Observations

A Monthly Publication Of The
CHESTER COUNTY ASTRONOMICAL SOCIETY

Vol. 28, No. 2 ***Three-Time*** *Winner of the Astronomical League's Mabel Sterns Award ☼ 2006, 2009 & 2016* *February 2020*

In This Issue

Membership Renewals Due

02/2020	Ruggeri
03/2020	Angelini DellaPenna Fulton Sterrett Zandler Zibinski
04/2020	Hepler Imburgia Miller Rossomando

UGC 2885, Rubin's Galaxy

Image Credit: NASA, ESA, B. Holwerda (University of Louisville)

February 2020 Dates

1st • First Quarter Moon, 11:45 p.m. EST, and around 4 p.m. EST.

2nd • the Lunar straight wall is visible .

9th • Full Moon, the Full Snow Moon or the Frog Moon, 2:33 a.m. EST.

11th-25th • The Zodiacal Light is visible in the west after evening twilight.

15th • Last Quarter Moon, 5:17 p.m. EST.

23rd • New Moon, 10:32 a.m. EST.

CCAS Upcoming Nights Out

In addition to our monthly observing sessions at the Myrick Conservancy Center, BRC (see pg. 2), 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 27, 2020** - CCAS Monthly Observing Session, Myrick Conservancy Center, Brandywine Red Clay Alliance. The observing session starts at sunset.

☼ **Friday, April 24, 2020** - CCAS Monthly Observing Session, Myrick Conservancy Center, Brandywine Red Clay Alliance. The observing session starts at sunset.

☼ **Saturday, April 25, 2020** - CCAS Special Observing Session with Atglen Library at Wolf's Hollow County Park, Atglen, PA.

Winter Society Events

February 2020

6th-7th • The von Kármán Lecture Series: Beyond the Pale Blue Dot: Seeing Distant Planets, Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

11th • CCAS Monthly Meeting, Room 113, Merion Science Center (former Boucher Building), West Chester University. The meeting starts at 7:30 p.m. Guest Speaker: Ravi Sheth, PhD, Dept. of Astronomy and Astrophysics, University of Pennsylvania – "Gravity Waves—The Discovery that Shook the Earth."

20th • Open call for articles and photographs for the March 2020 edition of Observations.

21st • West Chester University Planetarium Show: "A Star is Born," in the Schmucker Science Building. The show starts at 7 p.m. and runs approximately one hour in length. For more information and reservations, visit the WCU Public Planetarium Shows webpage.

26th • Deadline for newsletter submissions for the March 2020 edition of Observations.

March 2020

5th-6th • The von Kármán Lecture Series: The Search for Life: Exploring Ocean Worlds, Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

8th • Daylight Saving Time begins at 2:00 a.m. Turn clocks forward one hour.

14th • CCAS Monthly Meeting, Room 113, Merion Science Center (former Boucher Building), West Chester University. The meeting starts at 7:30 p.m. Guest Speaker: Marco Raveri, PhD, Center for Particle Cosmology, University of Pennsylvania – "The Hubble Constant 'Tension' - Impact on the Physics of Dark Matter and Dark Energy."

19th • Vernal Equinox, 11:50 p.m. EDT. First day of spring.

20th • Open call for articles and photographs for the April 2020 edition of Observations.

20th • West Chester University Planetarium Show: "Our Amazing Sun," in the Schmucker Science Building. The show starts at 7 p.m. and runs approximately one hour in length. For more information and reservations, visit the WCU Public Planetarium Shows webpage.

26th • Deadline for newsletter submissions for the April 2020 edition of Observations.

27th • CCAS Monthly Observing Session, Myrick Conservancy Center, BRC. The observing session starts at sunset. Resumption of monthly observing sessions through November 2020.

Minutes from the January 14, 2020, CCAS Monthly Meeting

by Bea Mazziotti, CCAS Secretary

- Club President Dave Hockenberry called the meeting to order and welcomed attendees.
- He announced that John Conrad, the evening's scheduled presenter, would not be speaking due to a recent accident. His program, Lunar Science: Historical Overview and Future Moon Missions will be rescheduled.
- Bruce Ruggieri, Program Chair, announced a free lecture on Apollo 11 on January 25th at the Philadelphia Free Library Logan Circle. He reviewed the list of upcoming meeting speakers. He also announced that Don Knabb would present the evening's program.
- Dave Hockenberry gave a tour of some notable objects to see in the January night sky, including a very bright Venus, Uranus just west of the Pleiades, Mars situated near Antares and the Auriga clusters just below the Perseus double cluster. On the 28th, Neptune will be visible near Venus.
- Dave told members that the CCAS Chester County night school astronomy class would begin on Monday 3/16. He reviewed the weekly subject matter and invited all members to attend and/or assist. Classes will be at Rustin HS from 7:00 to 8:00 PM. A photo from the Night School brochure is posted on the CCAS FB page. It has more details about the course.
- Don presented "Apollo Landing Sites & Their Stories," which chronicles the landing sites of Apollos 11 through 17. The presentation included photos of real time landings side by side with photos of the broader lunar landing area. There were also details about the launches and travel times, the astronauts on each mission, their time spent on the surface and the materials they gathered to bring back to earth. Each mission spent a little more time than the previous one and was able to return with more samples.
- Don had enjoyed this program at Green Bank Star Quest. Upon his request, the author, Terry Mann had kindly shared it with him so he could share with the club.
- Ms. Mann served 2 terms as president of the Astronomical League, has been a JPL Solar System Ambassador and has written articles for Reflector Magazine. She has also won awards for her astrophotography, which has taken her around the world to photograph such things as a total solar eclipse, a Venusian transit, and the Aurora Borealis. She is very highly respected for her expertise and experience as well as her dedication to outreach.

