



Observations

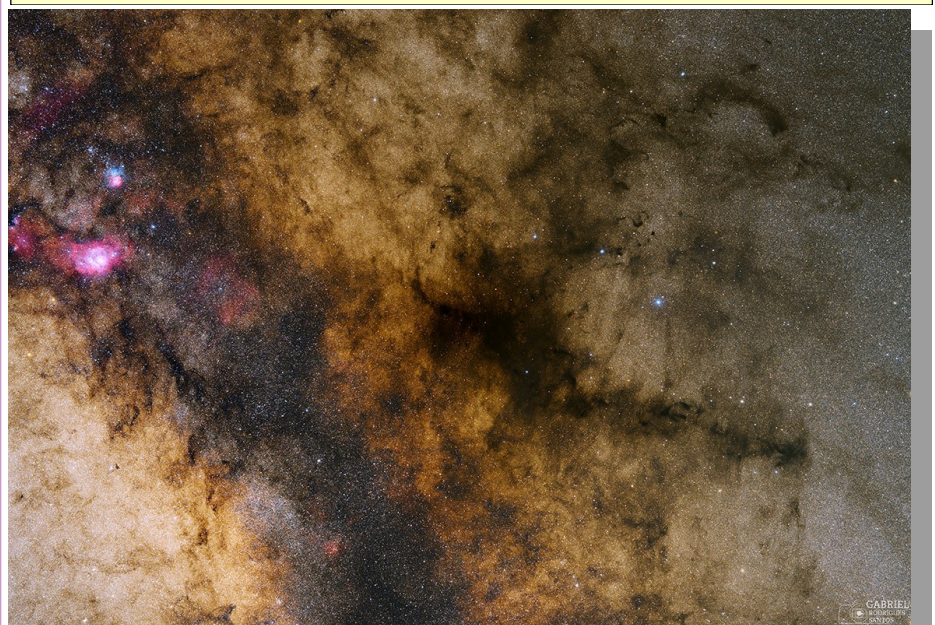
A Monthly Publication Of The
CHESTER COUNTY ASTRONOMICAL SOCIETY

Vol. 29, No. 11 **Three-Time Winner of the Astronomical League's Mabel Sterns Award** ☼ 2006, 2009 & 2016 November 2021

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The Central Milky Way from Lagoon to Pipe



*Cataloged in the early 20th century by astronomer E. E. Barnard, the obscuring interstellar dust clouds seen toward the right include B59, B72, B77 and B78, part of the Ophiuchus molecular cloud complex a mere 450 light-years away. To the eye their combined shape suggests a pipe stem and bowl, and so the dark nebula's popular name is the Pipe Nebula. Three bright nebulae gathered on the left are stellar nurseries M8 (the Lagoon Nebula), M20 (The Trifid), and NGC 6559.
Image Credit & Copyright: Gabriel Rodrigues Santos*

Membership Renewals Due

11/2021	Buczynski DiGiovanni Holenstein Kerkel Romer Scovill Smith Taylor
12/2021	Damerau DeAngelo DellaPenna Etherington Moynihan O'Leary Orso Watson & Metts
01/2022	Belczyk Carlton Johnson Kellerman Kovacs McElwee Reese Reynolds

November 2021 Dates

- 4th** • New Moon, 5:14 p.m. EDT
- 7th** • Daylight Saving Time ends and the Moon is close to Venus
- 11th** • First Quarter Moon, 7:45 a.m. EST
- 17th** • The Leonid meteors peak today
- 19th** • Full Moon, the Full Beaver Moon or the Rivers Freezing Full Moon, 3:57 a.m. EST
- 19th** • A penumbral lunar eclipse occurs in the early morning hours
- 27th** • Last Quarter Moon, 7:27 a.m. EST



CCAS Upcoming Nights Out

Until further notice, monthly observing sessions at Myrick Conservancy Center, BVA, are limited to vaccinated CCAS members only in response to the current increase in Covid-19 infections.

Upcoming dates (weather dependent):

- ☼ **Friday, Sept. 3rd**
- ☼ **Friday, Oct. 1st**
- ☼ **Friday, Nov. 5th**

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

Autumn Society Events

November 2021

5th • CCAS Monthly Observing Session, BRC. Due to increase in Covid-19 infections, session is limited to vaccinated CCAS members only.

7th • Daylight Saving Time ends, turn clocks back one hour, 2:00 a.m. ET.

