



Observations

A Monthly Publication Of The
CHESTER COUNTY ASTRONOMICAL SOCIETY

Vol. 31, No. 5 **Three-Time Winner of the Astronomical League's Mabel Sterns Award** ☼ 2006, 2009 & 2016

May 2023

In This Issue

CCAS Spring/Summer Events	2
April 2023 Meeting Minutes	2
May 2023 CCAS Meeting Agenda	2
May 2023 Speaker Profile	3
The Sky Over Chester County: May 2023	4
May 2023 Observing Highlights	5
Looking Up: The Three Leaps of the Gazelle	6
Classic La Para	7
CCAS Directions: Brandywine Red Clay Alliance	7
Hubble Spots Black Hole Leaving Behind a Trail of New Stars	9
Hubble Follows Shadow Play Around Planet-forming Disk	11
Galactic Gobble: Star Swallows Planet in One Big Gulp	12
Membership Renewals	14
New Member Welcome	14
CCAS Directions: WCU Map	14
Treasurer's Report	14
CCAS Information Directory	15-16

Venus & The Pleiades



CCAS member Jack O'Neill captured this image of Venus and M45. for more details about the image and Jack's equipment & image processing, see page 13.

Membership Renewals Due

05/2023	Blessing Cunningham Malkan O'Hara OstaneK Rosenstein
06/2023	Crabb Cunningham Curry Dautrich, Chris Dautrich, Cindy Dhargalkar Hanspal Harris Hebding Hobson Lindtner Maynard Mazziotta / Calobrisi McCausland O'Neill Thomas
07/2023	Hunsinger McGuigan Morgan Piehl

May 2023 Dates

- 5th** • Full Moon, the Flower Moon, the Milk Moon Frog Croaking Moon or the Corn Moon, 1:36 a.m. EDT.
- 12th** • Last Quarter Moon, 10:29 a.m. EDT.
- 19th** • New Moon, 11:55am EDT.
- 22nd** • The Moon sweeps past Venus, Mars and the Twins of Gemini in the evening.
- 26th** • Regulus is the bright star near the Moon at night-fall.
- 28th** • First Quarter Moon, 11:23am EDT.
- 28th** • The Lunar X is visible this evening.



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, May 5th • Walk When the Moon is Full w/Malvern Arts at Paoli Battlefield @ Dusk.
- ☼ Friday, May 12th • CCAS Monthly Observing Session, Myrick Conservancy Center, BRC. The observing session starts at sunset.
- ☼ Saturday, May 20th • CCAS Special Observing Session at Hoopes Park, West Chester, PA. The observing session starts at sunset.

For more information about future observing opportunities, contact our [Observing Chair](#), Michael Manigly.

Spring / Summer Society Events

May 2023

1st • Introduction to Astronomy Class: Beyond Naked-Eye Observing, Stetson Middle School, 7 p.m. EDT.

2nd • Star Party w/WCU Astronomy Club at Ram Park (North of Sykes Student Union Building) 8:30-9:30 p.m. EDT,

5th • Walk When the Moon is Full w/Malvern Arts at Paoli Battlefield @ Dusk.

9th • CCAS Monthly Meeting, Merion Science Center, Room 112. Guest Speaker: Dr. Candice Hansen-Koharcheck, JPL and Planetary Science Institute, "JunoCam Images of Jupiter: A New Perspective."

12th • CCAS Monthly Observing Session, Myrick Conservancy Center, BRC. The observing session starts at sunset.

18th • The von Kármán Lecture Series: [InSight End of Mission: Our Time on Mars](#), Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech starting at 10:00 p.m. EDT.

20th • CCAS Special Observing Session at Hoopes Park, West Chester, PA. The observing session starts at sunset.

20th • Open call for articles and photographs for the June 2023 edition of [Observations](#).

26th • Deadline for newsletter submissions for the June 2023 edition of [Observations](#).

June 2023

9th • CCAS Monthly Observing Session, Myrick Conservancy Center, BRC. The observing session starts at sunset.

14th-18th • York County Star Party #1. Presented by Sky Shed Pod PA, York, PA. Cherry Springs State Park, Susquehannock State Park, 1880 Park Dr, Drumore, PA 17518.

15th-18th • Cherry Springs Park Star Party. Presented by the Astronomical Society of Harrisburg, Harrisburg, PA. Cherry Springs State Park, Coudersport, Pennsylvania.

20th • Open call for articles and photographs for the July 2023 edition of [Observations](#).

21st-24th • Green Bank Star Quest. National Radio Observatory, Green Bank, West Virginia.

22nd • The von Kármán Lecture Series: [The Universe of Very Cold: The James Webb Space Telescope, MIRI, and the Cryocooler](#), Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech starting at 10:00 p.m. EDT.

26th • Deadline for newsletter submissions for the July 2023 edition of [Observations](#).

30th • Solar Observing w/Roger Kennedy at Rachel Kohl Library. For more information, contact our Observing Chair, Mike Manigly.

