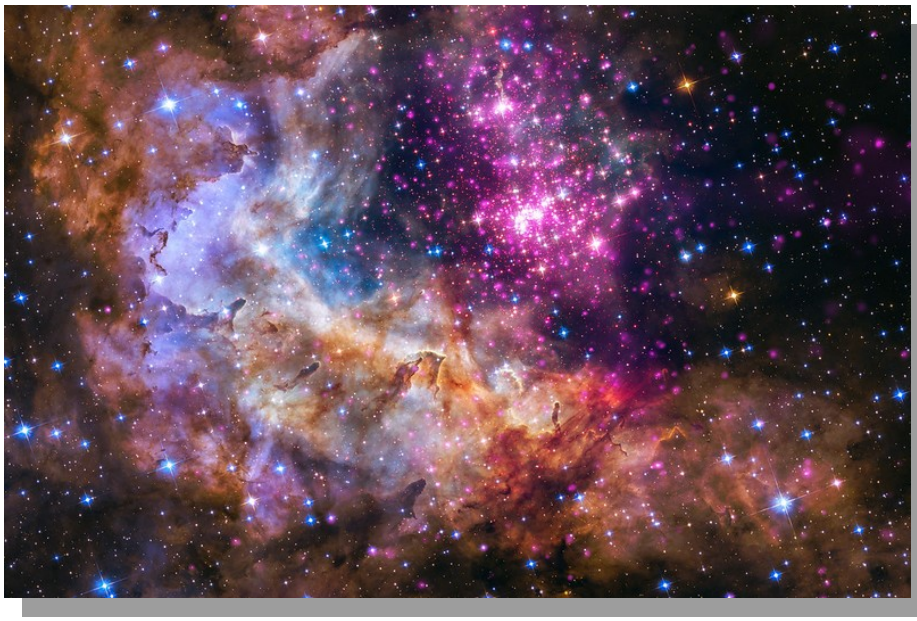
02/2023	Murphy Ruggeri Sutton Tronel
03/2023	Angelini Colosimo DellaPenna Fulton Rainville Sterrett Zibinski

Westerlund 2



Composite image created from image data from Hubble and Chandra Observatories. For more details about the image, see page 2 of this month's newsletter.

January 2023 Dates

1st • Uranus is near the Moon

4th • The Quadrantid meteor shower peaks in the early morning hours

6th • Full Moon, the Full Wolf Moon or the Full Child Moon, 6:07 p.m. EST

14th • Last Quarter Moon, 9:10 p.m. EST

21st • New Moon, 3:53 p.m. EST

28th • First Quarter Moon, 10:18 a.m. EST

28th • The First Quarter Moon is half-way between Jupiter and Mars

30th • The Moon is very close to Mars

CCAS Upcoming Nights Out

In addition to our monthly observing sessions at the Myrick Conservancy Center, BRC (see pg. 7), CCAS has several special "nights out" scheduled over the next few months. Members are encouraged to help out during these events any way they can. See below for more information.

☼ Friday, March 24th • CCAS Monthly Observing Session, Myrick Conservancy Center, BRC. The observing session starts at sunset.

For more information about future observing opportunities, contact our Observing Chair, Don Knabb.

Winter Society Events

January 2023

10th • CCAS Monthly Meeting, Merion Science Center, Room 112. Guest Speaker: Dr. Carol Paty, University of Oregon, "Exploring the Ice Giant Magnetospheres—Science and Future Missions to Explore Neptune and Uranus."

20th • Open call for articles and photographs for the February 2023 edition of Observations.

26th • Deadline for newsletter submissions for the February 2023 edition of Observations.

27th • Planetarium show at the Mather Planetarium at WCU, "Jupiter: King of the Planets." For more information, visit the WCU Public Planetarium Shows webpage.

February 2023

14th • CCAS Monthly Meeting, Merion Science Center, Room 112. Guest Speaker: Dr. Marco Raveri, University of Genoa, "New Developments in Our Understanding of Dark Matter and Dark Energy."

24th • Planetarium show at the Mather Planetarium at WCU, "Black Holes Don't Suck." For more information, visit the WCU Public Planetarium Shows webpage.

20th • Open call for articles and photographs for the March 2023 edition of Observations.

26th • Deadline for newsletter submissions for the March 2023 edition of Observations.

About the Cover Image

Westerlund 2 is a cluster of young stars – about one to two million years old – located about 20,000 light years from Earth. Data in visible light from the Hubble Space Telescope (green and blue) reveal thick clouds where the stars are forming. High-energy radiation in the form of X-rays, however, can penetrate this cosmic haze, and are detected by Chandra (purple). This image was retrieved from the Chandra Data Archive, a sophisticated digital system that ultimately contains all of the data obtained by the telescope since its launch into space in 1999. Chandra's archive is a resource that makes these data available to the scientific community and the general public for years after they were originally obtained. Visit http://bit.ly/3ChZuGA to view the original image.

Ancient Galaxies Revealed by Webb Unveil Clues about What Happened Just After the Big Bang

by Jeffrey Kluger, courtesy Time.com

The James Webb Space Telescope (JWST) has ticked a lot of boxes in the near year it's been aloft. Fly safely to its appointed spot in space 1.6 million km (1 million mi.) from Earth? Check. Successfully deploy its mirror, scientific instruments, and tennis court-sized sun shield? Check. Begin returning eye-popping images like none ever seen before? Check.

Now, the Webb has delivered on its biggest promise to date. According to a new, not-yet peer-reviewed paper on the pre-publication website arXiv, and presented on Dec. 12 at the Space Telescope Science Institute in Baltimore, Webb's mission control, the telescope has spotted and confirmed the four oldest galaxies ever seen—galaxies which date back an average of just 400 million years (some even earlier) after the Big Bang, which occurred 13.8 billion years ago.

"This is the way the galaxies would have appeared 13.4 billion years ago," says lead author Brant Robertson, professor of astronomy and physics at the University of California, Santa Cruz. "[With Webb] you can rewind the clock and see them as they were back then. That's what we're trying to do by taking these observations: we're looking back in time."

The new findings show not only that galaxies started forming as early as 325 million years after the Big Bang, but that there are likely ones that are older still—bringing astronomers closer to discovering the actual birth date of the very first galaxies.

This discovery is the result of work conducted by the JWST Advanced Deep Extragalactic Survey (JADES), an international team of more than 80 astronomers from 10 countries who used 10 days of observation to study a deep field of 100,000 galaxies first imaged by the Hubble Space Telescope in 2010. Apparent size, faintness, and distance of many of the gal-

(Continued on page 12)

January 2023 CCAS Meeting Agenda

by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on January 10, 2023, in person (as well as via Zoom) at West Chester University's Merion Science Center, Room 112. The Science Center is located at 720 S. Church St., West Chester, PA. This month's guest speaker is Dr. Carol Paty, from the University of Oregon, whose presentation is entitled "Exploring the Ice Giant Magnetospheres—Science and Future Missions to Explore Neptune and Uranus."

Please note that inclement weather or changes in speakers' schedules may affect the program. In the event there is a change, CCAS members will be notified via e-mail with as much advance notice as possible.

As for future meetings, we are looking for presenters for our 2023-2024 season and beyond. If you are interested in presenting, or know someone who would like to participate, please contact me at programs@ccas.us.

January 2023 Speaker Profile

by Bruce Ruggeri, CCAS Program Chair

Dr. Carol Paty, University of Oregon, is our guest speaker at our January 2023 monthly meeting. Her presentation is entitled "Exploring the Magnetospheres of the Ice Giant Planets."

Presentation Overview: The Ice Giant planets provide some of the most interesting natural laboratories for studying the influence of large obliquities, rapid rotation, and highly asymmetric magnetic fields on magnetospheric processes. The geometries of the solar wind-magnetosphere interaction at the Ice Giants vary dramatically on diurnal timescales due to large tilt of the magnetic axis relative to each planet's rotational axis and due to the 'off-centered' nature of the magnetic field. There is also a seasonal effect on this interaction geometry due to the large obliquity of each planet (especially Uranus!).