11th • Monthly CCAS Meeting (virtual only meeting – note different meeting date). The meeting starts at 7:30 p.m. Guest Speaker: Dr. Steven Levin, NASA's Jet Propulsion Laboratory (JPL); "Highlights and Updates on the Juno Mission to Explore the Jovian System."

11th • The von Kármán Lecture Series: [Rising Tides: First Year in Space for NASA's Earth Flagship](#), 10:00 pm EDT. Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

20th • Open call for articles and photographs for the December 2021 edition of [Observations](#).

26th • Deadline for newsletter submissions for the December 2021 edition of [Observations](#).

December 2021

14th • CCAS Annual Holiday Party. More details will appear in the December 2021 newsletter.

20th • Open call for articles and photographs for the January 2022 edition of [Observations](#).

21st • Winter Solstice, 10:59 a.m. EST; first day of winter.

26th • Deadline for newsletter submissions for the January 2022 edition of [Observations](#).

October 2021 Monthly Meeting Minutes

by Bea Mazziotta, CCAS Secretary

- Dave Hockenberry welcomed members and guests to the meeting on October 12th, which was held in person at West Chester University. Zoom and YouTube were also available for members and guests. Approximately 40 attended in total with 24 present in the classroom. He also advised that the November 2021 meeting will be via Zoom ONLY and will be on the 2nd Thursday (November 11) rather than Tuesday in order to accommodate the presenter's schedule.
- Don Knabb took the group on a tour of the October night sky, which includes such amazing and perennial favorite objects as the Andromeda galaxy, the Hercules Cluster and the Pleiades. He used Stellarium, a free open source planetarium for computers that shows a realistic sky in 3D, just like what you see with your eyes, binoculars or a telescope.
- John Conrad, a NASA Solar System Ambassador and CCAS member was the evening's presenter. His topic was the recently launched NASA mission 'Lucy'.
 - Named after the famous Ethiopian fossil Lucy, NASA's Lucy mission is to visit the last unexplored 'fossils' of our solar system, the Trojan asteroids, which have been trapped in Jupiter's orbit since the formation of the solar system.
 - The Trojans orbit the sun in two loose groups. One group leads ahead of Jupiter in its path, the other trails behind. They are clustered around two Lagrange points equidistant from the sun and Jupiter and are stabilized in their orbit by the Sun and it's largest planet in an amazing gravitational balancing act.
 - A small (1 Billion) mission by NASA standards, Lucy launched via an Atlas booster from Cape Canaveral on October 16, 2021 and will complete her mission in 12 years. Stay tuned to NASA for voyage updates and her first Trojan encounter in 2027.

November 2021 CCAS Meeting Agenda

by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on **November 11, 2021, online via Zoom**. Guest Speaker: Dr. Steven Levin, NASA's Jet Propulsion Laboratory (JPL); "Highlights and Updates on the Juno Mission to Explore the Jovian System."

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 2021-2022 season and beyond. If you are interested in presenting, or know someone who would like to participate, please contact me at programs@ccas.us.

Astronomers Find Evidence of a Planet Outside Our Galaxy for the First Time

by Robert Lea, Newsweek.com



CXC/SAO/R. DiStefano, et al.; Optical: NASA/ESA/STScI/Grendler/NASA The location of the first detected extra galactic planet in the galaxy M51. Astronomers made the discovery by examining X-ray emissions from a binary system containing a neutron star or black hole.

Astronomers have found signs of a planet orbiting a star outside our galaxy, the Milky Way, for the first time.

The team found evidence of a possible planet in the spiral galaxy Messier 51 (M51), which is located around 28 million light-years from Earth. The galaxy is also known as the Whirlpool Galaxy because of its distinctive appearance.

They calculated that the exoplanet could be approximately the size of Saturn, the solar system's second-largest planet after Jupiter, and that it's orbiting a star and a partner that is either a neutron star or a black hole.

Until now, all the planets found outside the solar system, or exoplanets, have still been located within the confines of

the Milky Way. The majority of these planets have also been located within 3,000 light-years of the Earth.

That means that if this is indeed a planet in M51, it is thousands of times more distant than even the furthest previously detected exoplanet. If confirmed, the planet will join the catalog of over 4,000 of those objects detected thus far, but it will also become the first object in a new catalog of extragalactic planets.

The astronomers who discovered this extragalactic world did so using NASA's Chandra X-ray Observatory, searching nearby galaxies in the X-ray region of the electromagnetic spectrum. It is the reliance on X-rays that makes the detection of more dis-

tant worlds such as this one, possible.

While even stars in neighboring galaxies can be difficult to distinguish in visible light and other regions of the electromagnetic spectrum, because stars shine less brightly in the X-rays, using these emissions can make distinguishing individual objects much easier.

