Observations

A Monthly Publication Of The
CHESTER COUNTY ASTRONOMICAL SOCIETY

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Membership Renewals Due

11/2022	Buczynski Holenstein Romer Scovill Smith
12/2022	Damerau DeAngelo DellaPenna Gandhi Moynihan O'Leary Orso Watson & Metts
01/2023	Carlton Johnson Kellerman Kovacs LaFrance McDevitt McElwee Reynolds Schier

M33: The Triangulum Galaxy

Image Credit & Copyright: Processing - Robert Gendler; Data - Hubble Legacy Archive, KPNO, NOIRLab, NSF, Aura, Amateur Sources

November 2022 Dates

1st • First Quarter Moon, 2:37 a.m. EDT

4th • The Moon is near Jupiter

6th • Daylight Saving Time ends, 2:00 a.m. ET

8th • Full Moon, the Full Beaver Moon or the Full Rivers Freezing Moon and total lunar eclipse

16th • Last Quarter Moon, 8:27 p.m. EST

17th • The Leonid meteor shower peaks

23rd • New Moon, 5:57 p.m. EST

30th • First Quarter Moon, 9:37 a.m. EST

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, November 18th • 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.

Autumn / Winter Society Events

November 2022

6th • Daylight Saving Time Ends, 2:00 a.m. ET. Turn clocks back one hour.

8th • CCAS Monthly Meeting, Merion Science Center, Room 112. Guest Speaker: Joseph Neilsen, PhD, Assistant Professor of Physics, Villanova University. His presentation is titled "The Shadow of a Sleeping Giant – An Astrophysical Adventure."

10th • The von Kármán Lecture Series: What's in a Name? How We Find, Name, and Investigate Exoplanets, 10:00 pm EDT. Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

18th • Planetarium show at the Mather Planetarium at WCU, "Black Holes: The Other Side of Infinity." For more information, visit the WCU Public Planetarium Shows webpage.

18th • CCAS Monthly Observing Session, Myrick Conservancy Center, BRC. The observing session starts at sunset. Last observing session for the year.

20th • Open call for articles and photographs for the December 2022 edition of Observations.

26th • Deadline for newsletter submissions for the December 2022 edition of Observations.

December 2022

9th • Planetarium show at the Mather Planetarium at WCU, "Once in a Blue Moon…" For more information, visit the WCU Public Planetarium Shows webpage.

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

21st • Winter Solstice (4:48 P.M. EST) - The South Pole of the earth will be tilted toward the Sun, which will have reached its southernmost position in the sky and will be directly over the Tropic of Capricorn at 23.44 degrees south latitude. This is the first day of winter (winter solstice) in the northern hemisphere and the first day of summer (summer solstice) in the southern hemisphere.

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

Monthly Meeting Minutes: October 11, 2022

by Bea Mazziotta, CCAS Secretary

- Dave Hockenberry welcomed members and guests to the meeting which was held In person at WCU and online via zoom and YouTube. He briefly touched on the DART Mission which had been the topic of September's presentation and whose successful landing impact far exceeded the Mission's goals.
- Don Knabb spoke about several upcoming viewing events. Please visit the club website for dates and details. http://www.ccas.us/. Bruce Ruggeri informed members of the upcoming South Jersey Star Party. Visit http://www.sjac.us/star-party/ for details.
- Don Knabb gave a brief tutorial on how to find objects in the sky. He described new go-to telescope technology which is becoming more and more user friendly. He also described his preferred more traditional methods - learning the constellations, star hopping and using a red dot finder. Club member Kathy Buczynski recommended a book to complement his method -*Turn Left at Orion*.
- Bruce Ruggeri introduced the evening's guest speaker, Dr. Kevin Peter Hand. Dr. Hand is a planetary scientist at NASA's JPL at Caltech and is the director of Ocean Worlds Lab. He earned his doctorate at Stanford in 2007 with a dissertation on whether Jupiter's moon Europa has an ocean that could harbor life. While a PhD candidate he was chosen to take part in an exploration of hypothermal vents in the deepest ocean trenches and he also was featured in James Cameron's documentary, Aliens of the Deep. In 2020 Dr. Hand published a book entitled *Alien Oceans*.
- His presentation was entitled *Alien Oceans: The Search for Life in the Depths of Space.*
- One of the great discoveries of the last 60 years has been that liquid water oceans exist beyond earth. This has given rise to exploration of those worlds in the search for life. Moons of both Jupiter and Saturn present possibilities for subsurface oceans that harbor some form of life. Photos from the Cassini Mission show jets of water erupting from cracks in the surface of Enceladus. Samples collected from those plumes show the presence of salt, an indicator that the ocean is active. Hubble detected similar plumes of vapor on Europa, a moon of Jupiter and a particular focus of Dr. Hand's research. He is part of the Europa Clipper Mission which will launch in 2024 and whose goal it is to perform a detailed investigation of this moon which could host conditions favorable for life. Discovery of even the tiniest microbe would be monumental.

November 2022 CCAS Meeting Agenda

by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on November 8, 2022, 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. Guest speaker: Joseph Neilsen, Ph.D., Assistant Professor of Physics, Villanova University, "The Shadow of a Sleeping Giant – An Astrophysical Adventure."

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 2022-2023 season and beyond. If you are interested in presenting, or know someone who would like to partici-

November 2022 Speaker Profile

by Bruce Ruggeri, CCAS Program Chair

Our guest presenter on November 8, 2022 is Joseph Neilsen, Ph.D., Assistant Professor of Physics, Villanova University. His presentation is entitled "The Shadow of a Sleeping Giant – An Astrophysical Adventure."