With existing in situ observations at Uranus and Neptune limited to a single encounter by the Voyager 2 spacecraft, a growing number of analytical and numerical models have been put forward to characterize these unique magnetospheres and test hypothesis related to the magnetic structures and the distribution of plasma observed. Yet many questions regarding the magnetospheres, magnetospheric coupling to the ionosphere and atmosphere, and potential interactions with orbiting satellites remain unanswered. Continuing to study and explore Ice Giant magnetospheres is important for comparative planetology as they represent critical benchmarks on a broad spectrum of planetary magnetospheric interactions, and provide insight into exoplanet magnetospheres and magnetic reversals. We will discuss the state of the science in terms of our understanding of these exciting planets, and future plans to revisit our distant neighbors.

The importance was of such research was reinforced by the recent National Academies Study: *Origins, Worlds, and Life: A Decadal Strategy for Planetary Science and Astrobiology 2023-2032* which prioritizes Uranus as the target for NASA's next flagship mission.

Carol Paty, Ph.D.

Speaker Bio: Dr. Paty is a planetary and space physicist specializing in studying moon-magnetosphere interactions and icy moon interiors with simulations and spacecraft observations.

She received her B.A. in Physics and Astronomy from Bryn Mawr College, and her Ph.D. from the University of Washington in Earth and Space Science. She is a co-investigator on NASA's Europa Clipper mission and is actively developing new

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NASA Fixed a Glitch on Voyager 1 After Consulting 45-Year-Old Manuals

by Paola Rosa-Aquino, courtesy Business Insider.com

In May, NASA scientists said the Voyager 1 spacecraft was sending back inaccurate data from its attitude-control system. In order to find a fix, engineers dug through decades-old manuals.

The Voyager team solved the mysterious glitch in late August, NASA officials wrote in an update. Turns out, the spacecraft was beaming information using a dead computer that was corrupting the data.

Voyager 1, along with its twin Voyager 2, launched in 1977 with a design lifetime of five years to study Jupiter, Saturn, Uranus, Neptune, and their respective moons up close.

After nearly 45 years in space, both spacecraft are still functioning. In 2012, Voyager 1 became the very first human-made object to venture beyond the boundary of our sun's influence, known as the heliopause, and into interstellar space. It's now around 14.8 billion miles from Earth and sending data back from beyond the solar system.

"Nobody thought it would last as long as it has," Suzanne Dodd, project manager for the Voyager mission at NASA's Jet Propulsion Laboratory, told Insider over the summer before the Voyager team found a fix, adding, "And here we are."

Voyager 1 was designed and built in the early 1970s, complicating efforts to troubleshoot the spacecraft's problems.

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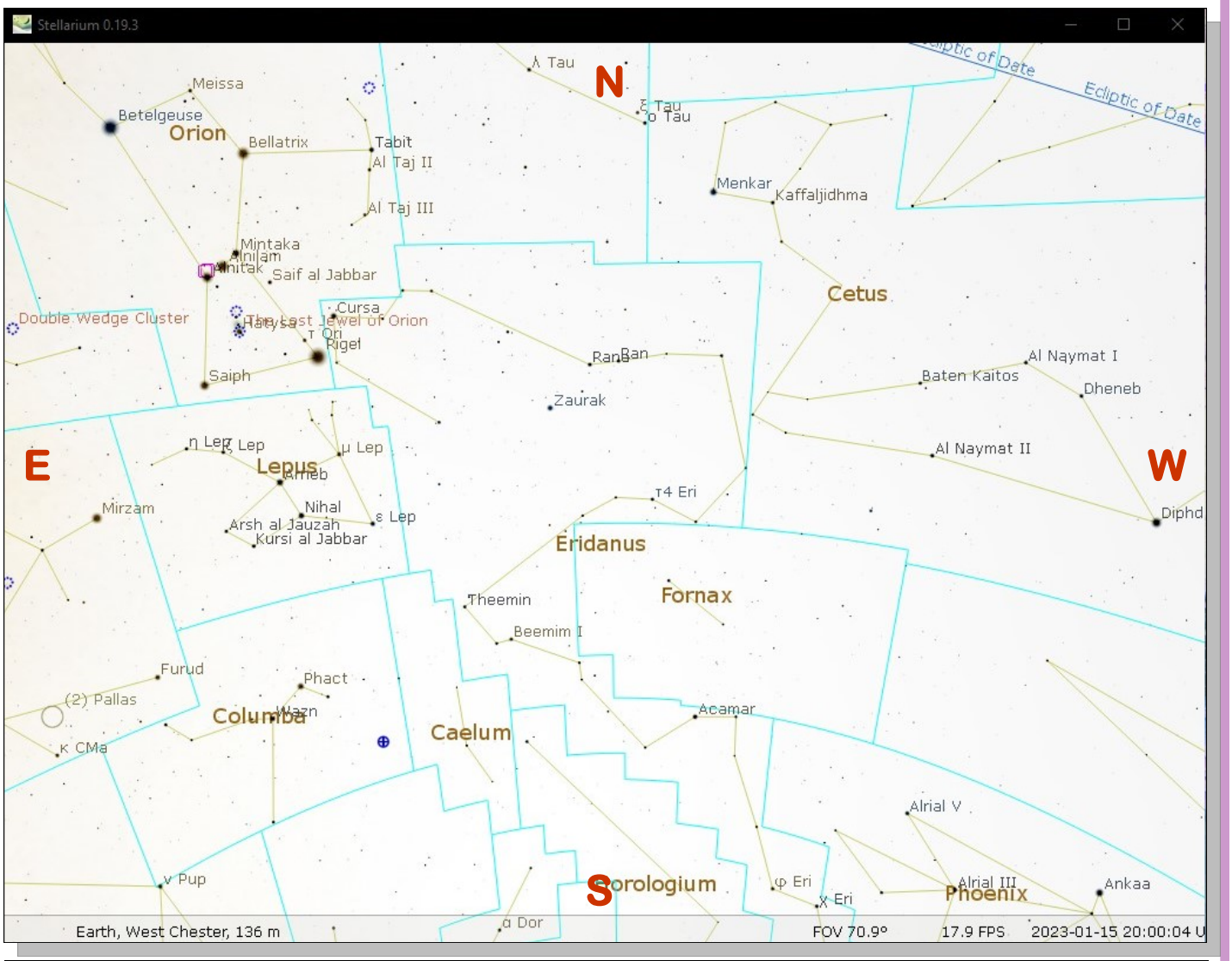
The Sky Over Chester County

January 15, 2023 at 8:00 p.m. ET

Note: This screen capture is taken from Stellarium, the free planetarium software available for download at www.stellarium.org.



Date	Civil Twilight Begins	Sunrise	Sunset	Civil Twilight Ends	Length of Day
01/01/2023	6:53 a.m. EST	7:24 a.m. EST	4:47 p.m. EST	5:18 p.m. EST	9h 23m 44s
01/15/2023	6:52 a.m. EST	7:22 a.m. EST	5:01 p.m. EST	5:31 p.m. EST	9h 39m 13s
01/31/2023	6:43 a.m. EST	7:11 a.m. EST	5:20 p.m. EST	5:48 p.m. EST	10h 08m 20s

Moon Phases					
			Full Moon	01/06/2023	6:07 p.m. EST
Last Quarter	01/14/2023	9:10 p.m. EST	New Moon	01/21/2023	3:53 p.m. EST
First Quarter	01/28/2023	10:18 a.m. EST			

January 2023 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

1	**Uranus is near the Moon**
3	**The Moon and Mars are close and are above Aldebaran in Taurus**
4	**The Quadrantid meteor shower peaks in the early morning hours**
6	**Full Moon, the Full Wolf Moon or the Full Child Moon**
6	**The Full Moon, Castor and Pollux form a triangle**
14	**Last Quarter Moon, 9:10 p.m. EST**
21	**New Moon, 3:53 p.m. EST**
22	**Venus and Saturn are very close low in the west after sunset**
28	**The First Quarter Moon is half-way between Jupiter and Mars**
28	**The elusive Lunar X is visible around 9 p.m.**
29	**The Lunar Straight Wall is visible this evening**
30	**The Moon is very close to Mars**

Yes, it's cold outside, so instead of trying to set up a telescope with your gloves on, grab a pair of binoculars and a star map and look for the many beautiful open star clusters in the winter sky. And the biggest and brightest nebula of the entire sky is the Orion Nebula, which is easy to find in the "sword" of Orion. Jupiter and Mars put on a great show and the elusive Lunar X is visible on January 28th. If you are an early riser, look for the Quadrantid meteor shower in the hour before dawn on the morning of January 4th. I have seen some amazing outbursts from this meteor shower.