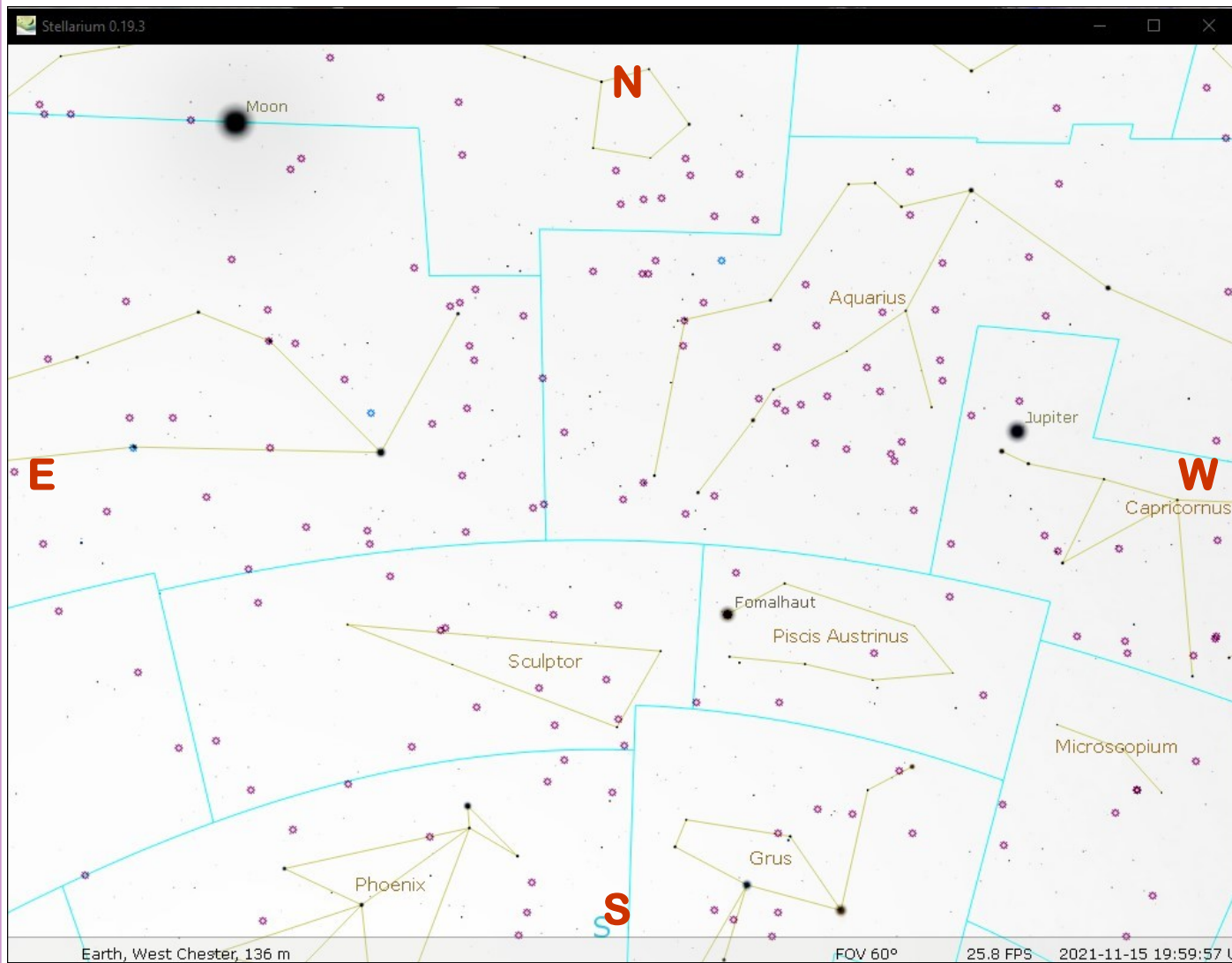
"We are trying to open up a whole new arena for finding other worlds by searching for planet candidates at X-ray wavelengths, a strategy that makes it possible to discover them in other galaxies," researcher from the Center for Astrophysics | Harvard & Smithsonian (CfA), Cambridge, Massachusetts, Rosanne Di Stefano, said in a NASA press release.