Synopsis: Supermassive black holes light up the distant and local universe, but the Milky Way galaxy is remarkably quiet: our supermassive black hole, Sagittarius A* (Sgr A*), at the center of the Milky Way galaxy, is orders of magnitude fainter than its extragalactic counterparts. Drs. Reinhard Genzel and Andrea Ghez were awarded the 2020 Nobel prize in Physics for their discovery that Sagittarius A* is a supermassive compact

Joseph Neilsen, Ph.D.

object, for which a black hole was the only plausible explanation at the time. On May 12, 2022, astronomers using the Event Horizon Telescope, released the first image of the accretion disk around the horizon of Sagittarius A* produced using a world-wide network of radio observatories made in April 2017, confirming the object to be a black hole. This is the second confirmed image of a black hole, after Messier 87's supermassive black hole in 2019 (a topic which Dr Neilsen presented to the CCAS in October 2019). This image Sagittarius A* (Sgr A*) took five years of calculations to process, with the data collected by eight radio observatories at six geographical sites. Dr. Neilsen will highlight

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First Known Map of Night Sky Found Hidden in Medieval Parchment

by Jo Marchant, courtesy Nature.com

The library of St Catherine's Monastery on the Sinai Peninsula in Egypt yielded a palimpsest containing stellar coordinates by Hipparchus. Image Credit: Amanda Ahn/Alamy

A medieval parchment from a monastery in Egypt has yielded a surprising treasure. Hidden beneath Christian texts, scholars have discovered what seems to be part of the long-lost star catalogue of the astronomer Hipparchus — believed to be the earliest known attempt to map the entire sky.

Scholars have been searching for Hipparchus's catalogue for centuries. James Evans, a historian of astronomy at the University of Puget Sound in Tacoma, Washington, describes the find as "rare" and "remarkable". The extract is published online this week in the *Journal for the History of Astronomy*. Evans says it proves that Hipparchus, often considered the greatest astronomer of ancient Greece, really did

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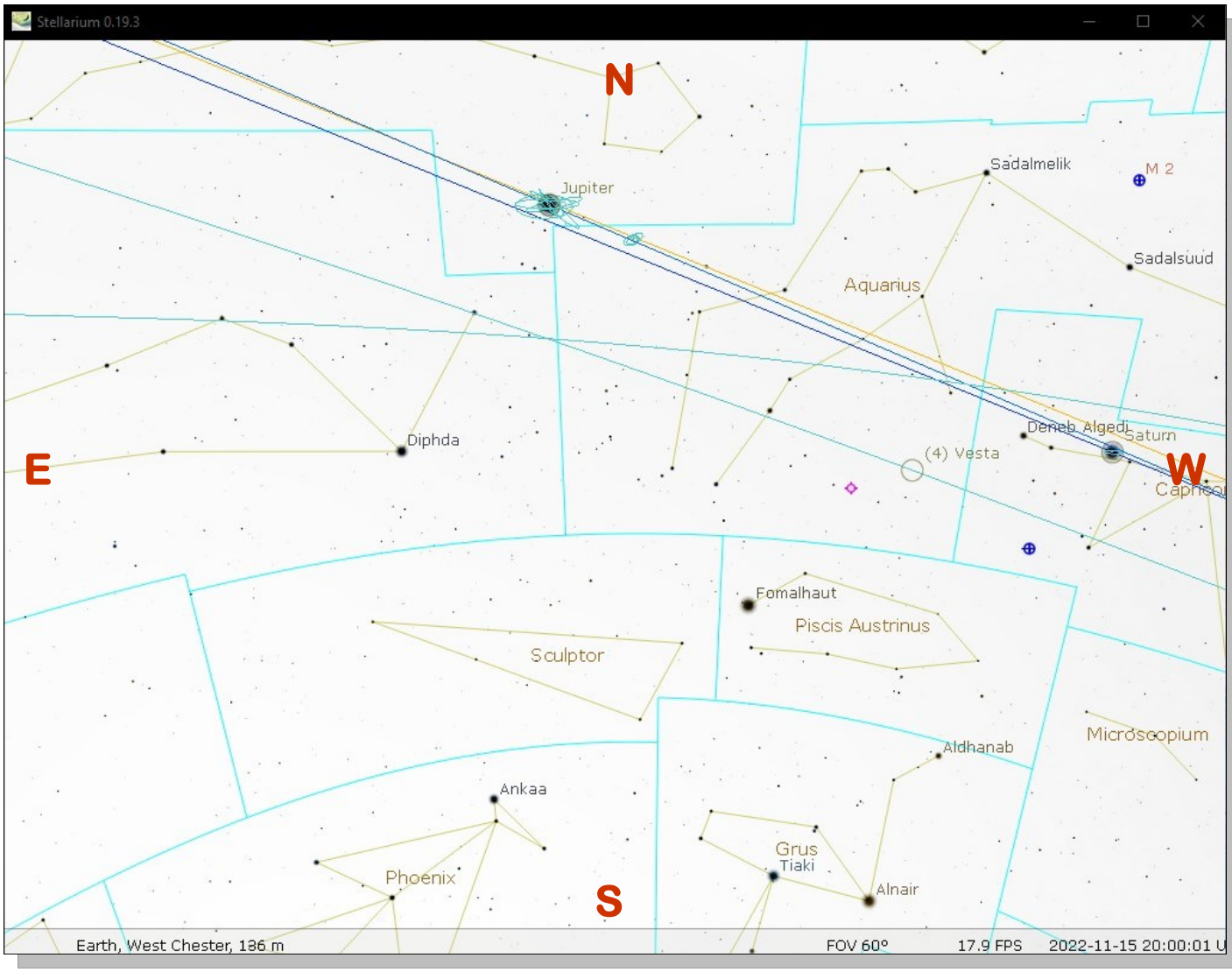
The Sky Over Chester County

November 15, 2022 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
11/01/2022	7:03 a.m. EDT	7:31 a.m. EDT	6:00 p.m. EDT	6:28 p.m. EDT	10h 28m 30s
11/15/2022	6:18 a.m. EST	6:47 a.m. EST	4:46 p.m. EST	5:15 p.m. EST	9h 58m 36s
11/30/2022	6:34 a.m. EST	7:03 a.m. EST	4:38 p.m. EST	5:07 p.m. EST	9h 34m 06s

Moon Phases					
First Quarter	11/01/2022	2:37 a.m. EDT	Full Moon	11/08/2022	6:02 p.m. EST
Last Quarter	11/16/2022	8:27 p.m. EST	New Moon	11/23/2022	5:57 p.m. EST
First Quarter	11/30/2022	9:37 a.m. EST			