Monthly Meeting Minutes: April 11, 2023

by Bea Mazziotta, CCAS Secretary

- Dave Hockenberry welcomed members and guests to the April meeting, which was held in the Mather Planetarium at WCU.
- The session was also broadcast via Zoom and YouTube despite the Planetarium's dome shape inhibited online viewing.
- He announced that Michael Manigly as taken over as the new CCAS Observing Chair. Dave and members thanked Don Knabb for his many years of excellent service in that role.
- Michael Manigly reminded members of upcoming public observation events and asked for member participation at the events.
 - 5/2 Tuesday - Star Party w/WCU Astronomy Club at Ram Park (North of Sykes Student Union Building) 8:30-9:30 p.m. EDT
 - 5/5 Friday - Walk When the Moon is Full w/Malvern Arts at Paoli Battlefield @ Dusk
 - 5/12 Friday - CCAS Monthly Observing Event at BRC @ Dusk
 - 5/20 Saturday - Special Observing Event w/West Chester Parks & Recreation at Hoopes Park 8pm
- CCAS is seeking someone to take over managing the club's Night Sky Network responsibilities.
- Bruce Ruggeri, Program Chair, introduced the evening's program speaker Dr. Marc Gagné.
- Dr. Gagné is a Professor of Astronomy at WCU. His research focuses on star formation, massive stars, high-speed computing and the geology of Mars.
- Dr. Gagné's topic was entitled *JWST: New Science Frontiers and Discoveries*. He narrated a slide show of the JWST's construction, launch and photos which it started to send in July 2022.
- He included views taken by the Hubble Space Telescope and highlighted the advanced capabilities of the Webb with a comparison of images taken of the same regions of space.
- The monthly meeting ended with a question and answer period following Dr. Gagné's presentation.

May 2023 CCAS Meeting Agenda

by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on May 9, 2023, in person 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. Candice Joy Hansen-Koharcheck, of the Planetary Science Institute in Tucson, Arizona. Her presentation is titled "JunoCam Images of Jupiter: A New Perspective."

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.

May 2023 Speaker Profile

by Bruce Ruggeri, CCAS Program Chair

Join us on May 9th for the last of our monthly CCAS meetings for the 2022-2023 season. This month, we're back in our usual meeting space in West Chester University's Merion Science Center, Room 112. We'll also broadcast the meeting online via Zoom/YouTube.

This month's guest speaker is Dr. Candice Joy Hansen-Koharcheck, of the Planetary Science Institute in Tucson, Arizona. Dr. Hansen-Koharcheck has had a distinguished history at NASA and JPL (and elsewhere) and has been involved in numerous past and current missions of exploration, most currently the Juno Mission and the JunoCam in particular.

Title: *JunoCam Images of Jupiter: A New Perspective*

Synopsis: Dr. Hansen is collaborator on NASA's Juno Mission, and is responsible for development and operation of the JunoCam, for which she received the NASA's Outstanding Public Leadership Medal in 2018. JunoCam is the first interplanetary outreach camera used for both science and outreach which produced the first close-up images of Jupiter's polar region. JunoCam was also used to capture images of volcanic plumes on Io.

Juno's unique polar orbit yields polar perspectives unavailable to earth-based observers or previous spacecraft. In a highly elliptical orbit Juno's closest approach comes within 3500 km of Jupiter's cloud tops. Evolution of the orbit has allowed the spacecraft to pass close to Ganymede and Europa, with close Io passes in the near

future. Members of the public have been invited to process JunoCam images.

Dr. Hansen will discuss the Juno Mission and share with us some of the amazing images and revelations made possible by



Candice Joy Hansen-Koharcheck, Ph.D.

JunoCam. She will also discuss briefly the ESA Juice Mission and NASA's Europa Clipper Mission to the Jovian system.

Bio sketch: Dr. Hansen received her Bachelor of Science in Physics from California State University in 1976 and began her career in planetary science, working at NASA's Jet Propulsion Laboratory.

At JPL, she worked on the Voyager mission as part of the Voyager Imaging Team and designed the imaging sequences for the flybys with Jupiter, Saturn, Uranus, and Neptune. From 1981 to 1984, when the Voyager was between Saturn and Uranus, Hansen worked at German Space Operations Center in Oberpfaffenhofen.

While working at JPL, Hansen completed a Master of Science in planetary physics (1989) and her

PhD in Earth and Space Science (1994) at UCLA.

In 1990, Dr. Hansen started working on the Cassini Mission as part of the Ultraviolet Imaging Spectrograph (UVIS) investigation team, where she is still co-investigator. She received the 2002 JPL Exceptional Leadership Award for her involvement in the planning of the Jupiter flyby.

Hansen is part of the team within the Cassini mission that studies the water vapor plumes on Enceladus, research which helped confirm the idea that there are subsurface bodies of water on Enceladus.

For her work on the water vapor plumes on Enceladus, Dr. Hansen received the Edward Stone Award in 2007 and the NASA Exceptional Scientific Achievement Medal in 2009.

Dr. Hansen retired from the JPL in 2010 but continues her work as senior scientist at the Planetary Science Institute in Tucson, Arizona where she is currently deputy Principal Investigator for the High Resolution Imaging Science Experiment (HiRISE) on the Mars Reconnaissance Orbiter.

As part of HiRISE, Dr. Hansen studies the seasonal carbon-dioxide ice on Mars and co-authored a book titled *'Mars: The Pristine Beauty of the Red Planet'*, a collection of HiRISE images.