Mercury: To see Mercury in the evening sky you need to look on January 1st or 2nd, low in the west about 20 minutes after sunset. Late in the month Mercury reappears in the pre-dawn sky.

Venus: Venus takes its place once again as the "evening star", low in the west, shining brightly in the fading glow of the Sun.

Mars: The view of Mars in early December was one of the best I have ever experienced with clear surface features and a prominent polar ice cap. Although past closest approach, Mars is higher in the sky during the evening hours of January so it will still be wonderful in a telescope even as it falls behind us in our race around the Sun.

Jupiter: The king of the planets continues to dazzle us when viewed in a telescope with cloud bands on the surface of the planet and the 4 Galilean moons dancing around the planet.

Saturn: Saturn is quickly falling into the western horizon so look for it low in the west just after darkness falls.

Uranus and Neptune: Uranus is high in the west around 9 p.m. in the constellation Aries. A pair of binoculars and a sky map app will allow you to star hop to find this distant gas giant. Neptune is in the southwest just after the sky darkens and you will need to use binoculars and carefully star hop to find this dim resident of the outer solar system.

The Moon: Full Moon is on January 6th. According to Native Americans, the full Moon of January is the Full Wolf Moon. Amid the cold and deep snows of midwinter, the wolf packs howled hungrily outside Indian villages, so it was named the Full Wolf Moon. Sometimes it was also referred to as the Old Moon, or the Moon after Yule. Some called it the Full Snow Moon, but most tribes applied that name to the next full Moon. Native Canadians called this the Child Moon.

On January 28 around 9 p.m. the elusive Lunar X is visible near crater Werner. If you have not seen this interesting feature on the Moon, be sure to look, it is amazing.

Constellations: Auriga, Taurus, Orion and Gemini are the highlights of the January skies. But the nights are so long that you can see many "summer" constellations setting early in the evening and many "spring" constellations rising if you stay up late. Dress warmly and sit in your lounge chair and see how many constellations you can record toward the Constellation Hunter club.

Messier/deep sky: During the winter months we are looking away from the center of the Milky Way, so the sky is not as full of deep sky wonders as dur-

(Continued on page 13)

Looking Up: The Winter Hexagon

by Don Knabb, CCAS Observing Chair & Treasurer

Telescopic observing during the winter months is not easy in our climate. Setting up, taking down and operating a telescope means you need to have your gloves off to turn knobs and set equipment into place. Eyepieces can easily be fogged by your breath, and they can slip out of your hands due to the cold temperatures and your frozen fingers. Even worse is taking your equipment apart after everything is down to very cold temperatures. Holding a tripod leg for even a few seconds chills your hands to the bone!

So, during the winter I tend to do more naked eye and binocular observing. Naked eye observing requires nothing more than holding a star map in your gloved hand with a red flashlight in the other hand. Binoculars, once you have them focused correctly, are also easy to handle with gloved hands. And with a lounge chair, warm, layered clothing and a sleeping bag you can be quite comfortable for an hour or so even in below freezing temperatures.

The winter night sky holds many "shapes in the sky". Most of these are constellations, but there are also asterisms, that is, patterns of stars in the sky. An asterism may form part of an official constellation or be composed of stars from more than one. Like constellations, asterisms are in most cases composed of stars which, while they are visible in the same general direction, are not physically related, often being at significantly different distances from Earth. The mostly simple shapes and few stars make these pat-

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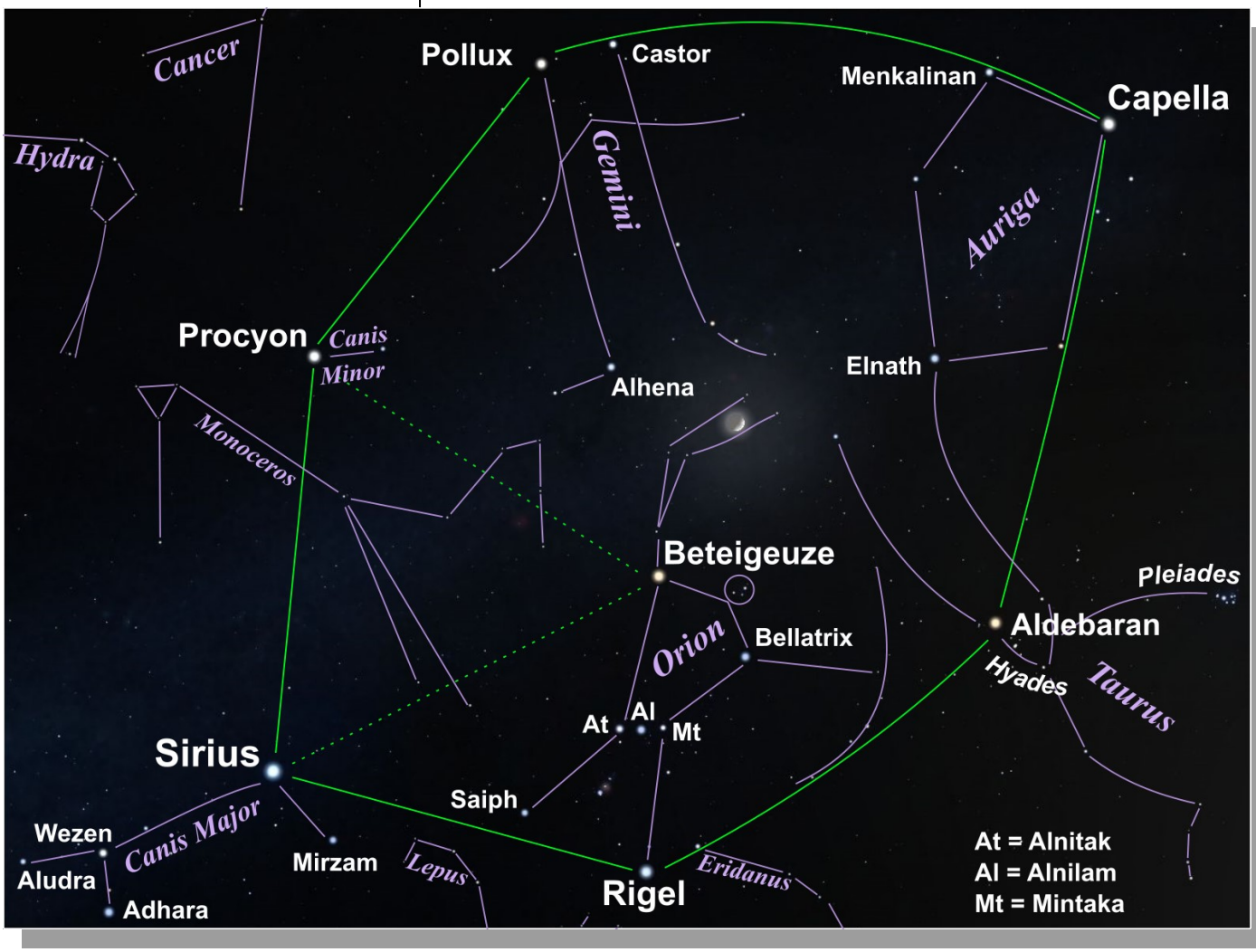

https://commons.wikimedia.org/wiki/File:Winter_Hexagon_and_Great_Southern_Triangle_(Stellarium).png, creative commons file: CC BY-SA 3.0, Author: Elop using Stellarium

Looking Up (Cont'd)

(Continued from page 6)

terns easy to identify, and thus particularly useful to those learning to familiarize themselves with the night sky.