February 2020 CCAS Meeting Agenda

by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on January 10, 2020, starting at 7:30 p.m. The meeting will be held in Room 113, Merion Science Center (former Boucher Building), West Chester University. Guest Speaker: Ravi Sheth, PhD, Dept. of Astronomy and Astrophysics, University of Pennsylvania who will present "Gravity Waves—The Discovery that Shook the Earth."

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 2020 season. If you are interested in presenting, or know someone who would like to participate, please contact me at programs@ccas.us.

Black Holes Caught in the Act of Swallowing Stars

by Daniel Clery, Science Magazine

Models suggest black holes can stretch devoured stars into long streamers. NASA/JPL-CALTECH

At the center of nearly every galaxy lies a monster, a giant black hole millions or even billions of times heavier than the Sun. Some, known as quasars or active galactic nuclei, shine brightly from across the universe as they continuously devour surrounding gas. But most are dormant, lurking invisibly for thousands of years—until a star passes too close and is ripped to shreds. That triggers a monthslong tidal disruption event (TDE), which can shine as brightly as a supernova.

Until a few years ago, astronomers had spotted only a handful of TDEs. But now, a new generation of wide-field surveys is catching more of them soon after they start—yielding new insights into the violent events and the hidden population of black holes that drives them.

"We're still in the trenches, trying to understand the physical mechanisms powering these emissions," says Suvi Gezari of the University of Maryland, College Park. Earlier this month at the annual meeting of the American Astronomical Society in Honolulu, Gezari presented an analysis of 39 TDEs: 22 from recent years and 17 detected in the first 18 months of operation of the Zwicky Transient Facility (ZTF), a 1.2-meter survey telescope in California.

In the standard TDE picture, the gravity of the black hole shreds an approaching star into strands like spaghetti. The black hole immediately swallows half the star's matter while the rest arcs away in long streamers. These rapidly fall back and settle into an accretion disk that steadily feeds material into the black hole, growing so hot that it emits copious x-rays.

An x-ray mapping satellite spotted the first TDEs in the 1990s. Now, optical surveys like the ZTF are picking up the fast-changing events and capturing telltale details of the visible glow. They are also alerting other observatories, such as NASA's Swift telescope, to make follow-up observations at ultraviolet and x-ray wavelengths.

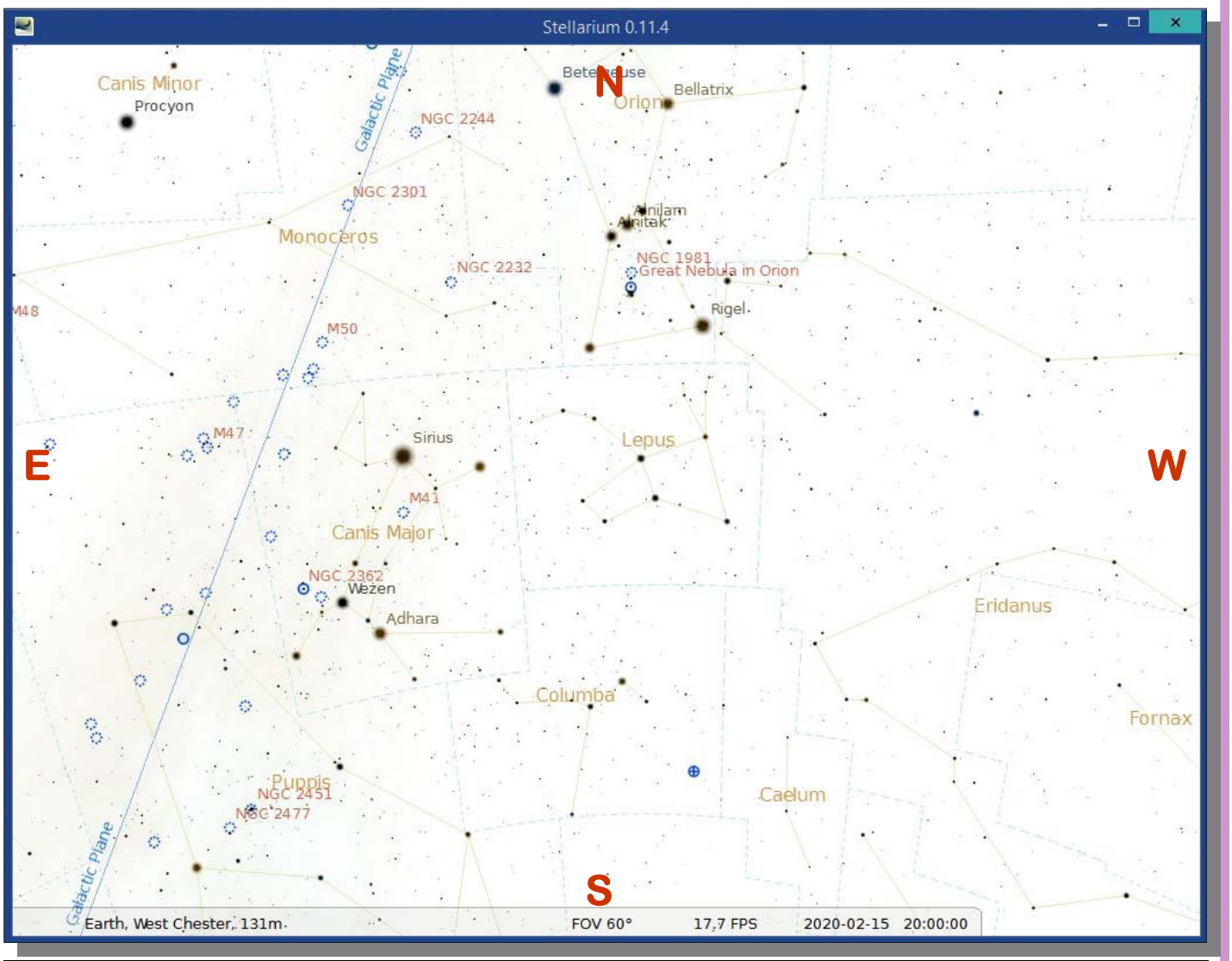
The fingerprints of certain gases in the spectra of the visible light can reveal what kind of star went down the black hole's maw. Gezari and her colleagues found that the TDE spectra fell into three classes, dominated by hydrogen, helium, or a mixture of gases. Hydrogen likely sig-