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The Sky Over Chester County

November 15, 2021 at 8:00 p.m. ET

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



Date	Civil Twilight Begins	Sunrise	Sunset	Civil Twilight Ends	Length of Day
11/01/2021	7:03 a.m. EDT	7:31 a.m. EDT	5:59 p.m. EDT	6:27 p.m. EDT	10h 27m 58s
11/15/2021	6:18 a.m. EST	6:47 a.m. EST	4:45 p.m. EST	5:14 p.m. EST	9h 58m 08s
11/30/2021	6:34 a.m. EST	7:04 a.m. EST	4:37 p.m. EST	5:07 p.m. EST	9h 33m 48s

Moon Phases					
			New Moon	11/04/2021	5:14 p.m. EDT
First Quarter	11/11/2021	7:45 a.m. EST	Full Moon	11/19/2021	3:57 a.m. EST
Last Quarter	11/27/2021	7:27 a.m. EST			

November 2021 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

4	New Moon, 5:14 p.m. EDT
5	Uranus is at opposition
7	Daylight Saving Time ends and the Moon is close to Venus
10	The Moon, Jupiter and Saturn form a triangle
11	First Quarter Moon and the Lunar X is visible at 6 p.m.
12	The Lunar Straight Wall is visible
17	The Leonid meteors peak today
19	Full Moon, the Full Beaver Moon or the Rivers Freezing Full Moon, 3:57 a.m. EST
19	A penumbral lunar eclipse occurs in the early morning hours
27	Last Quarter Moon, 7:27 a.m. EST

The best sights this month: Venus, Saturn and Jupiter are easy to find as soon as the sky darkens, and with a good astronomy app you can also find Uranus and Neptune. Uranus can be seen with binoculars, but you will need a telescope to see Neptune. The elusive Lunar X will be visible around 6 p.m. on November 11th.

Mercury: If you really want to see Mercury this month you will need to get up before the Sun and look in the east during the first week of the month. This doesn't sound like fun to me.

Venus: You can't miss bright Venus in the west just as the light of day begins to fade. On November 7th Venus is close to the Moon. This will most definitely be fun to see.

Mars: Mars is too close to the Sun to be seen until the last week of the month, when it can be found in the east just before the Sun brightens the sky. This also does not sound like fun. I'll stick to watching Venus and the gas giants this month.

Jupiter: Jupiter fades ever so slightly to magnitude -2.4 and is the brightest thing in the night sky after the Moon and Venus.

Saturn: Saturn leads Jupiter across the sky but is not nearly as bright. If you have a clear and not too cold November night, the ringed planet will be an amazing sight in the eyepiece of a telescope.

Uranus and Neptune: Uranus reaches opposition on November 5th, the point at which it is opposite the Sun in our sky, so it is visible all night for most of the month. Neptune crosses the sky ahead of Uranus so both distant, cold gas giants are well positioned for viewing during the evening hours.

The Moon: Full moon occurs on November 19th. This full Moon is the Full Beaver Moon. For Native Americans, the time of this full moon was the time to set beaver traps before the swamps froze, to ensure a supply of warm winter furs. It is sometimes also referred to as the Frosty Moon, but I don't think they were referring to the snowman, even though the Moon kind of looks like the head of a snowman. Native Canadian tribes called this the Rivers Freezing Moon.

If you are willing to get up in the middle of the night you can see a penumbral lunar eclipse in the early morning hours of November 19th. Mid-eclipse is at 4:03 a.m. This should be a nice sight if you can get out of bed for it.

Constellations: Now that we are well into autumn and back to Eastern Standard Time there are many hours of star gazing possible without staying up late. If only the nights were not getting so cold! The Summer Triangle is past center stage and is heading for the western horizon. Pegasus is well up in the southern sky in the early evening, and the jewels that are the Pleiades are rising in the east. Capella in Auriga is a bright point of light above Taurus. As it gets a bit later our old friend Orion returns from his summer vacation.

Messier/deep sky: There are many deep sky treats in the autumn and early winter sky. Some of my favorites this time of year are the three open star clusters in Auriga, M36, M37 and M38. Compare the structure of these open clusters and log them as a great start in pursuit of the binocular or telescopic Messier observing program of the Astronomical League. Then switch to a low power eyepiece and turn your telescope to M45, the Pleiades. I never tire of staring at this amazing cluster of stars.

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Astronomers Discover Massive Galaxy 'Shipyard' in the Distant Universe

by Daniel Stolte, University of Arizona, courtesy of ScienceDaily.com

Even galaxies don't like to be alone. While astronomers have known for a while that galaxies tend to congregate in groups and clusters, the process of going from formation to friend groups has remained an open question in cosmology.

In a paper published in the *Astronomy & Astrophysics Journal*, an international team of astronomers reports the discovery of a group of objects that appear to be an emerging accumulation of galaxies in the making -- known as a protocluster.