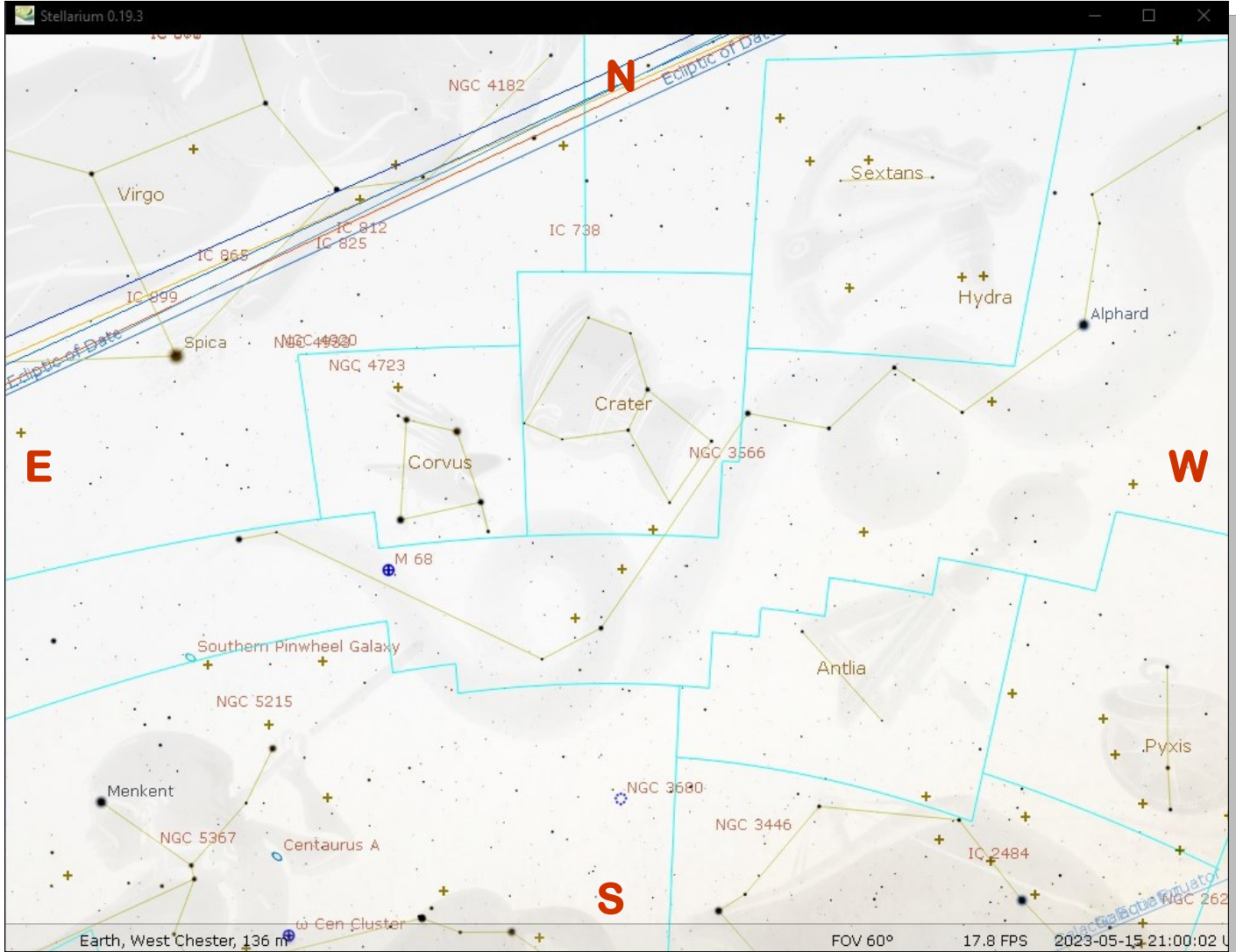
Among her additional research interests, Dr. Hansen studies planetary atmospheres in vapor pressure equilibrium with surface ices (Triton, Pluto, Kuiper

(Continued on page 14)

The Sky Over Chester County

May 15, 2023 at 9:00 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
05/01/2023	5:33 a.m. EDT	6:02 a.m. EDT	7:56 p.m. EDT	8:26 p.m. EDT	13h 54m 02s
05/15/2023	5:16 a.m. EDT	5:47 a.m. EDT	8:10 p.m. EDT	8:41 p.m. EDT	14h 23m 06s
05/31/2023	5:04 a.m. EDT	5:36 a.m. EDT	8:24 p.m. EDT	8:56 p.m. EDT	14h 47m 53s

Moon Phases					
			Full Moon	05/05/2023	1:34 p.m. EDT
Last Quarter	05/12/2023	10:28 a.m. EDT	New Moon	05/19/2023	11:53 a.m. EDT
First Quarter	05/27/2023	11:22 a.m. EDT			