(Continued on page 12)

The Sky Over Chester County

February 15, 2020 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
02/01/2020	6:40 a.m. EST	7:09 a.m. EST	5:19 p.m. EST	5:47 p.m. EST	10h 09m 55s
02/15/2020	6:26 a.m. EST	6:54 a.m. EST	5:36 p.m. EST	6:03 p.m. EST	10h 42m 04s
02/29/2020	6:07 a.m. EST	6:34 a.m. EST	5:52 p.m. EST	6:19 p.m. EST	11h 17m 23s

Moon Phases					
First Quarter	02/01/2020	8:41 p.m. EST	Full Moon	02/09/2020	2:33 a.m. EST
Last Quarter	02/15/2020	5:17 p.m. EST	New Moon	02/23/2020	10:32 a.m. EST

February 2020 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

1	First Quarter Moon, 8:41 p.m. EST
2	The Lunar Straight Wall is visible
7	Pollux and Castor in Gemini are above the Moon at nightfall
9	Regulus in Leo is near the rising Full Moon in early evening
9	Full Moon, the Full Snow Moon or the Frog Moon, 2:33 a.m. EST
10	Mercury is at greatest elongation, the best evening viewing of 2020
11-25	The Zodiacal Light is visible in the west after evening twilight
15	Last Quarter Moon, 5:17 p.m. EST
23	New Moon, 10:32 a.m. EST
26/27	Venus is near the Moon

The best sights this month: Venus rules the evening sky during February and is joined by Mercury early in the month. On February 10th we have our best opportunity of 2020 to see Mercury, so get out there with your binoculars and add Mercury to your observing list. And don't miss the opportunity to gaze at the Orion Nebula. Any telescope or binoculars will show you a "hazy star" in Orion's sword, the most spectacular nebula in the sky.

Mercury: The best apparition of 2020 occurs on February 10th when Mercury will be 18 degrees from the Sun. Use binoculars to aid your search for this elusive planet, but wait until the Sun is below the horizon.

Venus: Our sister planet continues to shine like a beacon in the west after sunset. Venus brightens to magnitude -4.3 in February and stands 35 degrees above the horizon at sunset at month's end, setting nearly 4 hours after the Sun.

Mars: On February 18th Mars will be occulted by the Moon, but at our location this happens just as the Sun is rising so Mars will not be visible since it shines at a dim magnitude 1.2.

Jupiter: Jupiter rises about 2 hours before the Sun during February.

Saturn: Saturn rises a short while after Jupiter and will be quite low in the east as dawn breaks.

Uranus and Neptune: To see the distant gas giants you will need to look as soon as the sky darkens. Late in February we'll lose Neptune into the glow of the setting Sun, and the same will happen to Uranus not many weeks later.

The Moon: The Moon is full this month on February 9th. According to Native Americans this is the Full Snow Moon since the heaviest snow usually falls during this month. Some tribes also referred to this Moon as the Full Hunger Moon, since harsh weather conditions in their areas made hunting very difficult. Native Canadian tribes called this the Full Frog Moon. At month's end look for Venus and the crescent Moon to make a beautiful sight in the west.

Constellations: During February look to the west early to see the Great Square of Pegasus setting. Behind Pegasus and Andromeda, the winter constellations take control of center stage for all of February. My favorite part of the February sky is the south in which we see several constellations with bright stars. This includes Taurus with Aldebaran, Orion with Betelgeuse and Rigel, Canis Major with Sirius and Canis Minor with Procyon. Sirius, Rigel, Aldebaran, Capella, Pollux and Procyon make up the Winter Hexagon. Stay up late and see bright Arcturus in Boötes rising in the east.

Messier/deep sky: Grab your binoculars to search the February sky for deep sky objects since binoculars have nearly zero set up time compared to a cold telescope. The hardest part of telescopic viewing during the cold months is setting up and putting a telescope away. It's hard to handle a telescope and tripod wearing gloves, but the cold metal parts chill your hands to the bone very quickly. Binoculars however, once you get them focused, can be easily handled with gloves on your hands. And even a small pair of binoculars will bring many deep sky objects within view.

Look for the three open clusters in Auriga – they might be in one field of view, or nearly so. Look also for two groups of stars called "The Waves" near the three open clusters. Then find one of my favorites, the Beehive Cluster, in Cancer the Crab. Also aim at Orion's belt and see the beautiful "S" curve of stars on the right side of his belt. And of course, take a long look at the Orion Nebula in the

(Continued on page 11)

Through the Eyepiece: Messier 94, the Galaxy with Rings within Rings

by Don Knabb, CCAS Treasurer & Observing Chair

Messier 94 (also known as NGC 4736) is a spiral galaxy in the constellation Canes Venatici, which rises late in the evening during February. Although some references describe M94 as a barred spiral galaxy, the "bar" structure appears to be more oval-shaped. The galaxy is also notable in that it has two ring structures.

This striking mage of Messier 94 as seen by the infrared eyes of NASA's Spitzer Space Telescope shows us the dual ring structure of this amazing galaxy.