November 2022 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

1	**First Quarter Moon and the Moon is near Saturn**
2	**The Lunar Straight Wall is visible this evening**
2	**The shadows of two moons are visible on Jupiter around 7:20 p.m.**
4	**The Moon is near Jupiter**
6	**Daylight Saving Time ends**
8	**Full Moon, the Full Beaver Moon or the Full Rivers Freezing Moon and total lunar eclipse**
9	**Uranus is at opposition**
16	**Last Quarter Moon**
17	**The Leonid meteors peak in the predawn sky**
23	**New Moon**
26	**Jupiter has only one moon visible at 7:16 p.m.**
30	**First Quarter Moon and the Lunar X is visible around 4 p.m.**
30	**Mars is at its closest approach to Earth**

Best viewing this month: A total lunar eclipse is the highlight of the November sky. However, you will need to rise early on November 8th to see it. The partial phase begins at 4:09 a.m. with the total eclipse beginning at 5:16 a.m., mid-eclipse is at 5:59 a.m. and the total phase ends at 6:42 a.m. which is just at sunrise. The other highlight of the month is the Leonid meteor shower, which is best viewed during the predawn hours of November 17th and 18th. We can expect up to 15 fast moving meteors per hour

Mercury: Mercury passes behind the Sun on November 8th and cannot be observed during November.

Venus: Our sister planet passed behind the Sun in late October and cannot be observed during November.

Mars: The red planet is at its closest approach to Earth on November 30th and is in excellent viewing position late at night. Mars rises around 8 p.m. and is near the horns of Taurus the Bull. At month's end Mars will be shining at a brilliant magnitude -1.8!

Jupiter: Jupiter is up all night and is best viewed as soon as the sky fully darkens. On November 2nd there will be the shadows of two moons visible on the planet at 7:20 p.m. and at 7:16 p.m. on November 26th there will be only one moon visible.

Saturn: Look for Saturn low in the southern sky as soon as the sky darkens. The ringed planet will set around 10:30 by the end of the month.

Uranus and Neptune: Uranus is at opposition on November 9th, so it is visible all night. Neptune is west-southwest of Jupiter and can be found with a little star hopping.

The Moon: Full moon occurs on November 8th. This full Moon is the Full Beaver Moon. For Native Americans, the time of this full moon was the time to set beaver traps before the swamps froze, to ensure a supply of warm winter furs. It is sometimes also referred to as the Frosty Moon, but I don't think they were referring to the snowman, even though the Moon kind of looks like the head of a snowman. Native Canadian tribes called this the Rivers Freezing Moon.

A total lunar eclipse occurs on the morning of November 8th. The partial phase begins at 4:09 a.m. with the total eclipse beginning at 5:16 a.m., mid-eclipse is at 5:59 a.m. and the total phase ends at 6:42 a.m. which is just at sunrise.

Constellations: During November the Great Square of Pegasus is at "center stage". To the left of the Great Square, sweeping up to the left is the constellation Andromeda. Use your binoculars to find our neighbor galaxy, which is also named Andromeda. It is a large fuzzy spot located between the constellation Andromeda and Cassiopeia. And by 9 p.m. the beautiful Pleiades, that really little dipper, is rising in the east ahead of Taurus the Bull. Capella in Auriga is a bright point of light upper left of Taurus. As it gets a bit later our old friend Orion returns from his summer vacation.

Messier/deep sky: I always look forward to au-

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Through the Eyepiece: M1, the Crab Nebula

by Don Knabb, CCAS Observing Chair & Treasurer

The Crab Nebula, M1, is the object that led Charles Messier to create his now famous catalog of objects that should not be mistaken for a comet. In 1758 while hunting for comet Halley on its first predicted return he found the Crab Nebula, and noticed that, unlike a comet, it did not move. Messier wrote in his logbook "It is a whitish light, elongated like a candle flame". He goes on to explain "this nebula had such a resemblance to a comet that I endeavored to find others, so that astronomers would not confuse these same nebulas with comets just beginning to shine". The nebulous remnant was first discovered by John Bevis in 1731 and Messier later acknowledged the earlier discovery by Bevis.

One can see why M1 might be mistaken for a comet by looking at the photograph to the right taken by Brent Crabb (really, his name has nothing to do with the Crab Nebula) from Orange County, California. The Crab Nebula looks like a faint comet without a tail.

The Crab Nebula is visible only with a telescope, between the horns of Taurus the Bull in winter skies. The nebula can be easily seen under clear dark skies, but can equally easily get lost in the background illumination that we experience in Chester County. Under good conditions M1 is just visible as a dim patch in 7x50 or 10x50 binoculars. With a little more magnification, it is seen as a nebulous oval patch, surrounded by haze as in the photograph above. In telescopes starting with 4-inch aperture, some detail in its shape becomes apparent. Only under excellent conditions and with larger telescopes, starting at about 16 inches aperture, suggestions of the filaments and fine structure may become visible.