May 2023 Observing Highlights

by Michael Manigly, CCAS Observing Chair

3	Spica, the brightest star in Virgo, can be located to the lower right of the Moon, at nightfall.
5	Full Moon, the Flower Moon, The Milk Moon Frog Croaking Moon or the Corn Moon, 1:36 a.m. EDT. Penumbral lunar eclipse across the eastern hemisphere but not observable from northeast USA.
6	Antares is close and below the Moon as they both climb into view before Midnight. The star gets closer and to the left of the Moon at first light on the 7th.
11	The Moon is at perigee, 1:05 a.m. EDT.
12	Last Quarter Moon, 10:29 a.m. EDT.
13	Looking like a bright star, Saturn will appear 3 degrees and to the upper left of the Moon at first light.
17	The Moon and Jupiter appear to nearly touch in the dawn twilight. They appear low in the sky requiring a clear horizon to observe.
19	New Moon, 11:55 a.m. EDT.
22	The Moon sweeps past Venus, Mars and the Twins of Gemini in the evening.
23	A conjunction of the Moon, Mars and Venus occurs.
25	The Moon is at apogee, 9:39 p.m. EDT.
26	Regulus is the bright star near the Moon at nightfall.
27	First Quarter Moon, 11:23 a.m. EDT.
28	Lunar Straight Wall visible this evening.
30	The Moon returns to Spica with this bright star to the lower left of the Moon

The best sights this month: Venus is the star in the evening sky during May. Saturn shines bright around a magnitude 0.8 in the hour before dawn for most of the month. The Aquariid meteor showers may bring some excitement on the 6th and 7th.

Mercury returns to the morning sky around mid month but appears relatively dim at magnitude 2.0

in the low ENE sky. On the 23rd it reaches magnitude 1.0 and can be located 7 degrees east of Jupiter.

Venus is the best target in the evening skies during May and appears high in the SW sky after sunset and sets in the NW after midnight. It shines brightly at magnitude -4.1 at the start of May and brightens to magnitude -4.4 by the end of the month. It can be found between the horns of Taurus the Bull on the 1st. The Moon passes 2 degrees to the north of Venus on the 23rd.

Mars appears high in the SW sky after sunset and sets in the WNT after 1:00am EDT. Mars is 5 degrees south of Pollux on the 9th with a magnitude 1.4, Pollux will appear brighter with a magnitude 1.2. Also on the 17th Mars aligns to the left of Pollux and Castor for several nights. They appear to be equally spaced with Mars and Pollux showing a little orange color.

Mars ends the month near M44 the Beehive Cluster. It is also part of a nice cluster with the Moon, Venus, Pollux and Castor on the 23rd and 24th.

Jupiter rises during the morning twilight in the ENE sky. It achieves a close conjunction with the waning crescent Moon on the 17th.

Saturn rises in the ENE skies and it is the brightest object in the sky at magnitude 0.8 for most of the month. The best time to view is about an hour before dawn in the SE sky. The Last Quarter Moon is nearby on the 13th.

Uranus is too close to the Sun to be observed this month.

Neptune can be spotted in the morning sky with binoculars shining at magnitude 7.8 with visibility improving throughout the month.

The **Moon** is full on the 5th. Native Americans called this the Flower Moon. Other names are Milk Moon, Frog Croaking Moon and Corn Moon. The Lunar Straight Wall is visible on then 28th.

Constellations: This a a good time of the year to look high overhead at the Big Dipper and find the entire constellation Ursa Major. Leo the Lion is still high in the sky as darkness falls. Boötes and Hercules are available to view as total darkness greets the sky. The spring constellations have arrived and if

(Continued on page 7)

Looking Up: The Three Leaps of the Gazelle

by Don Knabb, CCAS Treasurer

This month we'll step away from the eyepiece of our telescope and do a little naked eye stargazing. We'll head outside just as it has become fully dark and find one of the lesser-known asterisms in the spring sky. An asterism is not an official constellation but is a group of stars that make a distinctive shape. Two of the most famous asterisms in the sky are The Big Dipper and the Sickle, which is more commonly called the Backwards Question Mark.

Step outside when all the light from the sunset has faded and look to the south and then lean back and look straight overhead. This is best done in a lounge chair to avoid a stiff neck. Overhead you'll see the Big Dipper, which is part of the constellation Ursa Major, the Big Bear.

Now look down from the zenith toward the south and you will find The Sickle, or the Backwards Question Mark. This is the head of Leo the Lion. For young

readers, a sickle is a hand tool that was used to harvest wheat, or in my case it is what I used as a child to trim weeds before the invention of the modern miracle, the gas-powered line trimmer.

Between the top of the Sickle and the bottom of the bowl of the Big Dipper you will find three pairs of stars widely spaced from one another. The pairs are about the same dis-

(Continued on page 8)



Image credit: The author, using Stellarium, a free planetarium software package

Observing (Cont'd)

(Continued from page 5)

you hang out late enough you may even see the Summer Triangle.

Messier/deep sky: As summer nears it is time to observe globular clusters. Imagine 500,000 stars in your eyepiece. M3 is high overhead during May. If you stay out late you may find M13, the Great Globular Cluster in Hercules rising in the east. It contains up to a million stars!

Comets: If you have a large telescope and dark skies Comet 237P/LINEAR may be viewable during the second half of the month.