My favorite winter asterism is the Winter Hexagon. This asterism covers a huge area of the sky. If you can find Sirius, the brightest star in the sky, you can find the Winter Hexagon. If you aren't sure which star is Sirius, you can certainly find the constellation Orion. Then look to the lower left of Orion and the bright star that you see is Sirius. From Sirius you can proceed clockwise up to Procyon, then to Pollux (and Castor), on to Capella, down to Aldebaran and on around to Rigel. The band of our Milky Way Galaxy runs through

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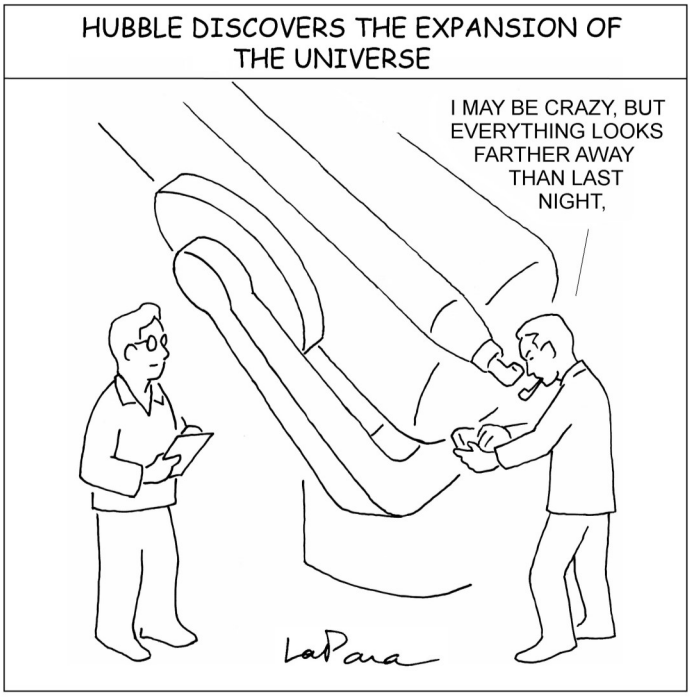
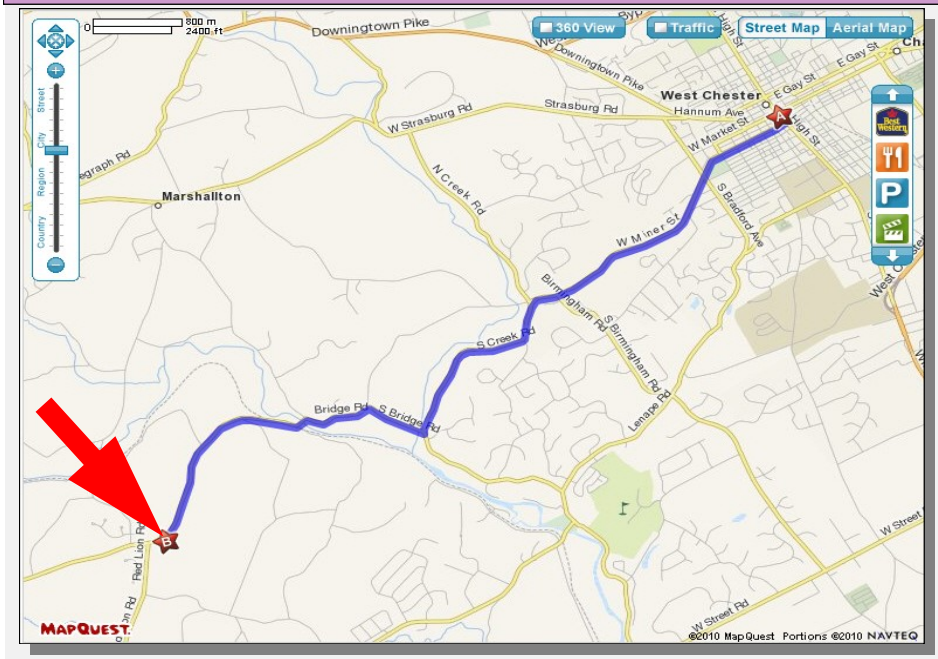
Classic La Para
by Nicholas La Para



CCAS Directions



Brandywine Red Clay Alliance
1760 Unionville Wawaset Rd
West Chester, PA 19382
(610) 793-1090
http://brandywinewatershed.org/

BRC was founded in 1945 and is committed to promoting and protecting the natural resources of the Brandywine Valley through educational programs and demonstrations for all ages.

Brandywine Red Clay Alliance

The monthly observing sessions (held February through November) are held at the Myrick Conservation Center of the Brandywine Red Clay Alliance.

To get to the Myrick Conservation Center from West Chester, go south on High Street in West Chester past the Courthouse. At the next traffic light, turn right on Miner Street, which is also PA Rt. 842. Follow Rt. 842 for about 6 miles. To get to the observing site at the BRC property, turn left off Route 842 into the parking lot by the office: look for the signs to the office along Route 842. From that parking lot, go left through the gate and drive up the farm lane about 800 feet to the top of the hill. The observing area is on the right.

If you arrive after dark, *please turn off your headlights and just use parking lights* as you come up the hill (so you don't ruin other observers' night vision).

Voyager 1 (Cont'd)

(Continued from page 3)

Though current Voyager engineers have some documentation — or command media, the technical term for the paperwork containing details on the spacecraft's design and procedures — from those early mission days, other important documents may have been lost or misplaced.

During the first 12 years of the Voyager mission, thousands of engineers worked on the project, Dodd said. "As they retired in the '70s and '80s, there wasn't a big push to have a project document library. People would take their boxes home to their garage," Dodd added. In modern missions, NASA keeps more robust records of documentation.

There are some boxes with documents and schematic stored off-site from the Jet Propulsion Laboratory, and Dodd and the rest of Voyager's handlers can request access to these records. Still, it can be a challenge. "Getting that information requires you to figure out who works in that area on the project," Dodd said.

For Voyager 1's recent telemetry glitch, mission engineers had to specifically look for boxes under the name of engineers who helped design the attitude-control system — which was "a time consuming process," Dodd said.

The spacecraft's attitude-control system, which sends telemetry data back to NASA,

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CCAS Original Astrophotography

by CCAS Member Jeffrey Cunningham

Image taken Christmas Eve, December 24, 2022 @ 5:24 pm EST of a one-day past new moon crescent, Mercury and Venus (L-R) at sunset. Image taken with a Canon Rebel T6, f/13 0.5 seconds ISO-400 135mm. Initial contrast, shadow, saturation and temperature updates via Canon Digital Photo Professional. Sharpness update via Topaz Sharpen AI.

Voyager 1 (Cont'd)

An engineer works on an instrument for one of NASA's Voyager spacecraft, on November 18, 1976. NASA/JPL-Caltech© NASA/JPL-Caltech

(Continued from page 8)

indicates Voyager 1's orientation in space and keeps the spacecraft's high-gain antenna pointed at Earth, enabling it to beam data home.

"Telemetry data is basically a status on the health of the system," Dodd said. But during this summer's glitch, the telemetry readouts the spacecraft's handlers were getting from the system were garbled, according to Dodd, which means they didn't know if the attitude-control system was working properly.

Dodd and her team had long suspected it was due to an aging part. "Not everything works forever, even in space," she said over the summer.

Engineers also thought Voyager's glitch may be influenced by its location in interstellar space. According to Dodd, the spacecraft's data suggests that high-energy charged particles are out in interstellar space. "It's unlikely for one to hit the spacecraft, but if it were to occur, it could cause more damage to the electronics," Dodd said, adding, "We can't pinpoint that as the source of the anomaly, but it could be a factor."

In late August, Voyager engineers located the source of the garbled data: the spacecraft's attitude-control system was routing information through a dead computer. They believe it was triggered by a faulty command from another onboard computer.