"This discovery is an important step toward reaching our ultimate goal: understanding the assembly of galaxy clusters, the most massive structures that exist in the universe," said Brenda Frye, an associate professor of astronomy at the University of Arizona's Steward Observatory and a co-author of the study.

The Milky Way, home to our solar system, belongs to a galaxy cluster known as the Local Group, which in turn is a part of the Virgo supercluster. But what did a supercluster such as Virgo look like 11 billion years ago?

"We still know very little about protoclusters, in part because they are so faint, too faint to be detected by optical light," Frye said. "At the same time, they are known to radiate brightly in other wavelengths such as the sub-millimeter."

Initially discovered by the European Space Agency's Planck telescope as part of an all-sky survey, the protocluster described in the new paper showed up prominently in the far-

infrared region of the electromagnetic spectrum. Sifting through a sample of more than 2,000 structures that could be in the process of becoming clusters, researchers came across a protocluster designated as PHZ G237.01+42.50, or G237 for short. The observations looked promising, but to confirm its identity required follow-up observations with other telescopes.

Led by Mari Polletta at the National Institute for Astrophysics in Milan, Italy, the team conducted observations using the combined power of the Large Binocular Telescope in Arizona, which is managed by UArizona, and the Subaru Telescope in Ja-

pan. The team identified 63 galaxies belonging to the G237 protocluster. The original discovery was published in a previous paper, and follow-up observations were also obtained using archival data, the Herschel Space Observatory and the Spitzer Space Telescope.

"You can think of galaxy protoclusters such as G237 as a galaxy shipyard in which massive galaxies are being assembled, only this structure existed at a time when the universe was 3 billion years old," Frye said. "At the same time, the genealogy may be closer than you think."

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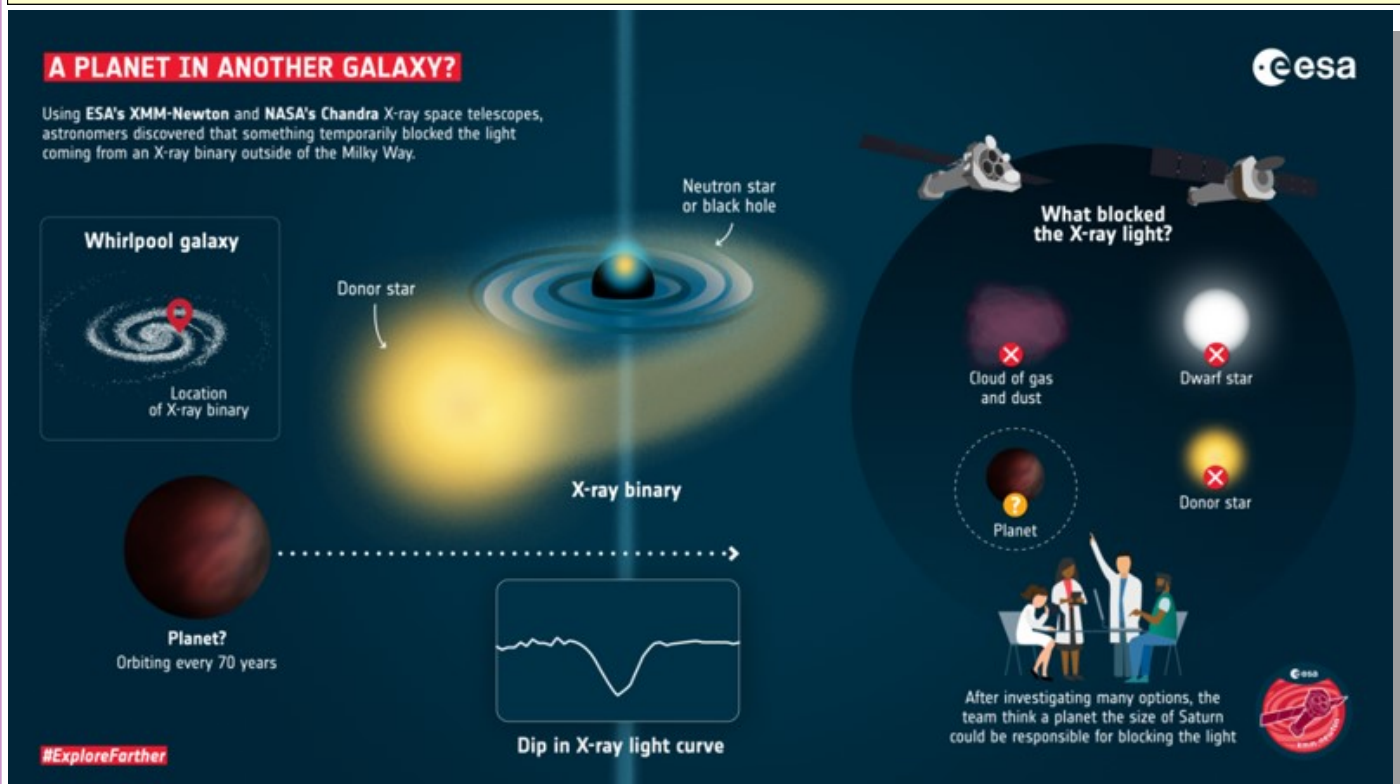
2021 Webmaster Award to CCAS Observing Chair Don Knabb