M1: The Crab Nebula. Image Credit: Brent Crabb, Orange County, California

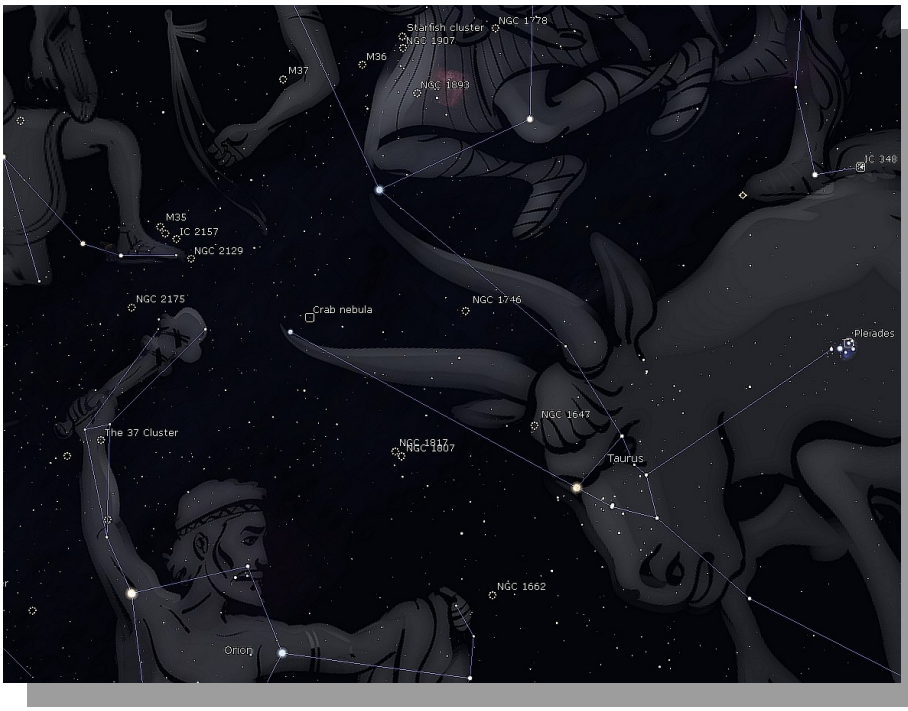

Image Created with Stellarium Software

(Continued on page 7)

Eyepiece (Cont'd)

(Continued from page 6)

M1 is not hard to find using the chart on pg. 6 that I created using Stellarium planetarium software.

The Crab Nebula is the shattered remains of a star that exploded in 1054 A.D. This supernova explosion was first recorded by Chinese and Japanese observers. For weeks this supernova was the brightest star-like object in the sky. It was about four times brighter than Venus, or about magnitude -6. It was reported to be visible in daylight for 23 days!

It is thought that this nebula was christened the "Crab Nebula" because of a drawing made by Lord Rosse about 1844. Lord Rosse erroneously thought the

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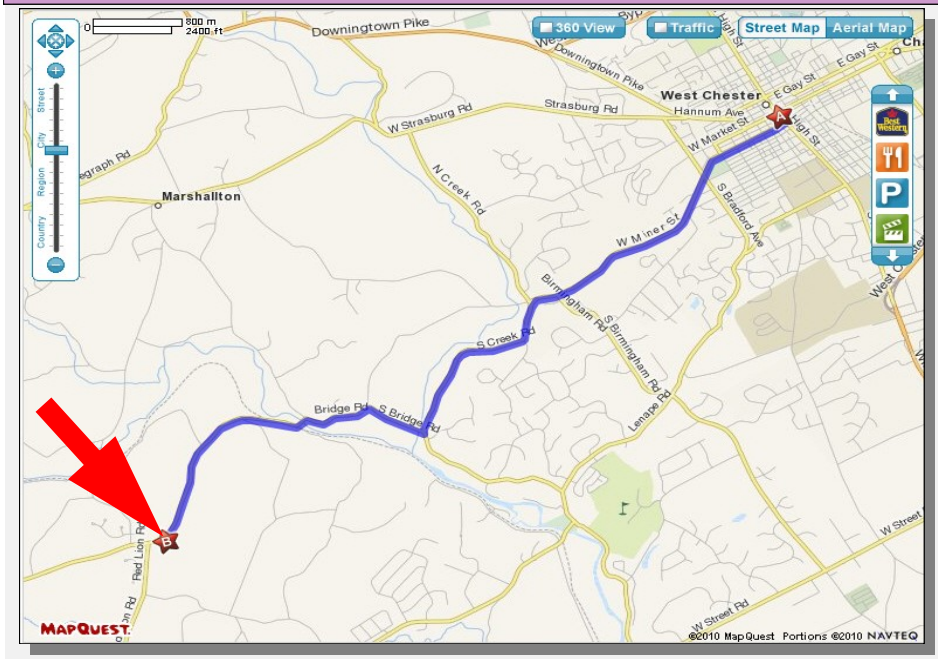
Classic La Para

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.