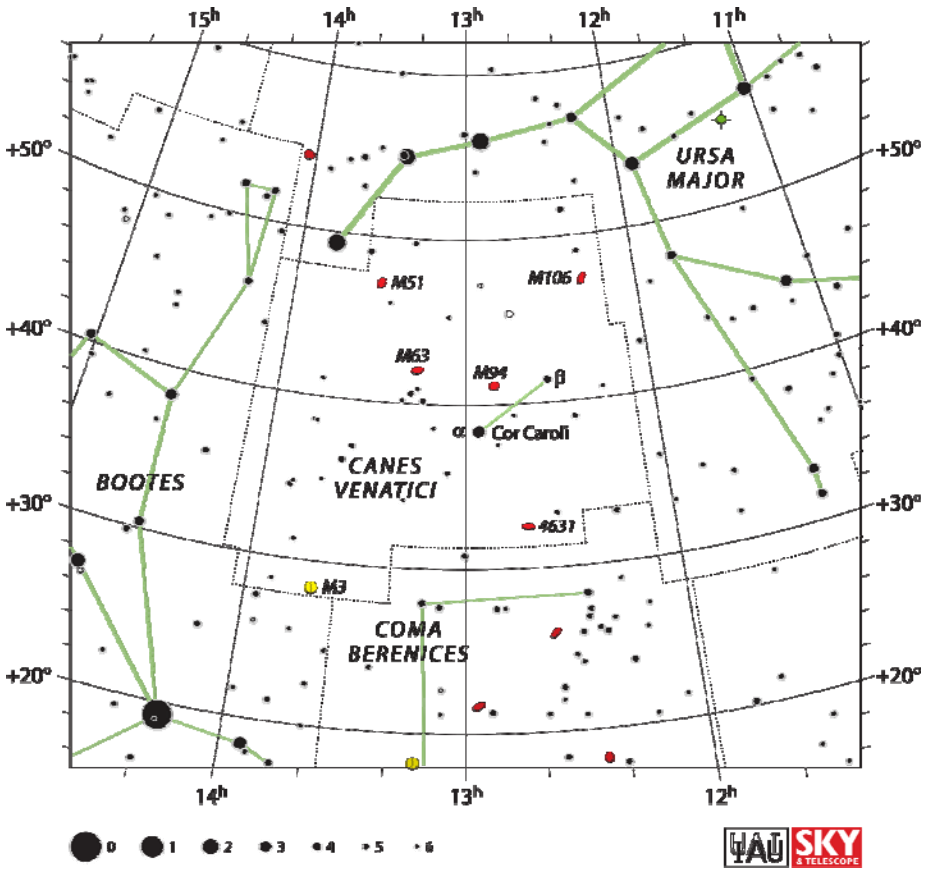
M94 contains both an inner ring with a diameter of 70" and an outer ring with a diameter of 600". These rings appear to form at resonance locations within the disk of the galaxy. The inner ring is the site of strong star formation activity and is sometimes referred to as a "starburst ring". It is identified as a "starburst ring" because of the frenetic pace of star formation in this confined area. Starbursts like this can often be triggered by gravitational encounters with other galaxies, but in this case may instead be caused by the galaxy's oval shape.

Tucked in between the inner starburst ring and the outer ring-like arms we find the galaxy's disk, striated with greenish filaments of dust. While, at first glance, these dusty arcs look like a collection of rings, they actually follow tightly wound spiral arcs.

M94 is one of the brightest galaxies within the M94 Group, a group of galaxies that contains between 16 and 24 galaxies. This group is one of many that

(Continued on page 7)

Image credit: http://www.spitzer.caltech.edu/images/5578-sig13-004-Galactic-Wheels-within-Wheels-



Star map credit: http://en.wikipedia.org/wiki/File:Canes_Venatici_IAU.svg

Eyepiece (Cont'd)

(Continued from page 6)
lie within the Virgo Supercluster (i.e. the Local Supercluster).

Locating Messier 94 is fairly easy. Beginning with the "Big Dipper" asterism of Ursa Major, look for a very conspicuous star about a palm's width from the last star in the "handle". This is Cor Caroli, and the double Alpha star of the constellation of Canes Venatici. If you are observing from a dark sky location, relax your eyes until you see the other two primary stars that make up the shallow triangle of the constellation. You'll find M94 located almost centrally between them. From slightly more light polluted skies, use Cor Caroli as your starting point and you can also locate M94 about two finger widths north. It will appear as a round, hazy patch in larger binoculars and small telescopes. Spiral structure will become evident in larger aperture telescopes. At magnitude 8, Messier 94 will stand up to suburban lighting conditions and partial moonlight.

M94 was discovered by Pierre Méchain on March 22, 1781. Getting the report of his friend, Charles Messier observed it, determined its position and cataloged it on March 24, 1781. In his notes he states: "Nebula without star, above the Heart of Charles [Alpha Canum Venaticorum]".

On March 18, 1787, Sir William Herschel got a much better look with his larger telescope, enough of a look to see structure. In his unpublished notes he writes: "Very brilliant, a large, luminous nucleus of more than 20″ diameter with faint chevalure and branches extending 6 or 8′." M94 would later be observed by Herschel's son John many times, where he once described it as "Not resolved but resolvable. A very interesting object, being a nebula very suddenly much brighter toward the middle on a great scale."

The optical image in the lower left shows the beauty of M94.

So, when the weather warms and we find ourselves once again under the stars at the Brandywine Red Clay Alliance, let's try to see M94 "live and up close".