by Dave Hockenberry, CCAS President



Don Knabb recently was recognized by the Astronomical League as 1st place winner of the webmaster award for the MERAL and ALCON '21 websites.

Evidence of Planet (Cont'd)



© ESA A ESA diagram explains how the discovery of a Saturn-sized planet outside the Milky Way was made. ESA

(Continued from page 3)

Di Stefano was the lead researcher on the study, published in the journal *Nature Astronomy*.

In order to spot this planet, Di Stefano and the team adopted a technique that has been used with great success to detect exoplanets outside the solar system, but within our galaxy.

As exoplanets pass the face of their parent star, they block the light from that star and cause tiny, but detectable, dips in the star's light output. This happens for light across the entire electromagnetic spectrum including X-rays.

This transit method of exoplanet detection has been used by astronomers with both ground-based and space-based telescopes – like those carried by

NASA's *Kepler* and *Transiting Exoplanet Survey Satellite* (TESS) missions—to discover thousands of exoplanets.

To use the transit method to detect dips in X-ray emissions caused by transiting exoplanets, the team had to use stars that are associated with strong output in this region of the electromagnetic spectrum.

For this, the team used X-ray binaries, systems of two orbiting stars one of which is a compact stellar remnant, a neutron star or a black hole, that is feeding on material from its companion. When this material falls to the compact object surface, the intense gravitational force heats it tremendously and causes it to release high-energy X-ray emissions.

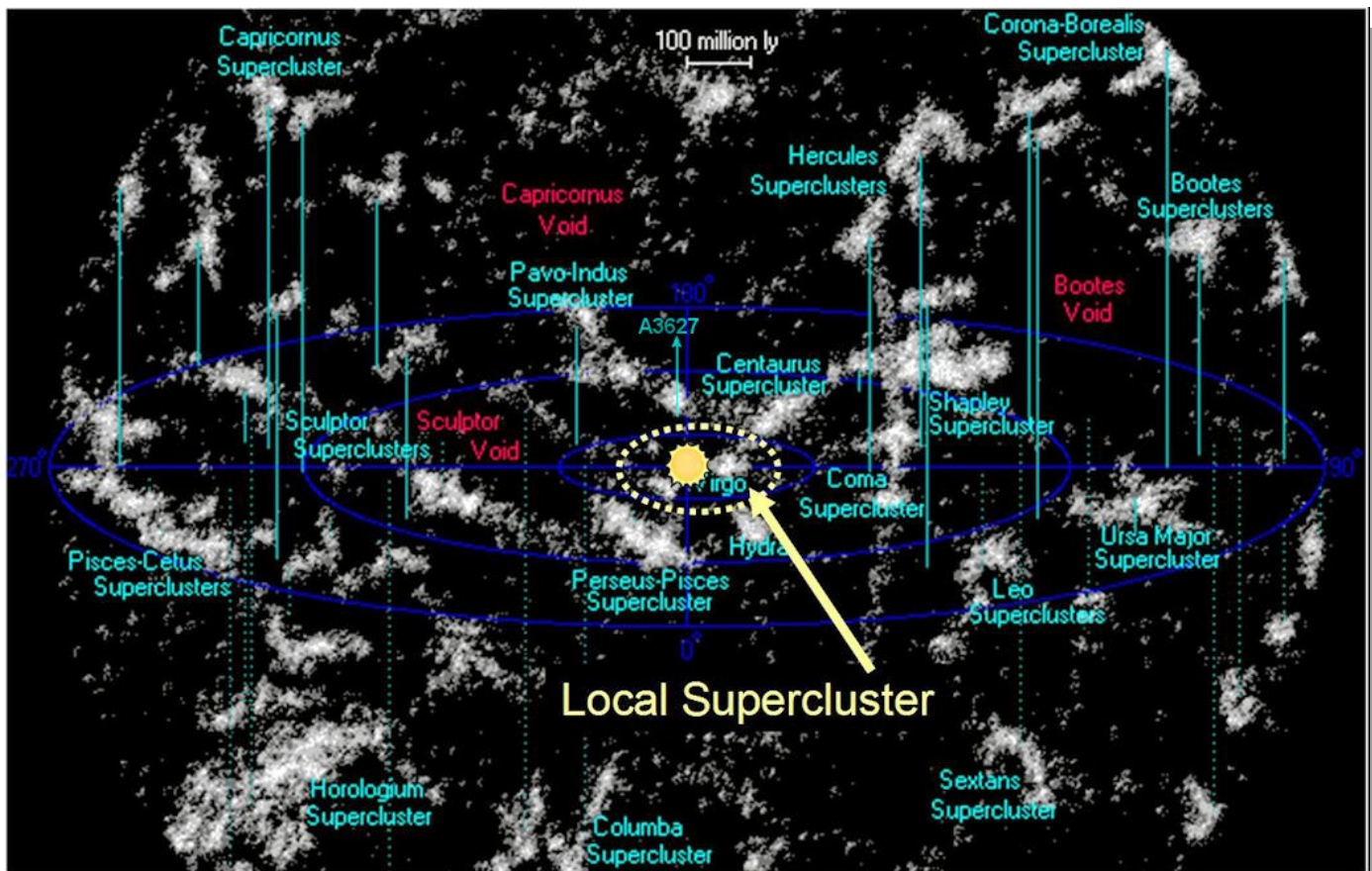
"X-ray binaries may be ideal places to search for planets, because, although they are a million times brighter than our Sun, the X-rays come from a very small region," Di Stefano said. "In fact, the source that we studied is smaller than Jupiter, so a transiting planet could completely block the light from the X-ray binary."