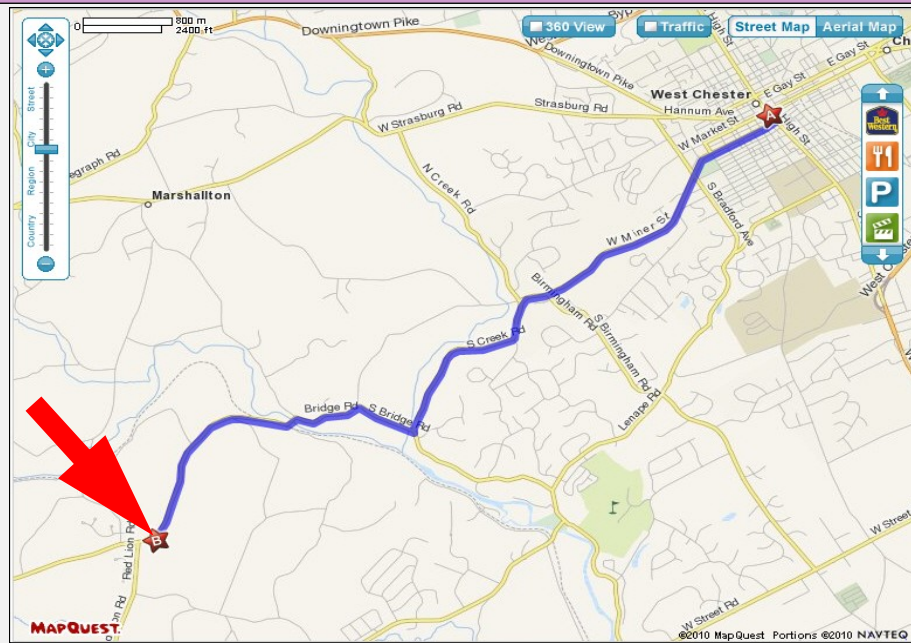
Meteor showers: The ETA Aquariids peaks on May 6th but

(Continued on page 14)

Classic La Para by Nicholas La Para



CCAS Directions



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).

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.

Looking Up (Cont'd)



Image credit: https://en.wikipedia.org/wiki/Ursa_Major, public domain image

(Continued from page 6)

tance apart from each other and the stars are around the same magnitude of brightness.

These pairs of stars form the asterism known as The Three Leaps of the Gazelle. According to the legend, when the gazelle ran from Leo the Lion it leapt across the sky from east to west (left to right), leaving impressions in the mud like deer hooves. The three star pairs are all within the constellation Ursa Major the Big Bear.

On page 6 I included a diagram of The Three Leaps of the Gazelle that I made using Stel-

larium, a free planetarium software package.

I recently observed the three pairs of stars from our backyard, which has a fair amount of sky glow from nearby West Chester, so you do not need a dark sky site to see this asterism.

If you look at some of the old constellation drawings such as the one below you can see that the three pairs of hoof prints belong to Ursa Major.

According to Ulugh Beg, a 13th century Arabic Astronomer, who first makes mention of the Three Leaps of the Gazelle, the

creature was grazing amongst the stars that today we call Leo Minor (the little lion) when Leo (the big lion) swished its mighty tail across the sky.

This startled the gazelle and it bounded away for safety, leaving behind its softly glowing tracks in the sky, still seen by us to this day.

Just to the rear of Leo is a misty patch of stars that the IAU officially recognizes as the constellation of Coma Berenices but, in Beg's day, was recognized by many as the lion's tufted tail.

(Continued on page 9)

Hubble Spots Black Hole Leaving Behind a Trail of New Stars

by Jake Parks, *Astronomy Magazine*

Astronomers think they've discovered a black hole some 20 million times the mass of the Sun speeding away from the core of a distant galaxy. And as the supermassive black hole barrels through intergalactic space, it's compressing the scant gas and dust available out there, leaving behind a thin line of newly formed stars that's some 200,000 light-years long.

"We think we're seeing a wake behind the black hole where the gas cools and is able to form stars," said Pieter van Dokkum of Yale University, who first identified the star trail, in a [NASA release](#). "What we're seeing is the aftermath. Like the wake behind a ship, we're seeing the wake behind the black hole."

Despite being relatively thin, the black hole's stellar wake is

packed with plenty of hot blue stars, making it nearly half as bright as the parent galaxy it traces back to. Based on the available evidence, the researchers think this black hole was likely ejected during a complex dance between three supermassive black holes that were involved in a pair of galaxy mergers. If confirmed, this would be the first observational evidence showing that supermassive black holes can be ejected from their parent galaxies.

A paper detailing [the candidate runaway black hole and its stellar wake](#) was published April 6 in *The Astrophysical Journal Letters*.

But it wasn't an accretion disk that gave away this black hole. It was the unusual linear streak

Looking Up (Cont'd)

(Continued from page 8)

So, step outside on a warm May night and look at the zoo in the sky and the prints left by The Three Leaps of the Gazelle!

Information credits:

- <http://whassupinthemilky-way.blogspot.com/2009/05/three-leaps-of-gazelle.html>
- <http://my.execpc.com/60/B3/culp/astronomy/Winter/Bears.html>
- <http://www.theskyscrapers.org/content2097.html>
- <https://astrobob.areavoices.com/2010/04/08/how-to-track-a-frightened-gazelle/>

seemingly linking it to a nearby galaxy, which van Dokkum first noticed in an image captured by the [Hubble Space Telescope](#). He and his team later confirmed the streak is indeed linked to the gal-

(Continued on page 10)



This illustration shows the suspected runaway black hole and the thin trail of new stars linking it back to the parent galaxy it was apparently tossed out of. Image credit: NASA, ESA, Leah Hustak (STScI)

Black Hole (Cont'd)

(Continued from page 9)

axy with follow-up observations taken with the Keck Observatory in Hawaii.