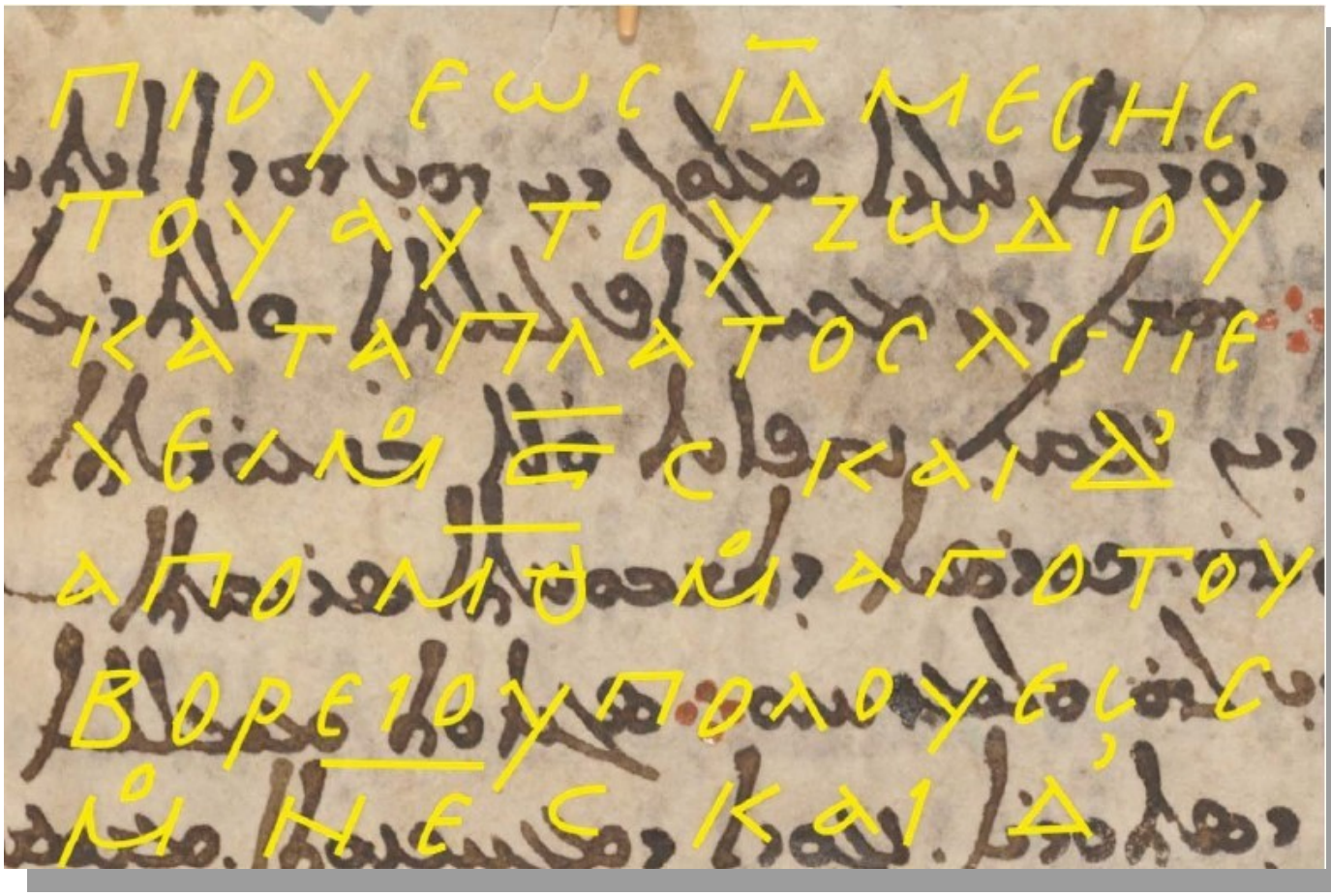
Brandywine Red Clay Alliance

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).

Parchment (Cont'd)



A detail of the palimpsest with a reconstruction of the hidden text in yellow. Credit: Museum of the Bible (CC BY-SA 4.0). Photo by Early Manuscripts Electronic Library/Lazarus Project, University of Rochester; multispectral processing by Keith T. Knox; tracings by Emanuel Zingg.

(Continued from page 3)

map the heavens centuries before other known attempts. It also illuminates a crucial moment in the birth of science, when astronomers shifted from simply describing the patterns they saw in the sky to measuring and predicting them.

The manuscript came from the Greek Orthodox St Catherine's Monastery in the Sinai Peninsula, Egypt, but most of its 146 leaves, or folios, are now owned by the Museum of the Bible in Washington DC. The pages contain the *Codex Climaci Rescriptus*, a collection of Syriac texts written in the tenth or eleventh centuries. But the codex is a palimpsest: parchment that was scraped clean of older text by the scribe so that it could be reused.

The older writing was thought to contain further Christian texts and, in 2012, biblical scholar Peter Williams at the University of Cambridge, UK, asked his students to study the pages as a summer project. One of them, Jamie Klair, unexpectedly spotted a passage in Greek often attributed to the astronomer Eratosthenes. In 2017, the pages were re-analyzed using state-of-the-art multispectral imaging. Researchers at the Early Manuscripts Electronic Library in Rolling Hills Estates, California, and the University of Rochester in New York took 42 photographs of each page in varying wavelengths of light, and used computer algorithms to search for combinations of frequencies that enhanced the hidden text.

Nine folios revealed astronomical material, which (according to radiocarbon dating and the style of the writing) was probably transcribed in the fifth or sixth centuries. It includes star-origin myths by Eratosthenes and parts of a famous third-century-BC poem called *Phaenomena*, which describes the constellations. Then, while poring over the images during a

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Parchment (Cont'd)

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coronavirus lockdown, Williams noticed something much more unusual. He alerted science historian Victor Gysembergh at the French national scientific research center CNRS in Paris. "I was very excited from the beginning," says Gysembergh. "It was immediately clear we had star coordinates."

The surviving passage, deciphered by Gysembergh and his colleague Emmanuel Zingg at Sorbonne University in Paris, is about a page long. It states the length and breadth in degrees of the constellation Corona Borealis, the northern crown, and gives coordinates for the stars at its extreme north, south, east and west.

Several lines of evidence point to Hipparchus as the source, beginning with the idiosyncratic way in which some of the data are expressed. And, crucially, the precision of the ancient astronomer's measurements enabled the team to date the observations. The phenomenon of precession — in which Earth slowly wobbles on its axis by around one degree every 72 years — means that the position of the 'fixed' stars slowly shifts in the sky. The researchers were able to use this to check when the ancient astronomer must have made his observations, and found that the coordinates fit roughly 129 BC — during the time when Hipparchus was working.

Until now, says Evans, the only star catalogue that had survived from antiquity was one compiled by astronomer Claudius Ptolemy in Alexandria, Egypt, in the second century AD. His treatise *Almagest*, one of the most influential scientific texts in history, set out a mathematical model of the cosmos — with Earth at its center — that was accepted for more than 1,200 years. He also gave the coordinates and magnitudes of more than 1,000 stars. However, it is mentioned several times in ancient sources that the person who first measured the stars was Hipparchus, who worked on the Greek island of Rhodes three centuries before, roughly between 190 and 120 BC.

Babylonian astronomers had previously measured the positions of some stars around the zodiac, the constellations that lie along the ecliptic — the Sun's annual path against the fixed stars, as seen from Earth. But Hipparchus was the first to define the locations of stars using two coordinates, and to map stars across the whole sky. Among other things, it was Hipparchus himself who first discovered Earth's precession, and he modelled the apparent motions of the Sun and Moon.

Gysembergh and his colleagues used the data they discovered to confirm that coordinates for three other star constellations (Ursa Major, Ursa Minor and Draco), in a separate medieval Latin manuscript known as the *Aratus Latinus*, must also come directly from Hipparchus. "The new fragment makes this much, much clearer," says Mathieu Ossendrijver, a historian of astronomy at the Free University of Berlin. "This star catalogue that has been hovering in the literature as an almost hypothetical thing has become very concrete."

The researchers think that Hipparchus's original list, like Ptolemy's, would have included observations of nearly every visible star in the sky. Without a telescope, says Gysembergh, he must have used a sighting tube, known as a *dioptra*, or a mechanism called an armillary sphere. "It represents countless hours of work."