"We're happy to have the telemetry back," Dodd said in a NASA statement released in August. Still, the team is uncertain why it occurred in the first place. "We'll do a full memory readout of the AACS and look at everything it's been doing. That will help us try to diagnose the problem that caused the telemetry issue in the first place. So we're cautiously optimistic, but we still have more investigating to do," Dodd said in the statement.

As part of an ongoing power management effort that has ramped up in recent years, engineers have been powering down non-technical systems on board the Voyager probes, like its science instruments heaters, hoping to keep them going through 2030.

From discovering unknown moons and rings to the first direct evidence of the heliopause, the Voyager mission has helped scientists understand the cosmos. "We want the mission to last as long as possible, because the science data is so very valuable," Dodd said.

"It's really remarkable that both spacecraft are still operating and operating well — little glitches, but operating extremely well and still sending back this valuable data," Dodd said, adding, "They're still talking to us."

NASA Night Sky Notes: Spot the Messenger — Observe Mercury

by David Prosper

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach.

Visit nightsky.jpl.NASA.gov to find local clubs, events, stargazing info and more.

Most planets are easy to spot in the night sky, but have you spotted Mercury? Nicknamed *the Messenger* for its speed across the sky, Mercury is also the closest planet to the Sun. Its swift movements close to our Sun accorded it special importance to ancient observers, while also making detailed study difficult. However, recent missions to Mercury have resulted in amazing discoveries, with more to come.

Mercury can be one of the brightest planets in the sky – but

also easy to miss! Why is that? Since it orbits so close to the Sun, observing Mercury is trickier than the rest of the "bright planets" in our solar system: Venus, Mars, Jupiter, and Saturn. Mercury always appears near our Sun from our Earth-bound point of view, making it easy to miss in the glare of the Sun or behind small obstructions along the horizon. That's why prime Mercury viewing happens either right before sunrise or right after sunset; when the Sun is blocked by the horizon, Mercury's shine can then briefly pierce the glow of twilight.

Mercury often appears similar to a "tiny Moon" in a telescope since, like fellow inner planet Venus, it shows distinct phases when viewed from Earth! Mercury's small size means a telescope is needed to observe its phases since they can't be discerned with your unaided eye. Safety warning: If you want to observe Mercury with your tele-

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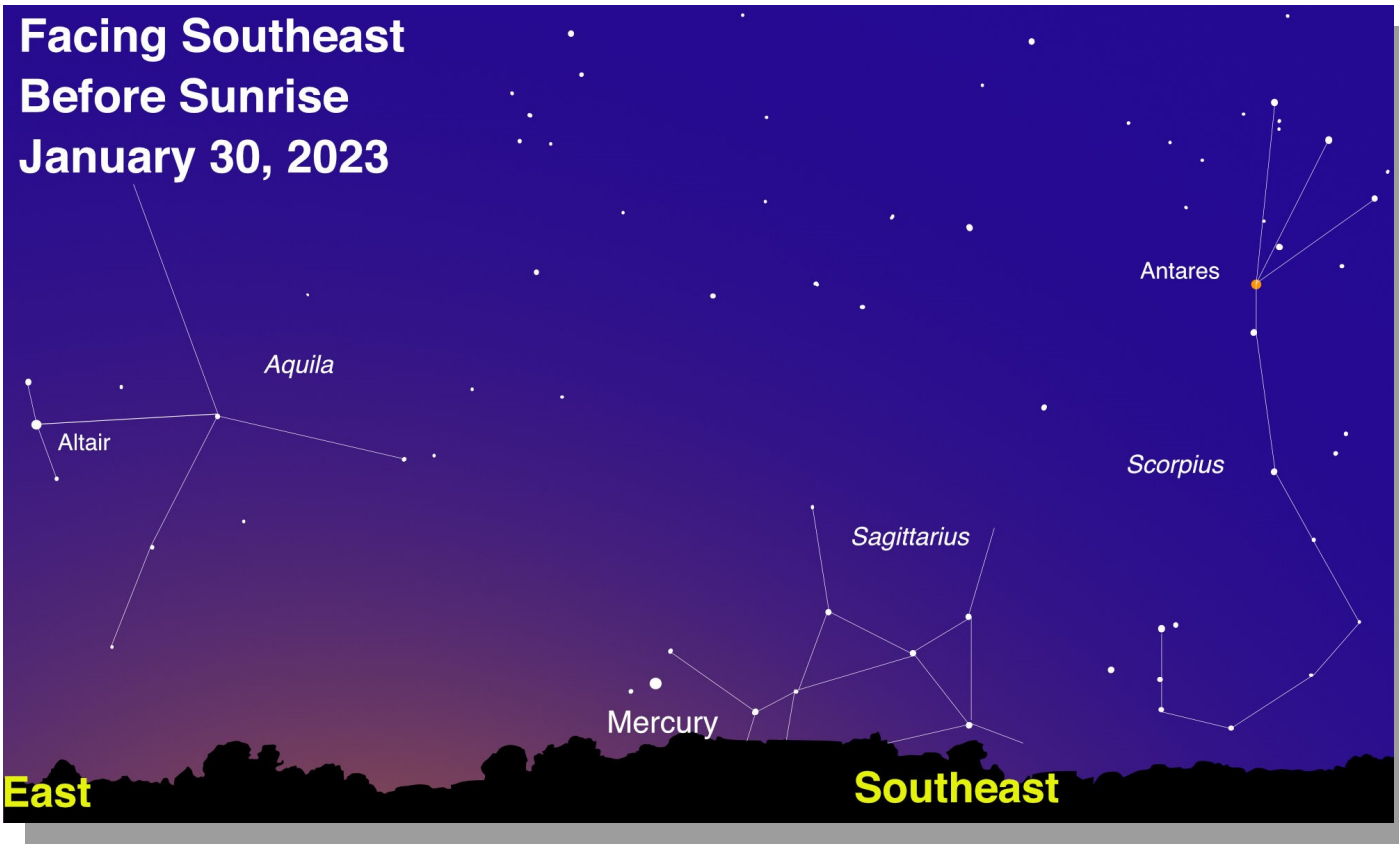

Mercury reaches maximum western elongation on the morning of January 30, which means that your best chance to spot it is right before sunrise that day! Look for Mercury towards the southeast and find the clearest horizon you can. Observers located in more southern latitudes of the Northern Hemisphere have an advantage when observing Mercury as it will be a bit higher in the sky from their location, but it's worth a try no matter where you live. Binoculars will help pick out Mercury's elusive light from the pre-dawn glow of the Sun. Image created with assistance from Stellarium

Night Sky Notes (Cont'd)

(Continued from page 10)

scope during daytime or before sunrise, **be extremely careful**: you don't want the Sun to accidentally enter your telescope's field of view. As you may already well understand, this is extremely dangerous and can not only destroy your equipment, but permanently blind you as well! That risk is why NASA does not allow space telescopes like Hubble or the JWST to view Mercury or other objects close to the Sun, since even the tiniest error could destroy billions of dollars of irreplaceable equipment.

Despite being a small and seemingly barren world, Mercury is full of interesting features. It's one of the four rocky (or terrestrial) planets in our solar system, along with Earth, Venus, and Mars. Mercury is the smallest planet in our solar system and also possesses the most eccentric, or non-circular, orbit of any planet as well: during a Mercurian year of 88 Earth days, the planet orbits between 29 million and 43 million miles from our Sun – a 14-million-mile difference! Surprisingly, Mercury is **not** the hottest planet in our solar system, despite being closest to the Sun; that honor goes to Venus, courtesy its thick greenhouse shroud of carbon dioxide. Since Mercury lacks a substantial atmosphere and the insulating properties a layer of thick air brings to a planet, its temperature swings wildly between a daytime temperature of 800 degrees Fahrenheit (427 degrees Celsius) and -290 degrees Fahrenheit (-179 degrees Celsius) at night.