"This is pure serendipity that we stumbled across it," said van Dokkum, who was initially looking at the Hubble image to investigate an unrelated dwarf galaxy. "I was just scanning through the Hubble image and then I noticed that we have a little streak." He says he initially almost dismissed it as an imaging artifact, but "[w]hen we eliminated cosmic rays we realized it was still there. It didn't look like anything we've seen before."

The researchers also investigated the possibility that the streak was an [astrophysical jet](#) shooting from the black hole

core of the nearby galaxy — which is not an uncommon sight. But the streak gets stronger farther from the core of the galaxy, and it doesn't fan out at the end, leading the researchers to conclude the streak is instead a trail of new stars.

At the outer tip of the streak, where the suspected black hole is thought to be, the researchers also see evidence of a shock wave in front of the black hole. "Gas in front of it gets shocked because of this supersonic, very high-velocity impact of the black hole moving through the gas," said van Dokkum. "How it works exactly is not really known."

But it wasn't an accretion disk that gave away this black hole. It was the unusual linear streak

seemingly linking it to a nearby galaxy, which van Dokkum first noticed in an image captured by the Hubble Space Telescope. He and his team later confirmed the streak is indeed linked to the galaxy with follow-up observations taken with the Keck Observatory in Hawaii.

"This is pure serendipity that we stumbled across it," said van Dokkum, who was initially looking at the Hubble image to investigate an unrelated dwarf galaxy. "I was just scanning through the Hubble image and then I noticed that we have a little streak." He says he initially almost dismissed it as an imaging artifact, but "[w]hen we eliminated cosmic rays we realized it was still there. It didn't

(Continued on page 13)



The strange linear feature was first identified in this archival photo captured by the Hubble Space Telescope. Follow-up observations have shown the feature is actually a chain of young blue stars some 200,000 light-years long. Image credit: NASA, ESA, Pieter van Dokkum (Yale); Image Processing: Joseph DePasquale (STScI)

Hubble Follows Shadow Play Around Planet-forming Disk

by NASA/Goddard Space Flight Center

In 2017, astronomers reported discovering a shadow sweeping across the face of a vast pancake-shaped gas-and-dust disk surrounding the red dwarf star. The shadow isn't from a planet, but from an inner disk slightly inclined relative to the much larger outer disk -- causing it to cast a shadow. One explanation is that an unseen planet's gravity is pulling dust and gas into the planet's inclined orbit.

Now, a second shadow -- playing a game of peek-a-boo -- has emerged in just a few years between observations stored in Hubble's MAST archive. This could be from yet another disk nestled inside the system. The two disks are likely evidence of a pair of planets under construction.

TW Hydrae is less than 10 million years old and resides about 200 light-years away. In its infancy, our solar system may have resembled the TW Hydrae system, some 4.6 billion years ago. Because the TW Hydrae system is tilted nearly face-on to our view from Earth, it is an optimum target for getting a bull's-eye-view of a planetary construction yard.

The second shadow was discovered in observations obtained on June 6, 2021, as part of a multi-year program designed to track the shadows in circumstellar disks. John Debes of AURA/STScI for the European Space Agency at the Space Telescope Science Institute in Baltimore, Maryland, compared the TW Hydrae disk to Hubble observations made several years ago.

"We found out that the shadow

had done something completely different," said Debes, who is principal investigator and lead author of the study published in *The Astrophysical Journal*. "When I first looked at the data, I thought something had gone wrong with the observation because it wasn't what I was expecting. I was flummoxed at first, and all my collaborators were like: what is going on? We really had to scratch our heads and it took us a while to actually figure out an explanation."

The best solution the team came up with is that there are two misaligned disks casting shadows. They were so close to each other in the earlier observation they were missed. Over time they've now separated and split into two shadows. "We've never really seen this before on a protoplanetary disk. It makes the system much more complex than we originally thought," he said.

The simplest explanation is that the misaligned disks are likely caused by the gravitational pull of two planets in slightly different orbital planes. Hubble is piecing together a holistic view of the architecture of the system.

The disks may be proxies for planets that are lapping each other as they whirl around the star. It's sort of like spinning two vinyl phonograph records at slightly different speeds. Sometimes labels will match up but then one gets ahead of the other.

"It does suggest that the two planets have to be fairly close to each other. If one was moving much faster than the other, this would have been noticed in earli-

er observations. It's like two race cars that are close to each other, but one slowly overtakes and laps the other," said Debes.

The suspected planets are located in a region roughly the distance of Jupiter from our Sun. And, the shadows complete one rotation around the star about every 15 years -- the orbital period that would be expected at that distance from the star.

Also, these two inner disks are inclined about five to seven degrees relative to the plane of the outer disk. This is comparable to the range of orbital inclinations inside our solar system. "This is right in line with typical solar system style architecture," said Debes.

The outer disk that the shadows are falling on may extend as far as several times the radius of our solar system's Kuiper belt. This larger disk has a curious gap at twice Pluto's average distance from the Sun. This might be evidence for a third planet in the system.