Searching for dips in these X-ray emissions that could be caused by an orbiting star, Di Stefano and the team spotted such a signature around the X-ray binary – M51-ULS-1 – in the galaxy M51.

Studying the signal in detail they discovered the emission of X-rays dropped to zero as something transited the binary. This last for three hours then the X-ray transmission resumed.

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Shipyards (Cont'd)



Superclusters - The Virgo Supercluster (universe-review.ca)

(Continued from page 6)

Because the universe is homogeneous and the same in all directions, we think that the Milky Way may have docked at a protocluster node similar to G237 when it was very young."

At first, observations of G237 implied a total star formation rate that was unrealistically high, and the team struggled to make sense of the data. The G237 protocluster seemed to be forming stars at a rate of 10,000 times that of the Milky Way. At that rate, the protocluster would be expected to rapidly use up its stellar fuel and subsequently settle down into a complex system similar to the Virgo supercluster.

"Each of the 63 galaxies discovered so far in G237 was like a

star factory in overdrive," Frye said. "It's as if the galaxies were working on overtime to the assemble stars. The rate of production was unsustainable. At such a pace, the supply chains are expected to break in the near future, and in a way that permanently shuts down the galaxy shipyard."

Such high yields could only be maintained by a continuous injection of fuel, which for stars is hydrogen gas. Frye said that would require an efficient and unbroken supply chain that drew in unreasonably large amounts of fresh gas to fuel the star-forming factories.

"We don't know where that gas was coming from," she said. Later, the team discovered that

some of what it was seeing came from galaxies unrelated to the protocluster, but even after the irrelevant observations were removed, the total star formation rate remained high, at least 1,000 solar masses per year, according to Poletta. In comparison, the Milky Way produces about one solar mass each year.

"The picture we have pieced together now is that of a successful galaxy shipyard, which is working at high efficiency to assemble galaxies and the stars within them and has an energy supply that is more sustainable," Frye said.