Similar to our Moon, evidence of water ice is present at Mercury's poles, possibly hiding in the frigid permanent shadows cast inside a few craters. Evidence for ice on Mercury was first detected by radar observations from Earth, and follow-up ob-

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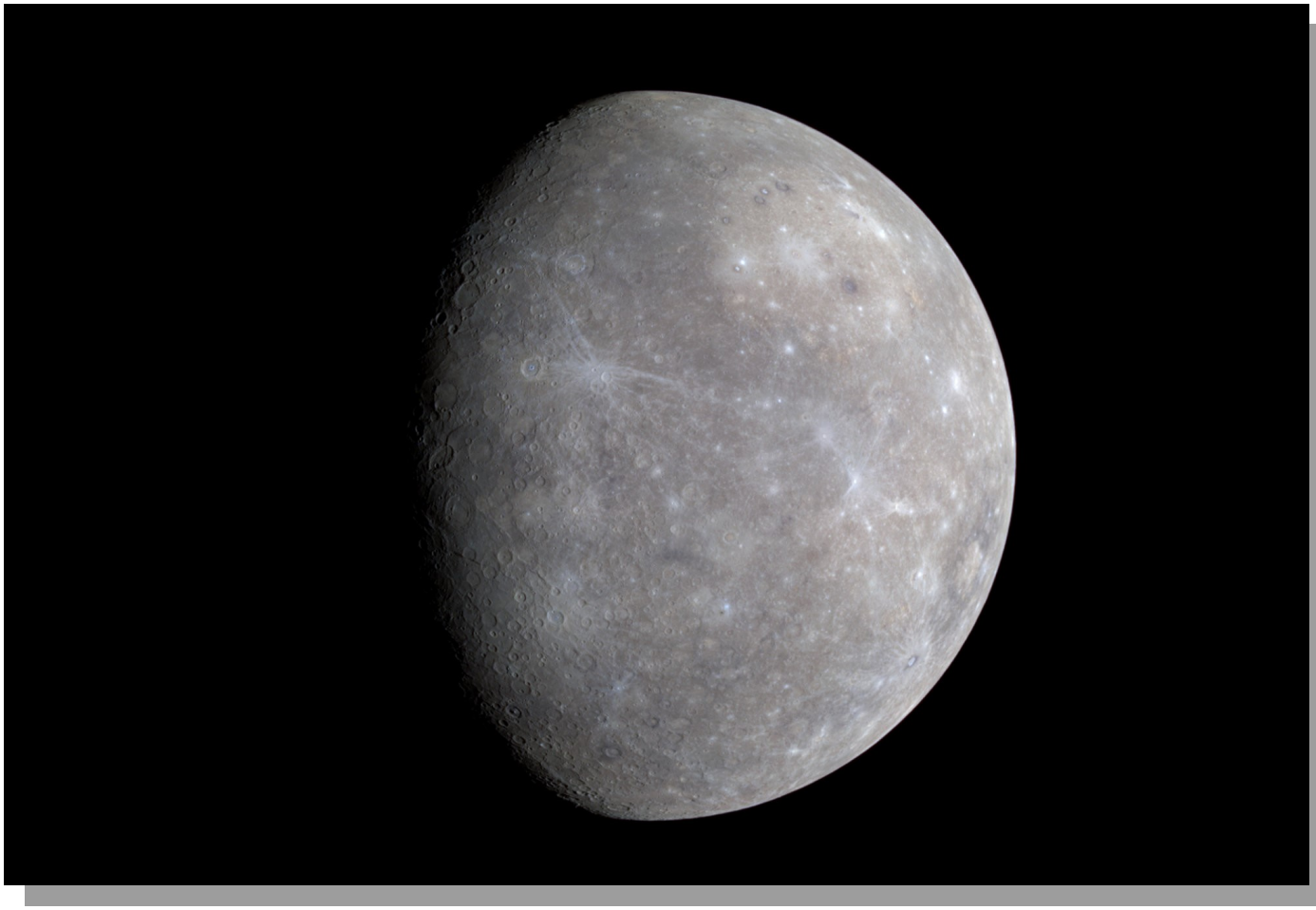


A pair of good binoculars can show craters on the Moon around 6 miles (10 km) across and larger. How large is that? It would take you about two hours to hike across a similar-sized crater on Earth. The "Can You See the Flag On the Moon?" handout showcases the levels of detail that different instruments can typically observe on the Moon, available at bit.ly/flagmoon. Moon image courtesy Jay Tanner

Ancient Galaxies (Cont'd)

(Continued from page 2)

axies suggested that they were fantastically old, but Hubble, which sees principally in visible light, didn't have the instrumentation to image them clearly or determine their age. That's because visible light from so far away can't easily penetrate the intervening dust of interstellar space. Infrared radiation, however, cuts right through the dust. This allows Webb— a telescope which detects energy in that frequency—to see as far as 13.6 billion light-years distant.

Using two instruments aboard the Webb—the Near Infrared Camera (NIRCam) and the Near Infrared Spectrograph (NIRSpec)—Robertson and his colleagues focused on four galaxies that appeared especially small, faint, and distant, studying what is known as their red shift. As objects move toward us in space, the wavelength of light they emit is compressed, shifting it to the bluer end of the visible spectrum. As objects move away from us, the wavelength is stretched, shifting it toward the red end. The redder an object appears, the more distant and old it is in our still-expanding universe.

Red shift is a tricky thing to measure, because it has no particular units like inches or nanometers. Instead, it is just a number that indicates how stretched the wavelength of the light is. An object like Jupiter, which is pretty much stationary in the sky relative to Earth, has a red shift of zero. The higher the number, the greater the movement of an object away from Earth. The cosmic background radiation, a burst of universe-wide energy that was released just 380,000 years or so after the Big Bang has a red shift of about 1,100.

"For most galaxies," says Robertson, "the highest red shifts [or the oldest galaxies] we had spectra for were at six, seven, or eight."

Against those relatively modest standards, the four galaxies Robertson's team imaged blew the doors off the old record, weighing in with red shifts of 10.38, 11.58, 12.63, and 13.2. Those numbers put the galaxies on a continuum from about 450 million years after the Big Bang—13.35 billion years ago—to 325 million years after the Big Band, or 13.475 billion years ago.

"These are well beyond what we could have imagined finding before [Webb]," said Robertson in a statement accompanying the release of the paper.

The galaxies are impressive by dint their age, but not by dint of their size and mass. "The Milky Way is a few tens of billions of times the mass of the sun in stars," says Robertson. "These galaxies are 100 million to a billion times the mass of the sun in stars."

The explanation for that is a straightforward one. Astronomers don't yet know exactly when the first dust and gas began to accrete into galactic clouds, and stars then accreted within them, but the newly measured quartet emerged very early in that process. "The universe just wasn't building big galaxies at that point," Robertson says. "There was not a lot of time [for larger galaxies to form]."

(Continued on page 13)

Speaker Bio (Cont'd)

(Continued from page 3)

mission strategies to explore the Uranus system. Previously she worked on developing mission strategies to the Neptune-Triton system as part of the Trident Discovery mission team and the Neptune Odyssey Planetary Mission Concept Study.

She currently sits on the steering committee of the Outer Planets Assessment Group and recently served on the National Academies Ocean Worlds and Dwarf Planet panel for the Planetary Science and Astrobiology Decadal Survey.

Dr. Paty has an appointment in the University of Oregon's Clark Honors College where she worked on the recent curriculum revision and implementation, and her research home is in the Earth Sciences department where she teaches and mentors students in planetary and space science.

Prior to arriving at the University of Oregon, she spent 10 years at the Georgia Institute of Technology in the Department of Earth and Atmospheric Sciences developing a planetary sciences focus and the Center for Space Technology and Research which bridged space research interests between the College of Science and College of Engineering.

Her postdoc was spent working with the Cassini Plasma Spectrometer team while at the Southwest Research Institute.

Looking Up (Cont'd)

(Continued from page 7)

the center of the Winter Hexagon, while the Pleiades open star cluster is visible just above it.