Image credit: ESA/Hubble & NASA

Credits:

- Pasachoff, Jay M. 2000. A Field Guide to the Stars and Planets. New York, NY. Houghton Mifflin.
- Dickinson, Terence 2006. Nightwatch: a practical guide to viewing the universe. Buffalo, NY. Firefly Books
- http://en.wikipedia.org/wiki/Messier_94
- http://www.universetoday.com/48442/messier-94/
- http://www.spitzer.caltech.edu/images/5578-sig13-004-Galactic-Wheels-within-Wheels-

Breaking News: NASA Artemis Program Challenged

by John Conrad, CCAS Member & NASA Solar System Ambassador

But first – the old news: You probably remember that NASA and the Administration / National Space Council announced the name and nature of a new NASA Moon Program – Artemis – in the first few months of 2019. "Landing the first woman and the next man on the lunar surface by 2024." Through the rest of the year, here are the principal features of the Artemis program that emerged:

- New moon rocket would be Boeing Space Launch System (SLS), not yet fully integrated or tested;
- New manned spacecraft would be the reusable Lockheed Martin Orion Multi Purpose Crew Vehicle, scheduled for first crewed mission not earlier than late 2022 (not to be confused with the Boeing Starliner manned spacecraft or the SpaceX Crew Dragon manned spacecraft, both scheduled for first crewed flight this year or next);
- New mini-space station in lunar orbit known as the Gateway, no prime contractor or design yet selected, to serve as the staging point for Orion crews prior to launching to the lunar surface, on the following;
- Another new spacecraft, a reusable lunar lander, currently known as the Human Landing System, to 'ferry' astronauts from the Gateway to the lunar surface. Bids are in, but no contractor or design selected for this key vehicle.

Whew! Four major large space development programs, none fully tested, that must all succeed and work in an integrated way – in less than 5 years.

What didn't emerge in 2019 was a total Artemis budget forecast and request for funding. Clearly, at least a 5-year forecast would be needed to discuss and justify such a program, but Congress was continually thwarted in hearings. These committee hearings are available to all of us on-line, so I listened to some hard questioning of NASA and heard only promises such as "We're working out the details and total budget and will have that to you, Congressman, by [future date]. . . ."

So, it doesn't surprise any NASA budget watcher to see that the Administration's 2020 budget request in Artemis areas was not fully supported when Congress finalized the budget in December. Most relevant to Artemis was that the new $1B request for the lunar lander program was cut by 40% to $600M. (*Of interest to you astronomy enthusiasts* is that the Administration's attempt to cancel the WFIRST space telescope was completely overridden, and their attempt to short-change the long-delayed JWST space telescope also was thwarted by Congress.)

Now – the breaking news!

January 25, 2020: Here's an excerpt from an on-line *ArsTechnica* article (with my *ital-*

(Continued on page 9)

Classic La Para

by Nicholas La Para

"I WISH WINTER WAS OVER!"

Artemis (Cont'd)

(Continued from page 8)

ics for emphasis).

"On Friday evening, a US House of Representatives committee released H.R. 5666, an authorization act for NASA. Such bills are not required for an agency to function, and they do not directly provide funding—that comes from the appropriations committees in the House and Senate. *Authorization bills provide a "sense" of Congress, however and indicate what legislators will be willing to fund in the coming years.*

"The big-picture takeaway from the *bipartisan* legislation is that it *rejects the Artemis Program put forth by the Trump White House*, which established the Moon as a cornerstone of human exploration for the next decade or two and as a place for NASA astronauts to learn the skills needed to expand toward Mars in the late 2030s and 2040s. *Instead, the House advocates for a "flags-and-footprints" strategy whereby astronauts make a few short visits to the Moon beginning in 2028 and then depart for a Mars orbit mission by 2033."*

The full article is available at: https://arstechnica.com/science/2020/01/house-bill-seeks-to-gut-nasas-artemis-plan-resurrect-journey-to-mars

Another on-line news source, spacepolicyonline.com, had this: "The bill makes clear that human exploration of Mars, not the Moon, is the priority. The Moon is only a steppingstone and activities in or around the Moon are sharply limited to their application for Mars exploration. The 'Moon to Mars' program specifically does not include lunar outposts. . . . .

"The bill rejects Pence's March 26, 2019, declaration that the next Americans will land on the Moon by 2024, the end of a second Trump term assuming he wins reelection. Instead, it sticks with NASA's previous plan of achieving that in 2028.

"It sets another deadline, 2033, for humans to orbit Mars, but the overall goal is landing people on Mars 'in a sustainable manner as soon as practicable.' No date is specified."

The full article is available at: https://spacepolicyonline.com/

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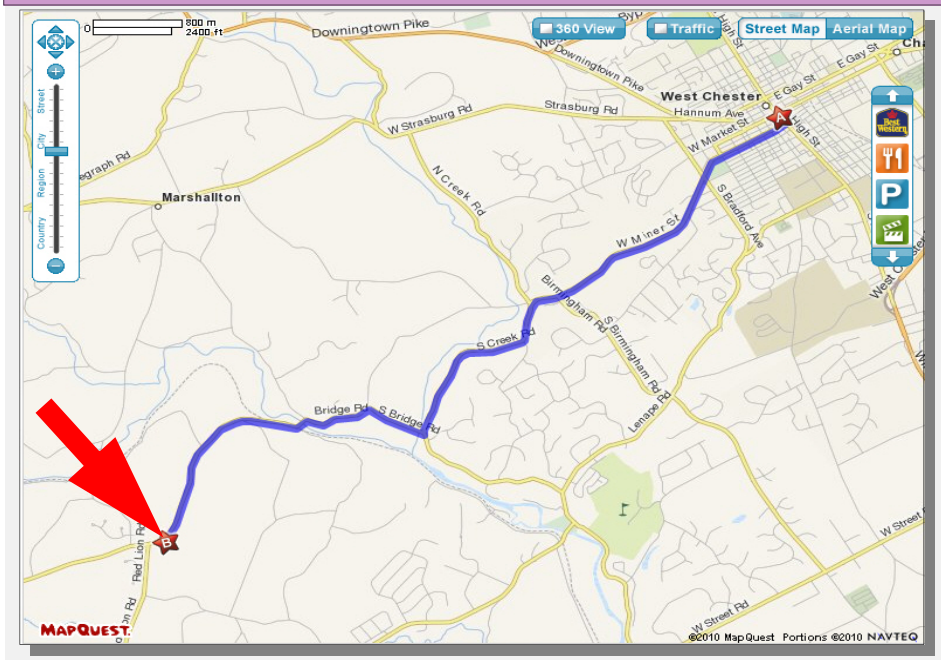
CCAS Directions



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).