The relationship between Hipparchus and Ptolemy has always been murky. Some scholars have suggested that Hipparchus's catalogue never existed. Others (starting with sixteenth-century astronomer Tycho Brahe) argued that Ptolemy had stolen Hipparchus's data and claimed it as his own. "Many people think that Hipparchus was the truly great discoverer," says Gysembergh, whereas Ptolemy was "an amazing teacher" who compiled his predecessors' work.

From the data in the fragments, the team concludes that Ptolemy did not simply copy Hipparchus's numbers. But perhaps he should have: Hipparchus's observations seem to be notably more accurate, with the coordinates read so far correct to within one degree. And whereas Ptolemy based his coordinate system on the ecliptic, Hipparchus used the celestial equator, a system more common in modern star maps.

The discovery "enriches our picture" of Hipparchus, says Evans. "It gives us a fascinating glimpse of what he actually

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NASA Night Sky Notes: Cepheus: A House Fit for a King

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.

Sometimes constellations look like their namesake, and sometimes these starry patterns look like something else entirely. That's the case for many stargazers upon identifying the constellation of **Cepheus** for the first time. These stars represent Cepheus, the King of Ethiopia, sitting on his throne. However, many present-day observers see

the outline of a simple house, complete with peaked roof, instead – quite a difference! Astronomers have another association with this northern constellation; inside its borders lies the namesake of one of the most important types of stars in modern astronomy: Delta Cephei, the original **Cepheid Variable**.

Cepheus is a circumpolar constellation for most observers located in mid-northern latitudes and above, meaning it does not set, or dip below the horizon. This means Cepheus is visible all night long and can be observed to swing around the northern celestial pole, anchored

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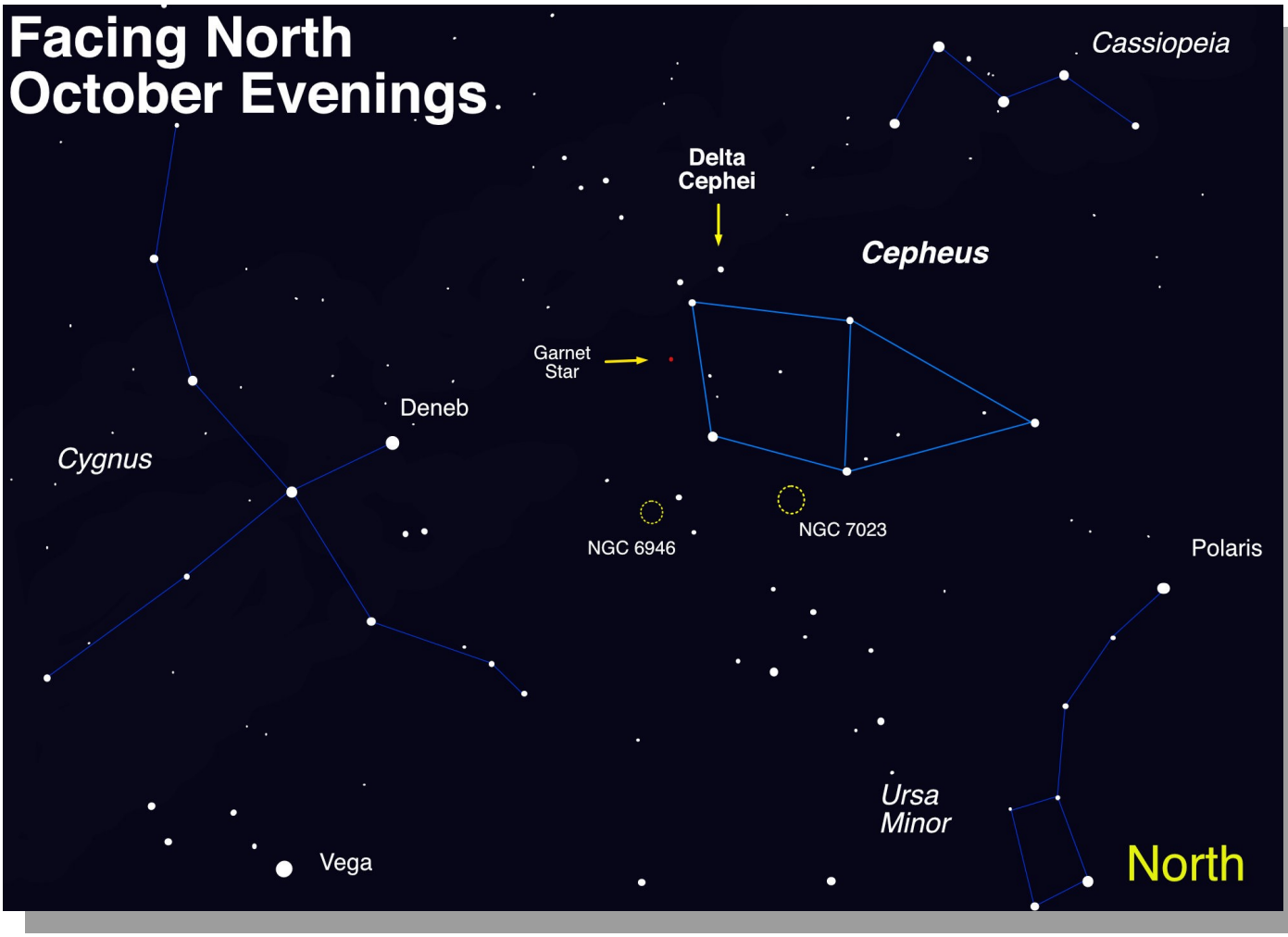

The stars of Cepheus are visible all year round for many in the Northern Hemisphere, but fall months offer some of the best views of this circumpolar constellation to warmly-dressed observers. Just look northwards! Image created with assistance from Stellarium: stellarium.org.