This asterism is an unrivalled collection of stars: Sirius is the brightest star in the night sky, Capella is the 6th brightest, Rigel is the 7th, Procyon the 8th and Aldebaran, Pollux and Castor are among the night's 25 brightest stars.

This asterism is also called the Winter Circle. The earliest reference to the designation Winter Hexagon that I can find is from the March 1988 issue of Astronomy magazine, although I am sure this shape was seen centuries into the past.

So bundle up on even the coldest night and step outside, if only for a few minutes. That is all it takes to find the Winter Hexagon!

Information credits:

- https://en.wikipedia.org/wiki/Winter_Hexagon
- https://commons.wikimedia.org/wiki/File:Winter_Hexagon_and_Great_Southern_Triangle_(Stellarium).png
- http://homepage.mac.com/kvmagruder/bcp/aster/constellations/win6.htm
- http://www.daviddarling.info/encyclopedia/W/Winter_Hexagon.html
- http://newton.dep.anl.gov/newton/askasci/1993/astron/AST015.HTM

Observing (Cont'd)

(Continued from page 5)

ing the summer. But the sky is clear and there are still many beautiful objects for us to enjoy. Don't miss the trio of clusters in Auriga, and not far away is another nice cluster, M35, at the feet of the twins of Gemini. And below and behind Orion is Canis Major with the cluster M41, the Little Beehive, not far from the brightest star in the night sky, Sirius. And don't miss M42, the Great Orion Nebula. Set up your telescope and just stare at this, the brightest nebula in the sky

Comets: Look for Comet (C/2022 E3) ZTF at the end of January near the Little Dipper and Polaris. Comet ZTF could be

(Continued on page 14)

Ancient Galaxies (Cont'd)

(Continued from page 12)

The team not only measured the mass of the galaxies, but also used the NIRSpec to determine their chemical makeup. As would be expected for galaxies so early in their development phase, the principle components were hydrogen and helium, without enough time for the early stars within them to have developed heavier elements. "They are relatively metal-poor," says Robertson, "with fewer heavy elements compared to the sun."

The findings as a whole, promise still bigger discoveries—and still older galaxies—to come in the 20-some years Webb is expected to remain operational. "For us, this really was a paradigm shift in the way we were thinking about the high-red shift universe," says Robertson. "Because we know for certain that there are some galaxies to be studied only a couple of hundred million years after the Big Bang."

Night Sky Notes (Cont'd)

(Continued from page 11)

servations from NASA's MESSENGER mission added additional strong evidence for its presence. Mercury sports a comet-like tail made primarily of sodium which has been photographed by skilled astrophotographers. The tail results from neutral atoms in its thin atmosphere being pushed away from Mercury by pressure from the nearby Sun's radiation.

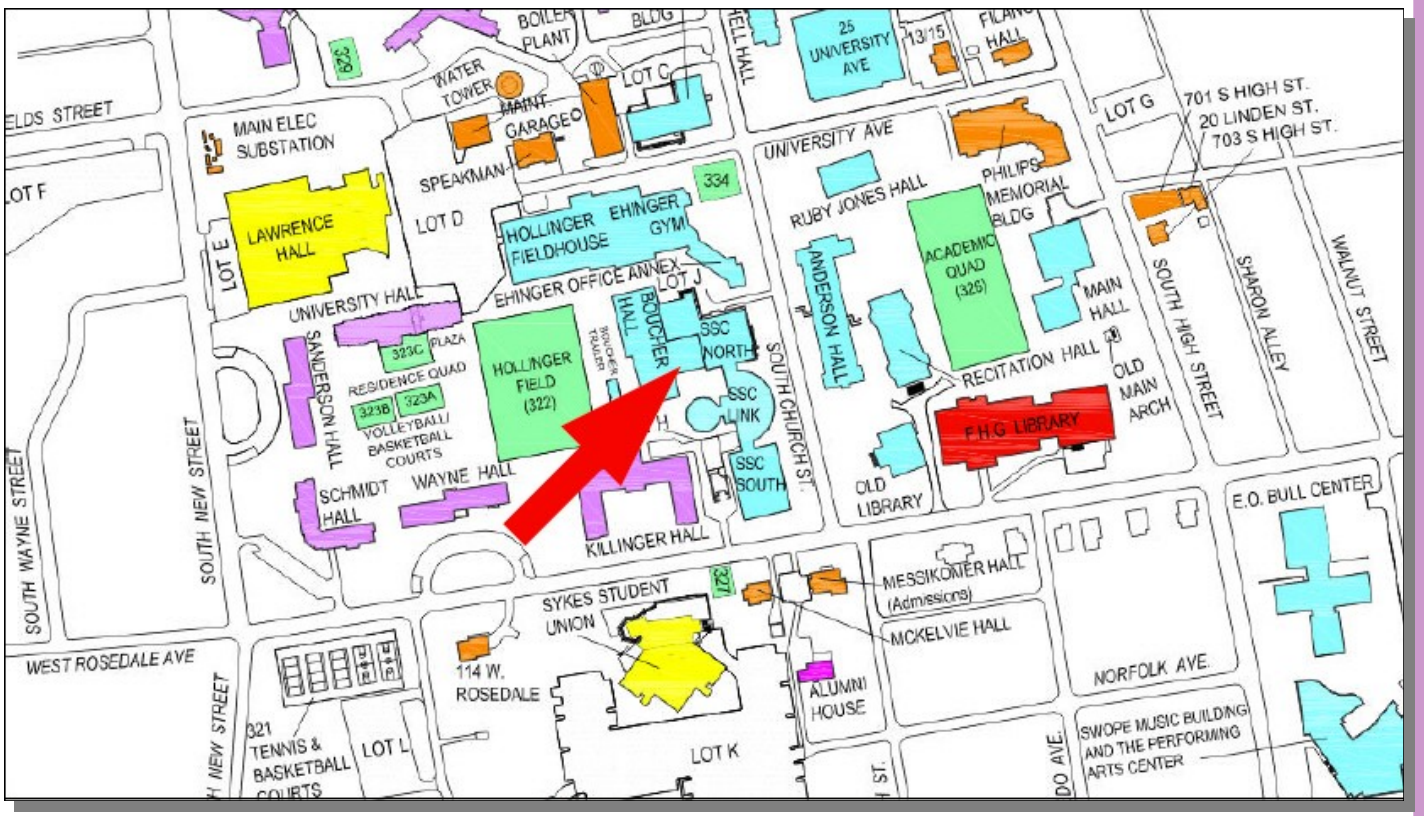
NASA's Mariner 10 was Mercury's first robotic explorer, flying by three times between 1974 -1975. Decades later, NASA's MESSENGER first visited Mercury in 2008, flying by three times before settling into an orbit in 2011. MESSENGER thoroughly studied and mapped the planet before smashing into Mercury at mission's end in 2015. Since MESSENGER, Mercury was briefly visited by BepiColombo, a joint ESA/JAXA probe, which first flew by in 2021 and is expected to enter orbit in 2025 - after completing six flybys.

Need more Mercury in your life? Check out NASA's discoveries and science about Mercury at solarsystem.nasa.gov/mercury/, and visit the rest of the universe at nasa.gov.

CCAS Directions

West Chester University Campus

The monthly meetings (September through May) are held in Room 112 in Merion Science Center (formerly the Boucher Building), attached to the Schmucker Science Center. The Schmucker Science Center is located at the corner of S. Church St & W. Rosedale Ave. Parking is generally available across Rosedale in the Sykes Student Union parking lot (Lot K).



Observing (Cont'd)

(Continued from page 13)

near magnitude 6 and easily visible in binoculars. A sky map is in the January issue of Sky and Telescope. Unless a new comet appears out of nowhere, Comet ZTF will be the best comet of 2023.

Meteor showers: The Quadrantid meteor shower peaks the night of January 3rd/4th. Because of a bright Moon most of the night it is best viewed in the hour before dawn on January 4th after the Moon has set. Even though the Moon will interfere with this shower it is worth looking before dawn. I have seen some amazing outbursts from this shower!