NASA Night Sky Notes: Betelgeuse and the Crab Nebula—Stellar Death and Rebirth

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.

What happens when a star dies? Stargazers are paying close attention to the red giant star **Betelgeuse** since it recently dimmed in brightness, causing speculation that it may soon end in a brilliant supernova. While it likely won't explode quite yet, we can preview its fate by observing the nearby **Crab Nebula.**

Betelgeuse, despite its recent dimming, is still easy to find as the red-hued shoulder star of Orion. A known variable star, Betelgeuse usually competes for the position of the brightest star in Orion with brilliant blue-white Rigel, but recently its brightness has faded to below that of nearby Aldebaran, in Taurus. Betelgeuse is a young star, estimated to be a few million years old, but due to its giant size it leads a fast and furious life. This massive star, known as a supergiant, exhausted the hydrogen fuel in its core and began to fuse helium instead, which caused the outer layers of the star to cool and swell dramatically in size. Betelgeuse is one of the only stars for which we have any kind of detailed surface observations due to its huge size – somewhere between the diameter of the orbits of Mars and Jupiter - and relatively close distance of about 642 light-years. Betelgeuse is also a "runaway star," with its remarkable speed possibly triggered by merging with a smaller

companion star. If that is the case, Betelgeuse may actually have millions of years left! So, Betelgeuse may not explode soon after all; or it might explode tomorrow! We have much more to learn about this intriguing star.

The **Crab Nebula** (M1) is relatively close to Betelgeuse in the sky, in the nearby constellation of Taurus. Its ghostly, spidery gas clouds result from a massive explosion; a supernova observed by astronomers in 1054! A backyard telescope allows you to see some details, but only advanced telescopes reveal the rapidly spinning neutron star found in its center: the last stellar remnant from that cataclysmic event. These gas clouds were created during the giant star's

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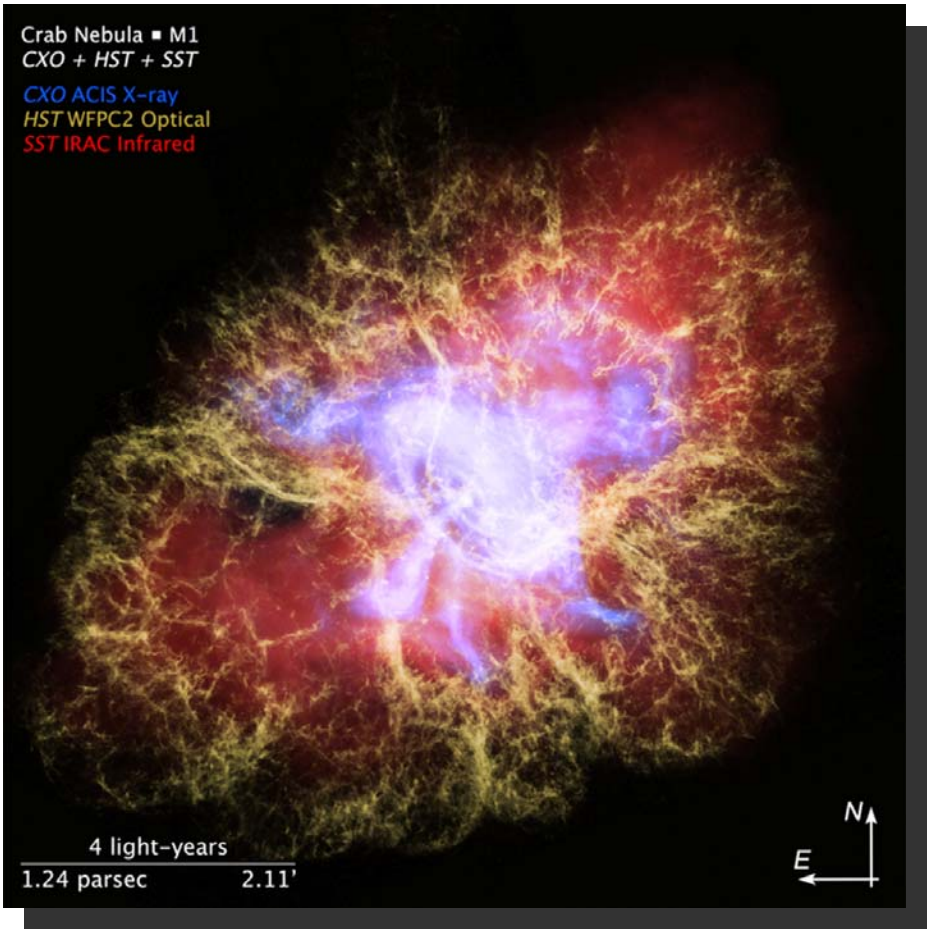


This image of the Crab Nebula combines X-ray observations from Chandra, optical observations from Hubble, and infrared observations from Spitzer to reveal intricate detail. Notice how the violent energy radiates out from the rapidly spinning neutron star in the center of the nebula (also known as a pulsar) and heats up the surrounding gas. More about this incredible "pulsar wind nebula" can be found at bit.ly/Crab3D
Credit: NASA, ESA, F. Summers, J. Olmsted, L. Hustak, J. DePasquale and G. Bacon (STScI), N. Wolk (CfA), and R. Hurt (Caltech/IPAC)

Night Sky Notes (Cont'd)

Spot Betelgeuse and the Crab Nebula after sunset! A telescope is needed to spot the ghostly Crab.

(Continued from page 10)

violent demise and expand ever outward to enrich the universe with heavy elements like silicon, iron, and nickel. These element-rich clouds are like a cosmic fertilizer, making rocky planets like our own Earth possible. Supernova also send out powerful shock waves that help trigger star formation. In fact, if it wasn't for a long-ago supernova, our solar system - along with all of us - wouldn't exist! You can learn much more about the Crab Nebula and its neutron star in a new video from NASA's Universe of Learning, created from observations by the Great Observatories of Hubble, Chandra, and Spitzer: bit.ly/CrabNebulaVisual.