Night Sky Notes (Cont'd)

(Continued from page 10)

by Polaris, the current North Star. Other circumpolar constellations include Cassiopeia, Ursa Major, Ursa Minor, Draco, and Camelopardalis. Its all-night position for many stargazers brings with it some interesting objects to observe. Among them: the "Garnet Star" Mu Cephei, a supergiant star with an especially deep red hue; several binary stars; several nebulae, including the notable reflection nebula NGC 7023; and the "Fireworks Galaxy" NGC 6946, known for a surprising amount of supernovae.

Perhaps the most famous, and certainly the most notable object in Cepheus, is the star **Delta Cephei**. Its variable nature was first discovered by John Goodricke, whose observations of the star began in October 1784. Slightly more than a century later, Henrietta Leavitt studied the variable stars found in the Magellanic Clouds in 1908 and discovered that the type of variable stars represented by Delta Cephei possessed very consistent relationships between their luminosity (total amount of light emitted), and their pulsation period (generally, the length of time in which the star goes through a cycle of where it dims and then brightens). Once the period for a Cepheid Variable (or **Cepheid**) is known, its luminosity can be calculated by using the scale originally developed by Henrietta Leavitt, now called "Leavitt's Law.". So, if a star is found to be a Cepheid, its actual brightness can be calculated versus its observed brightness. From that difference, the Cepheid's distance can then be estimated with a great deal of precision. This revolutionary discovery unlocked a key to measuring vast distances across the cosmos, and in 1924 observations of Cepheids by Edwin Hubble in what was then called the Andromeda Nebula proved that this "nebula" was actually another galaxy outside of our own Milky Way! You may now know this object as the "Andromeda **Galaxy**" or M31. Further observations of Cepheids in other galaxies gave rise to another astounding discovery: that our universe is not static, but expanding!

Because of their importance as a "standard candle" in measuring cosmic distances, astronomers continue to study the nature of Cepheids. Their studies revealed that there are two distinct types of Cepheids: Classical and Type II. Delta Cephei is the second closest Cepheid to Earth after Polaris, and was even studied in detail by Edwin Hubble's namesake telescope, NASA's Hubble Space Telescope, in 2008. These studies, along with others performed by the ESA's Hipparcos mission and other observatories, help to further refine the accuracy of distance measurements derived from observations of Cepheids. What will further observations of Delta Cephei and other Cepheids reveal about our universe?

Follow NASA's latest observations of stars and galaxies across our universe at nasa.gov.

Observing (Cont'd)

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tumn for viewing the Double Cluster between Cassiopeia and Perseus. This is a nice binocular object. Rising behind Perseus is the constellation Auriga and its three open star clusters M36, M37 and M38. If you stay up for late night observing you can get an early view of M42, the Great Orion Nebula.

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Guest Speaker (Cont'd)

(Continued from page 3)

some of the salient characteristics of black holes and discuss efforts to study this "sleeping giant", culminating in the recent discovery of the shadow of the black hole Sagittarius A* (Sgr A*), by the Event Horizon Telescope Collaboration.

Biosketch.: Dr. Joseph Neilsen is a black hole astrophysicist and Assistant Professor of Physics at Villanova University. He received undergraduate degrees from Kenyon College in Physics and Mathematics; he studied with Julia Lee at Harvard University and received his PhD in 2011. He joined the Villanova faculty in 2017. Dr. Neilsen is an expert in X-ray observations of black holes and is a member of the Event Horizon Telescope Collaboration.

Dr. Neilsen can be reached via email at jneilsen@villanova.edu or by phone at (610) 519-6497. His campus website is http://www.homepage.villanova.edu/joseph.neilsen

Parchment (Cont'd)

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did." And in doing so, it sheds light on a key development in Western civilization, the "mathematization of nature", in which scholars seeking to understand the Universe shifted from simply describing the patterns they saw to aiming to measure, calculate and predict.

Hipparchus was the pivotal figure responsible for "turning astronomy into a predictive science", agrees Ossendrijver. In his only surviving work, Hipparchus criticized earlier astronomical writers for not caring about numerical accuracy in their visions of orbits and celestial spheres.

He is thought to have been inspired by his contact with Babylonian astronomers, and to have had access to centuries' worth of their precise observations. The Babylonians had no interest in modelling how the Solar System was arranged in three dimensions but, because of their belief in celestial omens, they made accurate observations and developed mathematical methods to model and predict the timing of events such as lunar eclipses. With Hipparchus, this tradition merged with the Greek geometric approach, says Evans, and "modern astronomy really begins".

The researchers hope that as imaging techniques improve, they will uncover further star coordinates, giving them a larger data set to study. Several parts of the *Codex Climaci Rescriptus* have not yet been deciphered. It is also possible that additional pages from the star catalogue survive in the St Catherine's library, which contains more than 160 palimpsests. Efforts to read these have already revealed previously unknown Greek medical texts, including drug recipes, surgical instructions, and a guide to medicinal plants.

Beyond that, multispectral imaging of palimpsests is opening a rich new seam of ancient texts in archives around the world. "In Europe alone, there are literally thousands of palimpsests in major libraries," says Gysembergh. "This is just one case, that's very exciting, of a research possibility that can be applied to thousands of manuscripts with amazing discoveries every time."

Nature 610, 613-614 (2022)

doi: https://doi.org/10.1038/d41586-022-03296-1

References

Gysembergh, V., Williams, P. J. & Zingg, E. J. Hist. Astron. 53, 383–393 (2022).

CCAS Original Astrophotography

by CCAS Member Bill Kellar

Sunrise through fog and trees about 8:30 AM on November 3rd. It was taken with a cellphone at the Black Rock Sanctuary near Phoenixville, PA.

Eyepiece (Cont'd)

(Continued from page 7)

ragged filaments protruding from the nebula were unresolved chains of stars. Lord Rosse' Leviathan telescope was equipped with a 6-foot mirror, the largest telescope in the world at that time. To produce the drawing Lord Rosse used a 3-foot telescope before building Leviathan. He later observed the Crab Nebula with Leviathan to resolve the nebula's filaments into stars but was of course unable to do so since the filaments are part of the nebula, not chains of stars.

The nebula consists of the material ejected in the supernova explosion, which has been spread over a volume approximately 10 light years in diameter, and is still expanding at the very high velocity of about 1,800 km/sec.