CCAS Membership Information and Society Financials

Treasurer's Report
by Don Knabb

Dec. 2022 Financial Summary

Beginning Balance	$1679
Deposits	$185
Disbursements	-$0
Ending Balance	$1864

New Member Welcome!

Welcome to our new CCAS members Wayne Ross & family from West Chester, PA.

We're glad you decided to join us under the stars! Clear skies to you!

Membership Renewals

You can renew your CCAS membership by writing a check payable to "Chester County Astronomical Society" and sending it to our Treasurer:

Don Knabb
988 Meadowview Lane
West Chester PA 19382

The current dues amounts are listed in the *CCAS Information Directory*. Consult the table of contents for the directory's page number in this month's edition of the newsletter.

CCAS Information Directory

Join the Fight for Dark Skies!

You can help fight light pollution, conserve energy, and save the night sky for everyone to use and enjoy. Join the nonprofit International Dark-Sky Association (IDA) today. Individual memberships start at $30.00 for one year. Send to:

International Dark-Sky Association
5049 E Broadway Blvd, #105
Tucson, AZ 85711

Phone: **520-293-3198**
Fax: **520-293-3192**
E-mail: **ida@darksky.org**

For more information, including links to helpful information sheets, visit the IDA web site at:

http://www.darksky.org

Dark-Sky Website for PA

The Pennsylvania Outdoor Lighting Council has lots of good information on safe, efficient outdoor security lights at their web site:

http://www.POLCouncil.org

Find out about Lyme Disease!

Anyone who spends much time outdoors, whether you're stargazing, or gardening, or whatever, needs to know about Lyme Disease and how to prevent it. You can learn about it at:

http://www.lymebasics.org

Take the time to learn about this health threat and how to protect yourself and your family. It is truly "time well spent"!

Good Outdoor Lighting Websites

One of the biggest problems we face in trying to reduce light pollution from poorly designed light fixtures is easy access to good ones. When you convince someone, a neighbor or even yourself, to replace bad fixtures, where do you go for good lighting fixtures? Check out these sites and pass this information on to others. Help reclaim the stars! And save energy at the same time!

Light pollution from poor quality outdoor lighting wastes billions of dollars and vast quantities of valuable natural resources annually. It also robs us of our heritage of star-filled skies. Starry Night Lights is committed to fighting light pollution. The company offers the widest selection of ordinance compliant, night sky friendly and neighbor friendly outdoor lighting for your home or business. Starry Night Lights is located in Phoenix, Arizona.

Phone: **520-280-3846**

http://www.starrynightlights.com

★ ★ ★ ★ ★

Lighthouse Outdoor Lighting is a dedicated lifetime corporate member of the International Dark-Sky Association. Lighthouse's products are designed to reduce or eliminate the negative effects outdoor lighting can have while still providing the light you need at night.

211 North Walnut St.
1st Floor
West Chester, PA 19380

Phone: **484-291-1084** or **800-737-4068**

https://www.lighthouse-lights.com/landscape-lighting-design/pa-west-chester/

Local Astronomy-Related Stores

Listing retail sites in this newsletter does not imply endorsement of any kind by our organization. This information is provided only as a service to our members and the general public.

Skies Unlimited is a retailer of telescopes, binoculars, eyepieces and telescope accessories from Meade, Celestron, Televue, Orion, Stellarvue, Takahashi, Vixen, Losmandy and more.

Skies Unlimited
Suburbia Shopping Center
52 Glocker Way
Pottstown, PA 19465

Phone: **610-327-3500** or **888-947-2673**
Fax: **610-327-3553**
Email: **info@skiesunlimited.com**

http://www.skiesunlimited.net

★ ★ ★ ★ ★

Located in Manayunk, Spectrum Scientifics educates and entertains customers with an array of telescopes, microscopes, binoculars, science toys, magnets, labware, scales, science instruments, chemistry sets, and much more.

4403 Main Street
Philadelphia, PA 19127

Phone: **267-297-0423**
Fax: **215-965-1524**

Hours:
Monday thru Friday: 9AM to 5PM

http://www.spectrum-scientifics.com

CCAS Information Directory

CCAS Lending Telescopes

Contact Don Knabb to make arrangements to borrow one of the Society's lending telescopes. CCAS members can borrow a lending telescope for a month at a time; longer if no one else wants to borrow it after you. Don's phone number is 610-436-5702.

CCAS Lending Library

Contact our Librarian, Barb Knabb, to make arrangements to borrow one of the books in the CCAS lending library. Copies of the catalog are available at CCAS meetings, and on the CCAS website. Barb's phone number is 610-436-5702.

Contributing to *Observations*

Contributions of articles relating to astronomy and space exploration are always welcome. If you have a computer, and an Internet connection, you can attach the file to an e-mail message and send it to: **newsletter@ccas.us**

Or mail the contribution, typed or handwritten, to:

Dr. John C. Hepler
21 Medinah Drive
Reading, PA 19607

CCAS Newsletters via E-mail

You can receive the monthly newsletter (in full color!) via e-mail. All you need is a PC or Mac with an Internet e-mail connection. To get more information about how this works, send an e-mail request to Dr. John Hepler, the newsletter editor, at: **newsletter@ccas.us**.

CCAS Website

Dr. John Hepler is the Society's Webmaster. You can check out our Website at:

http://www.ccas.us

Dr. Hepler welcomes any additions to the site by Society members. The contributions can be of any astronomy subject or object, or can be related to space exploration. The only requirement is that it is your own work—no copyrighted material! Give your contributions to Dr. Hepler at (484) 883-5033 or e-mail to webmaster@ccas.us

CCAS Purpose

The Chester County Astronomical Society was formed in September 1993, with the cooperation of West Chester University, as a non-profit organization dedicated to the education and enjoyment of astronomy for the general public. The Society holds meetings (with speakers) and observing sessions once a month. Anyone who is interested in astronomy or would like to learn about astronomy is welcome to attend meetings and become a member of the Society. The Society also provides telescopes and expertise for "nights out" for school, scout, and other civic groups.

CCAS Executive Committee

For further information on membership or society activities you may call:

President:	Dave Hockenberry 610-558-4248
Vice President:	Pete Kellerman 610-873-0162
ALCor, Observing, & Treasurer:	Don Knabb 610-436-5702
Secretary:	Beatrice Mazziotta 610-933-2128
Librarian:	Barb Knabb 610-436-5702
Program:	Bruce Ruggeri 484-883-5092
Education:	Don Knabb 610-436-5702 Dennis O'Leary 610-701-8042
Webmaster & Newsletter:	John Hepler 484-883-0533
Public Relations:	Ann Miller 610-558-4248

CCAS Membership Information

The 2021 membership rates are as follows:

REGULAR MEMBER……$30/year
SENIOR MEMBER…….$15/year
STUDENT MEMBER……..$ 5/year
JUNIOR MEMBER……..$ 5/year
FAMILY MEMBER…….$40/year

Membership Renewals

Check the Membership Renewals on the front of each issue of *Observations* to see if it is time to renew. If you need to renew, you can mail your check, made out to "Chester County Astronomical Society," to:

Don Knabb
988 Meadowview Lane
West Chester PA 19382-2178

Phone: **610-436-5702**
e-mail: **treasurer@ccas.us**

*Sky & Tel*escope Magazine

The club membership subscription cost for *Sky and Telescope* magazine has increased to **$43.95**. This is still a good saving from the regular rate of **$56.05**.

There is no need to go through the CCAS treasurer for subscriptions or renewals. Just go to the Sky and Telescope website and select "Magazine", then under the FAQs you can subscribe at the club rate.

https://skyandtelescope.org/subscribe/

If you have **any** questions call Don Knabb at 610-436-5702.

Astronomy Magazine Group Rates

Subscriptions to this excellent periodical are available through the CCAS at a reduced price of **$34.00** which is much less than the individual subscription price of **$42.95** (or $60.00 for two years).

There is no need to go through the CCAS treasurer for subscriptions or renewals. Just call customer service at 877-246-4835 and request the club rate for your new subscription or renewal.