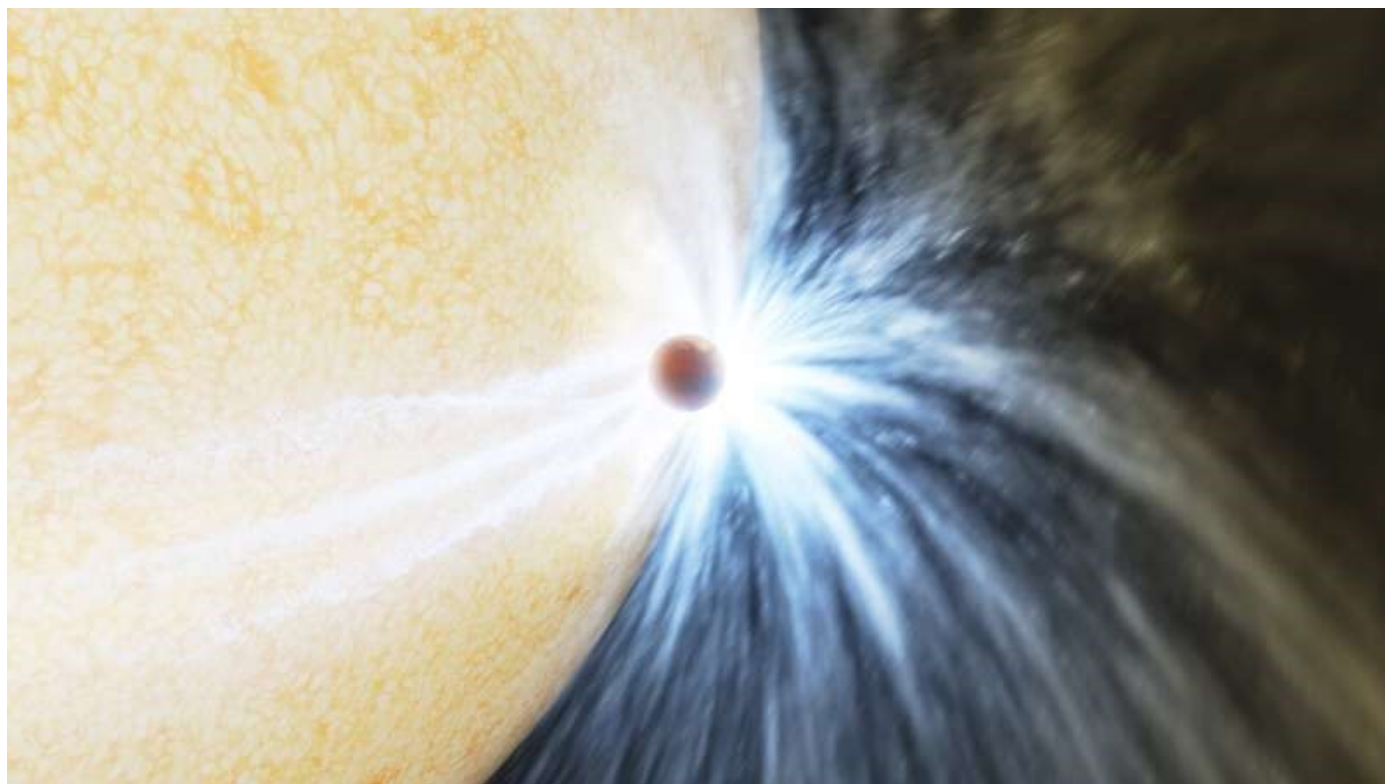
Any inner planets would be difficult to detect because their light would be lost in the glare of the star. Also, dust in the system would dim their reflected light. ESA's Gaia space observatory may be able to measure a wobble in the star if Jupiter-mass planets are tugging on it, but this would take years given the long orbital periods.

The TW Hydrae data are from Hubble's Space Telescope Imaging Spectrograph. The James Webb Space Telescope's infrared vision may also be able to

(Continued on page 13)

Galactic Gobble: Star Swallows Planet in One Big Gulp

by Marcia Dunn, *Physics.org*



This illustration provided Caltech/IPAC by depicts a planet skimming the surface of its star. Astronomers reported their observations Wednesday, May 3, 2023, of what appears to be a gas giant at least the size of Jupiter being eaten by its star. The sun-like star had been puffing up with old age for eons and finally got so big that it engulfed the close-orbiting planet. Image Credit: K. Miller, R. Hurt/Caltech/IPAC via AP

For the first time, scientists have caught a star in the act of swallowing a planet—not just a nibble or bite, but one big gulp.

Astronomers on Wednesday reported their observations of what appeared to be a gas giant around the size of Jupiter or bigger being eaten by its star. The sun-like star had been puffing up with old age for eons and finally got so big that it engulfed the close-orbiting planet.

It's a gloomy preview of what will happen to Earth when our sun morphs into a red giant and gobbles the four inner planets.

"If it's any consolation, this will happen in about 5 billion years," said co-author Morgan MacLeod of the Harvard-Smithsonian Center for Astro-

physics.

This galactic feast happened between 10,000 and 15,000 years ago near the Aquila constellation when the star was around 10 billion years old. As the planet went down the stellar hatch, there was a swift hot outburst of light, followed by a long-lasting stream of dust shining brightly in cold infrared energy, the researchers said.