Image credit:
William Parsons, Third Earl of Rosse
http://messier.seds.org/more/m001_rosse.html

On November 9, 1968, a pulsating radio source, the Crab Pulsar was discovered in M1 by astronomers of the now destroyed Arecibo Observatory 300-meter radio telescope in Puerto Rico. It has now been established that this pulsar is a rapidly rotating neutron star. It rotates about 30 times per second! The neutron star is an extremely dense object, denser than an atomic nucleus, concentrating more than one solar mass in a volume 30 kilometers across. This energy source is 100,000 times more energetic than our sun.

Image credit: NASA/ESA/JPL/Arizona State Univ.

To the left is an incredible photograph of the Crab Nebula. This composite image was assembled from 24 individual exposures taken with the NASA Hubble Space Telescope's Wide Field and Planetary Camera 2. It is one of the largest images taken by Hubble and is the highest resolution image ever made of the entire Crab Nebula.

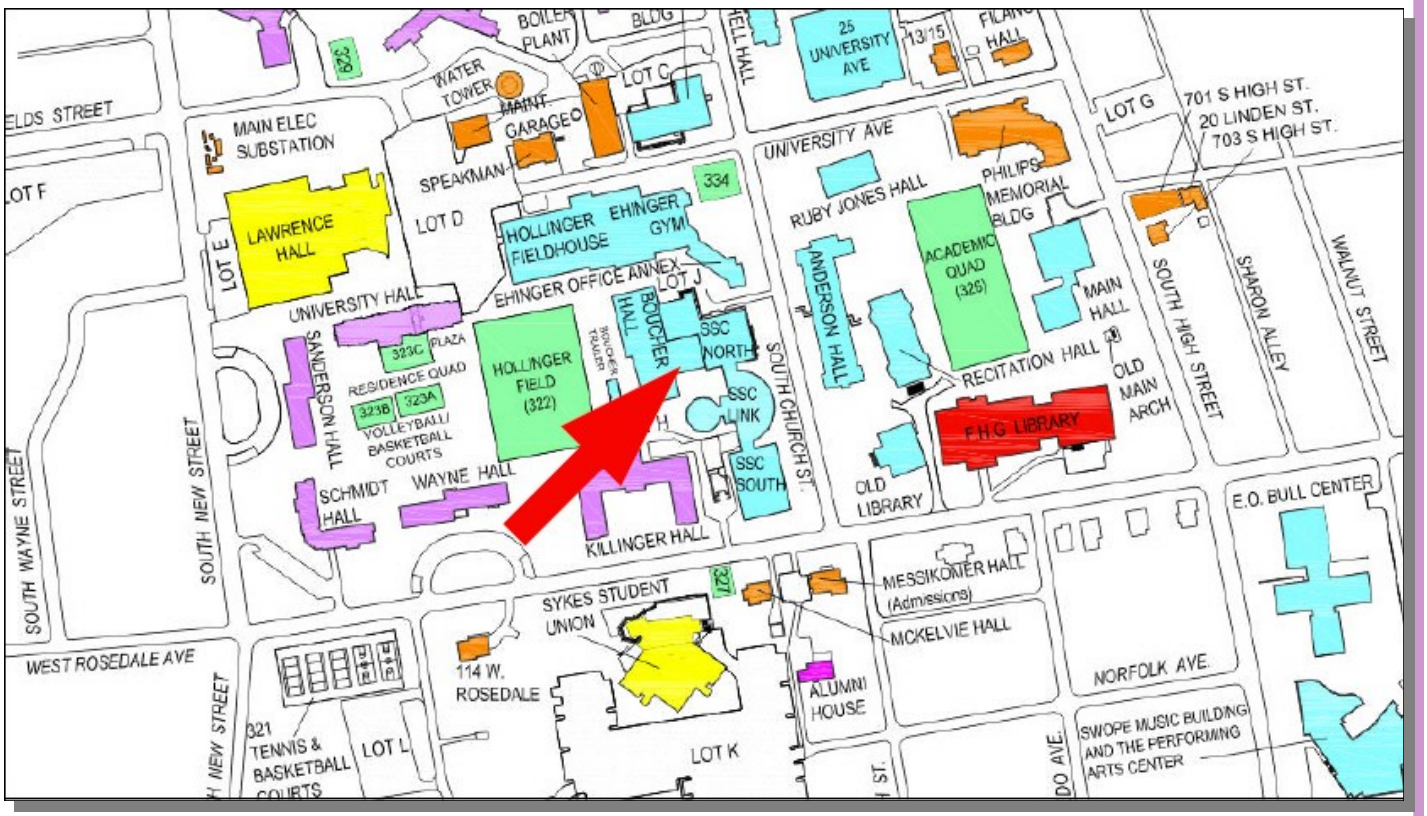
Information credits:

- Raymo, Chet. 1982. *365 Starry Nights*. New York, NY. Fireside/Simon & Schuster
- http://www.seds.org/messier/m/m001.html
- http://en.wikipedia.org/wiki/Crab_Nebula
- http://astro.nineplanets.org/twn/n1952x.html

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 11)

Comets: There are no bright comets visible during November.

Meteor showers: The Leonid meteor shower is best viewed during the predawn hours of November 17th and 18th. We can expect up to 15 fast moving meteors per hour. The Leonids are considered the fastest of any meteors so the chance of seeing a bright fireball is good.

CCAS Membership Information and Society Financials

Treasurer's Report
by Don Knabb

Oct. 2022 Financial Summary

Beginning Balance	$1504
Deposits	$105
Disbursements	-$135
Ending Balance	$1474

New Member Welcome!

Welcome to our new CCAS members Marie & Joseph Kania, Newtown Square, PA, and WCU student Numa Rashid.

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
3225 North First Avenue
Tucson, AZ 85719

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.LymePA.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 Park City, Utah.

Phone: **877-604-7377**
Fax: **877-313-2889**

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.

Phone: **484-291-1084**

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**

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: **215-667-8309**
Fax: **215-965-1524**

Hours:
Tuesday thru Saturday: 10AM to 6PM
Sunday and Monday: 11AM 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.