Our last three articles covered the life cycle of stars from observing two neighboring constel-

(Continued on page 14)

Artemis (Cont'd)

(Continued from page 9)

news/bipartisan-house-nasa-authorizers-reject-artemis-moon-by-2024-plan-wants-focus-on-mars-instead/

Let me conclude this news of a (potential) sea change to NASA's Artemis program with a reminder that, as stated above, regarding last Friday's legislation: "*Authorization bills provide a 'sense' of Congress . . . and indicate what legislators will be willing to fund in the coming years.*"

Having said that, this is anything but cast in stone. On January 29, 2020, the same committee was scheduled to hold hearings and do a further mark-up, in advance of February 10, 2020, when the White House releases its 2021 budget request, which will contain a five-year funding plan for Artemis along with a request for Congress to fund it.

So, this is an interim report. I'll be back soon—maybe next month—to provide some closure as well as some personal commentary on the value and priorities of different approaches to the Moon, Mars, and other major government science priorities.

Observing (Cont'd)

(Continued from page 5)

sword of Orion, M42!

Comets: There are no bright comets visible during February.

Meteor showers: There are no meteor showers during February. However, from February 11th until February 25th is a good time to look for the Zodiacal Light, a cone-shaped glow of light that is created when sunlight reflects off dusty debris in the inner solar system.

Black Holes (Cont'd)

(Continued from page 3)

nals large, young stars, whereas helium events could point to the cores of older stars whose hydrogen shells were stripped away—perhaps by an earlier brush with the black hole. She says the proportions reveal something about the populations of stars at the very centers of galaxies, at distances from Earth that would otherwise be impossible to probe.

If astronomers could turn the light into a reading of how quickly material is being sucked in, they might be able to determine a black hole's mass—something usually estimated crudely by measuring the size of its galaxy. For that, however, "We need to understand the astrophysics of the process with greater clarity," says Tsvi Piran of the Hebrew University of Jerusalem. For a few TDEs, astronomers have been able to compare the rise and fall of the visible glow with x-ray measurements made from space—and puzzlingly, the two don't match. The x-rays often flare irregularly, appear late, or are absent altogether.

The x-rays could be steady but obscured by a cloud of gas, hundreds of times bigger than the black hole, that forms from a backlog of material, says Kate Alexander of the Harvard-Smithsonian Center for Astrophysics. "It's like the black hole gets indigestion because it eats too much too fast." Piran thinks it's more likely that the x-rays are generated in bursts, as clumps of matter fall into the black hole. Either way, astronomers aren't ready to glean a black hole's mass from a TDE's brilliance.

Theory does suggest black holes can become too massive to trigger TDEs. Above a mass of 100 million suns, black holes should swallow stars whole rather than tearing them apart as they approach. So far, all of the growing number of TDEs come from smaller galaxies, suggesting the limit is real.

TDEs could even provide a window into a more elusive black hole characteristic: its spin. Dheeraj Pasham of the Massachusetts Institute of Technology has studied the soft x-ray emissions of three TDEs that pulse in semiregular beats. He says similar, higher frequency beats have been observed coming from smaller, stellar-mass black holes, and he suspects the pulsing reflects the black hole's spin. Constraints on this property could help solve an enduring mystery: whether giant black holes form by slowly accreting stellar matter over their lifetime—a process expected to produce a fast spin—or by merging with the giant black holes from other galactic cores, which would result in a slower spin. An x-ray survey of many TDEs could reveal which process dominates.

With the tally of captured TDEs growing fast, and hundreds or even thousands of discoveries per year expected from new surveys, researchers are hopeful that the events will answer more questions. "My dream is for TDEs to be some kind of ruler or scale for black hole mass," Gezari says. "We're not there yet but we're getting closer."

When Michael Saw the Moons

by Ron Dellapenna, CCAS Member

Michael came into my life in 2010 when I hired him to work for my landscaping business. Michael was a wonderful, outgoing young man even though he had many obstacles thrown at him throughout his young life.

He had few positive role models during his childhood and he had been exposed to drugs, alcohol, homelessness and abuse. Michael often complained to me about the "racing thoughts" in his head and shortly after I met him, he was diagnosed with bipolar disorder. He experienced the wild ride of extreme mania only to be followed by the crash of severe depression. The cycle would repeat over and over again. As is often the case in situations like this, Michael had a problem with addiction and often stopped taking his medication.

The summer of 2019, Michael was still working with me and we developed a great friendship and mentorship. In July, I was at West Chester University for a Chester County Astronomical Society star party in celebration of the Apollo 11 mission. This was also weekend that PENNSCYAA had their Alcoholics Anonymous (AA) conference for young people on campus. Michael had joined AA earlier in the summer and was on campus for the conference. He was really enjoying the weekend of sober activities. Between events on campus, he would come to look through my telescope. He viewed the moon, examining its craters and various other features. He was so fascinated by what he could see. Later in the

(Continued on page 13)