While there had been previous signs of other stars nibbling at planets and their digestive aftermath, this was the first time the swallow itself was observed, according to the study appearing in the journal *Nature*.

Massachusetts Institute of Technology researcher Kishalay De spotted the luminous out-

burst in 2020 while reviewing sky scans taken by the California Institute of Technology's Palomar Observatory. It took additional observations and data-crunching to unravel the mystery: Instead of a star gobbling up its companion star, this one had devoured its planet.

Given a star's lifetime of billions of years, the swallow itself was quite brief—occurring in essentially one fell swoop, said Caltech's Mansi Kasliwal, who was part of the study.

The findings are "very plausible," said Carole Haswell, an astrophysicist at Britain's Open University, who had no role in the research. Haswell led a team in 2010 that used the Hubble

(Continued on page 13)

Black Hole (Cont'd)

(Continued from page 10)

look like anything we've seen before."

The researchers also investigated the possibility that the streak was an astrophysical jet shooting from the black hole core of the nearby galaxy — which is not an uncommon sight. But the streak gets stronger farther from the core of the galaxy, and it doesn't fan out at the end, leading the researchers to conclude the streak is instead a trail of new stars.

At the outer tip of the streak, where the suspected black hole is thought to be, the researchers also see evidence of a shock wave in front of the black hole. "Gas in front of it gets shocked because of this supersonic, very high-velocity impact of the black hole moving through the gas," said van Dokkum. "How it works exactly is not really known."

The astronomers think this

runaway black hole was likely ejected from its parent galaxy after two separate galaxy mergers in the semi-recent past. The first merger between two galaxies would have occurred roughly 50 million years ago, resulting in the two galaxies' supermassive black holes entering orbit around one another.

Then, a later merger with a third galaxy threw the three supermassive black holes into a chaotic dance that ultimately led to the solitary black hole being ejected from the system altogether. The team also thinks that when the isolated black hole was thrown out, the remaining pair of binary black holes should have been thrown off in the opposite direction.

In order to confirm this hypothesis, the team next plans to capture follow-up observations with the James Webb Space Telescope and the Chandra X-ray Observatory.

One Big Gulp (Cont'd)

(Continued from page 12)

Space Telescope to identify the star WASP-12 in the process of eating its planet.

"This is a different sort of eating. This star gobbled a whole planet in one gulp," Haswell said in an email. "In contrast, WASP-12 b and the other hot Jupiters we have previously studied are being delicately licked and nibbled."

Astronomers don't know if more planets are circling this star at a safer distance. If so, De said they may have thousands of years before becoming the star's second or third course.

Now that they know what to look for, the researchers will be on the lookout for more cosmic gulps. They suspect thousands of planets around other stars will suffer the same fate as this one did and, eventually, so will our solar system.

"All that we see around us, all the stuff that we've built around us, this will all be gone in a flash," De said.

More information:

Kishalay De, An infrared transient from a star engulfing a planet, *Nature* (2023).

DOI: [10.1038/s41586-023-05842-x](https://doi.org/10.1038/s41586-023-05842-x).

www.nature.com/articles/s41586-023-05842-x

On This Month's Cover

Venus and M45 in very close proximity. This was taken shot on April 12, 2023, at 20:28. It was taken from my front porch in Phoenixville, PA with a Canon PowerShot SD1400 IS mounted on a tripod. ISO=80, shutter speed 6s, f/3.5. Minor lighting adjustment in Photoshop Elements.

Hubble Follows Shadow Play (Cont'd)

(Continued from page 11)

show the shadows in more detail.

The Hubble Space Telescope is a project of international cooperation between NASA and ESA. NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy, in Washington, D.C.

Story Source: Materials provided by [NASA/Goddard Space Flight Center](https://www.nasa.gov).

Journal Reference: John Debes, Rebecca Nealon, Richard Alexander, Alycia J. Weinberger, Schuyler Grace Wolff, Dean Hines, Joel Kastner, Hannah Jang-Condell, Christophe Pinte, Peter Plavchan, Laurent Pueyo. The Surprising Evolution of the Shadow on the TW Hya Disk*. *The Astrophysical Journal*, 2023; 948 (1): 36 DOI: [10.3847/1538-4357/acbdf1](https://doi.org/10.3847/1538-4357/acbdf1)

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 7)
is impaired by the Full Moon which remains visible all night. It is best seen during predawn hours with an expected peak of 50 meteors/hour.

Speaker Bio (Cont'd)

(Continued from page 3)
Belt Objects), erosional processes due to dry ice sublimation on Mars, and is Chair of NASA's Outer Planets Assessment Group.

CCAS Membership Information and Society Financials

Treasurer's Report by Don Knabb

April 2023 Financial Summary

Beginning Balance	\$2170
Deposits	\$345
Disbursements	-\$820
Ending Balance	\$1694

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

New Member Welcome!

Welcome to our new CCAS members Don McCabe, Aston, PA; John Quinn, Malvern, PA; and Robert Kagel, Chester Springs, PA.

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

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.

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

Lighthouse Outdoor Lighting is a dedicated lifetime corporate member of the [International Dark-Sky Association](http://www.ida-dsa.org). 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 & Treasurer: Don Knabb
610-436-5702

Observing: Michael Manigly
484-631-6197

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 & Telescope 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.