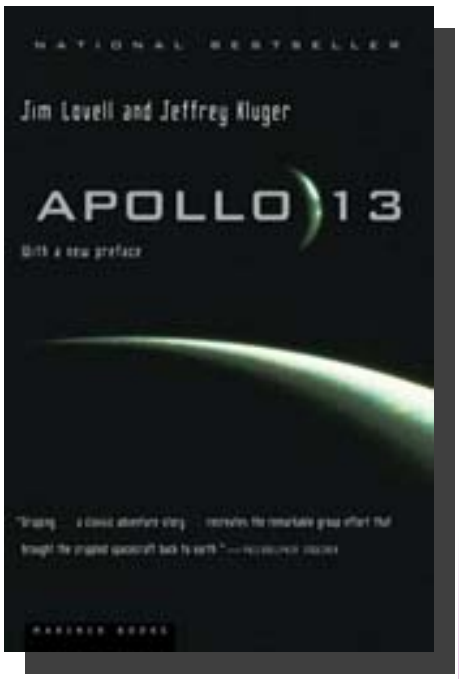
Book Review: Lost Moon by Jim Lovell & Jeffery Kluger

by Christ Trunk, CCAS Member

With the 50th anniversary of the Apollo 11 lunar landing now in the rear view mirror, April of this year marks another special occasion in the Apollo legacy, the 50th anniversary of the dramatic rescue of the Apollo 13 crew. *Lost Moon* by Apollo 13 commander Jim Lovell and co-author Jeffery Kluger details the events of that near-tragedy. However Lost Moon covers way more than just the Apollo 13 incident, delving into Lovell's difficulty gaining entry into the astronaut program, the loss of his good friend Ed White in the Apollo 1 Launchpad fire, and the personal and family hardships that came along with being a test pilot and astronaut.

Be forewarned, it's very hard to put this book down once you start reading. Lost Moon, published in 1994, served as the basis for the Oscar-winning film Apollo 13. As the saying goes; "the book is much better than the movie", and this one is no exception. The comprehensive & fascinating account covers 378 pages spread over 12 chapters (perhaps the authors didn't want to jinx the book with a 13th chapter), along with four appendices, detailed author's notes, an excellent index, and a small selection of B&W photos. Lost Moon is a great read for anyone with even the slightest interest or curiosity about the Apollo program in general or more specifically the Apollo 1 and 13 incidents.

As the 50th anniversary of the Apollo 13 incident approaches, Lost Moon and the movie that it inspired, serve to remind us that our greatest accomplishments have come from the collective



Paperback Cover

teamwork of a diverse group, not afraid to think outside the box.

The lead author and Apollo 13 Commander, Jim Lovell will be turning 92 in March of this year. A nice follow-up to Lost Moon is a lecture that Jim gave on May 11th 2016 at MIT to a large class of Aeronautics and Astronautics students. That video can be viewed on MIT's on-line video library at: https://aeroastro.mit.edu/videos/apollo-13s-capt-jim-lovell-aeroastro-talk-april-27-2016 Jim combines his charm & wit along with a first-hand account of the navigational and life-support issues that he and his Apollo 13 crew mates Fred Haise and Jack Swigert were facing.

Lost Moon: The Perilous Voyage of Apollo 13 can be found at the Chester County Library or can be purchased in paperback form.

Happy Reading! — Chris

Michael Cont'd)

(Continued from page 12)

night, he was able to view Jupiter and was amazed by the number of its moons. His young eyes were able to see more moons than I could see. In the nine years that I knew Michael, I had never seen him so genuinely happy. He was sober and enjoying the wonders of nature. His mind was free!

Michael always told me that he wanted to accomplish something with his life and he worked so hard to do so. Unfortunately, later that summer, Michael's demons returned. He became severely began a downward spiral and just wanted the pain of his life to end. I tried so hard to help him, but on December 28, 2019, at the age of 30 years old, Michael died by suicide.

I will always remember that night when Michael was sober and full of life. Michael gazed through my telescope and saw different worlds and for a brief time he found relief from adversity he fought his whole life on this world. More young people in need of hope or acceptance should get a chance to gaze at the stars or in some other way experience the wonders of nature. Maybe it will bring them some peace or might even change some lives.

I am so fortunate to have given Michael opportunity to view the night sky through my telescope. I am sure that whenever I am viewing the heavens, Michael will be looking down at me—with a smile.

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).

Night Sky Notes (Cont'd)

(Continued from page 11)

lations: Orion and Taurus! Our stargazing took us to the "baby stars" found in the stellar nursery of the Orion Nebula, onwards to the teenage stars of the Pleiades and young adult stars of the Hyades, and ended with dying Betelgeuse and the stellar corpse of the Crab Nebula. Want to know more about the life cycle of stars? Explore stellar evolution with "The Lives of Stars" activity and handout: bit.ly/starlifeanddeath.

Check out NASA's most up to date observations of supernova and their remains at nasa.gov

CCAS Membership Information and Society Financials

Treasurer's Report
by Don Knabb

Jan. 2020 Financial Summary

Beginning Balance	$879
Deposits	$155
Disbursements	-$0
Ending Balance	$1034

New Member Welcome!

Welcome new CCAS members Janet Holloway from Philadelphia, Jeff Johnson from Chester Springs, and Hyunjin Christina Lee from Chesterbrook. 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

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Spectrum Scientifics
Quality Science Products for All Ages

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
21103 Striper Run
Rock Hall, MD 21661

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 (410) 639-4329 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 410-639-4329
Public Relations:	Ann Miller 610-558-4248

CCAS Membership Information

The present membership rates are as follows:

REGULAR MEMBER……$25/year
SENIOR MEMBER…….$10/year
STUDENT MEMBER……..$ 5/year
JUNIOR MEMBER……..$ 5/year
FAMILY MEMBER…….$35/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 & Tele*scope Magazine Group Rates

Subscriptions to this excellent periodical are available through the CCAS at a reduced price of **$32.95,** much less than the newsstand price of $66.00, and also cheaper than individual subscriptions ($42.95)! Buying a subscription this way also gets you a 10% discount on other Sky Publishing merchandise.

To **start** a **new** subscription, make **sure** you make out the check to the **Chester County Astronomical Society**, note that it's for *Sky & Telescope*, and mail it to Don Knabb.

To **renew** your "club subscription" contact Sky Publishing directly. Their phone number and address are in the magazine and on their renewal reminders. If you have **any** questions call Don first 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). If you want to participate in this special Society discount offer, **contact our Treasurer Don Knabb.**