All galaxies in the universe are part of a giant structure that

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Evidence of Planet (Cont'd)

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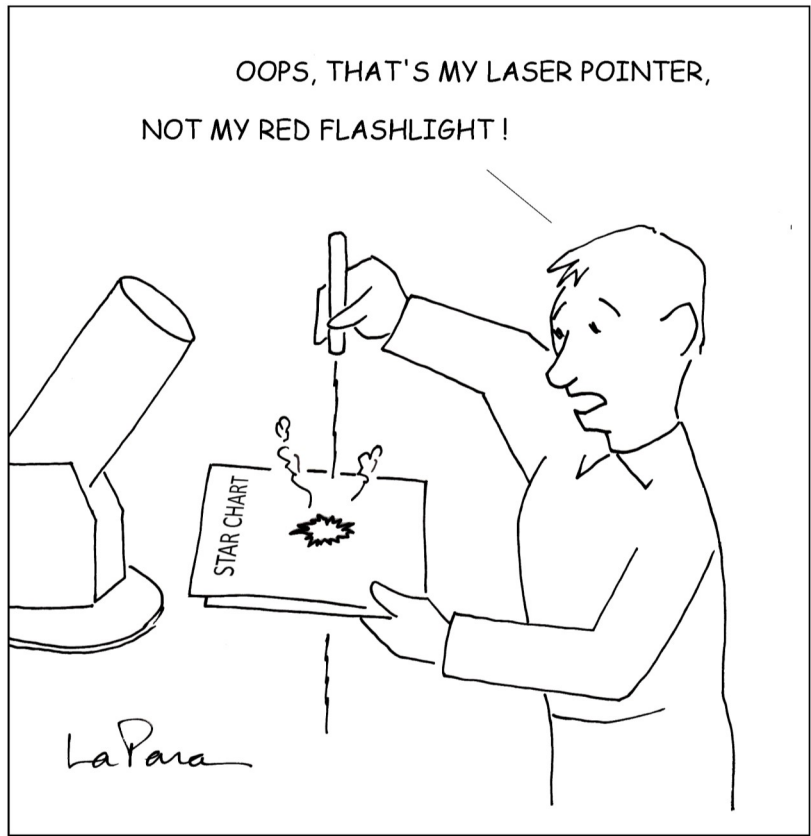
After eliminating other possibilities for this dip in X-ray emissions, such as dust or another object, the team concluded that they are caused by a transiting dark planet about the size of gas giant Saturn. The extragalactic planet is orbiting the X-ray binary data at a distance of twice the orbit of Saturn around the sun.

The researchers believe that given the orbit of this possible planet, it won't transit its parent star and compact stellar companion again blocking X-rays for another 70 years.

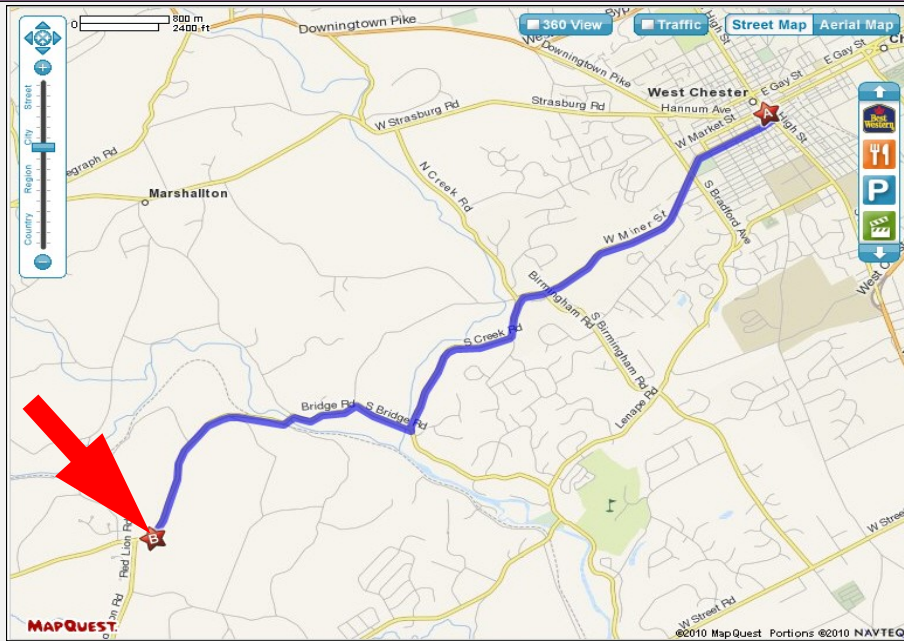
"Unfortunately, to confirm that we're seeing a planet we would likely have to wait decades to see another transit," said paper co-author and University of Califor-

(Continued on page 11)

Classic La Para by Nicholas La Para



CCAS Directions



Brandywine Red Clay Alliance

1760 Unionville Wawaset Rd
West Chester, PA 19382
(610) 793-1090

<http://brandywinewatershed.org/>

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

Brandywine Red Clay Alliance

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

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

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

Through the Eyepiece: The Open Clusters in Auriga: M36, M37 and M38

by Don Knabb, CCAS Observing Chair & Treasurer

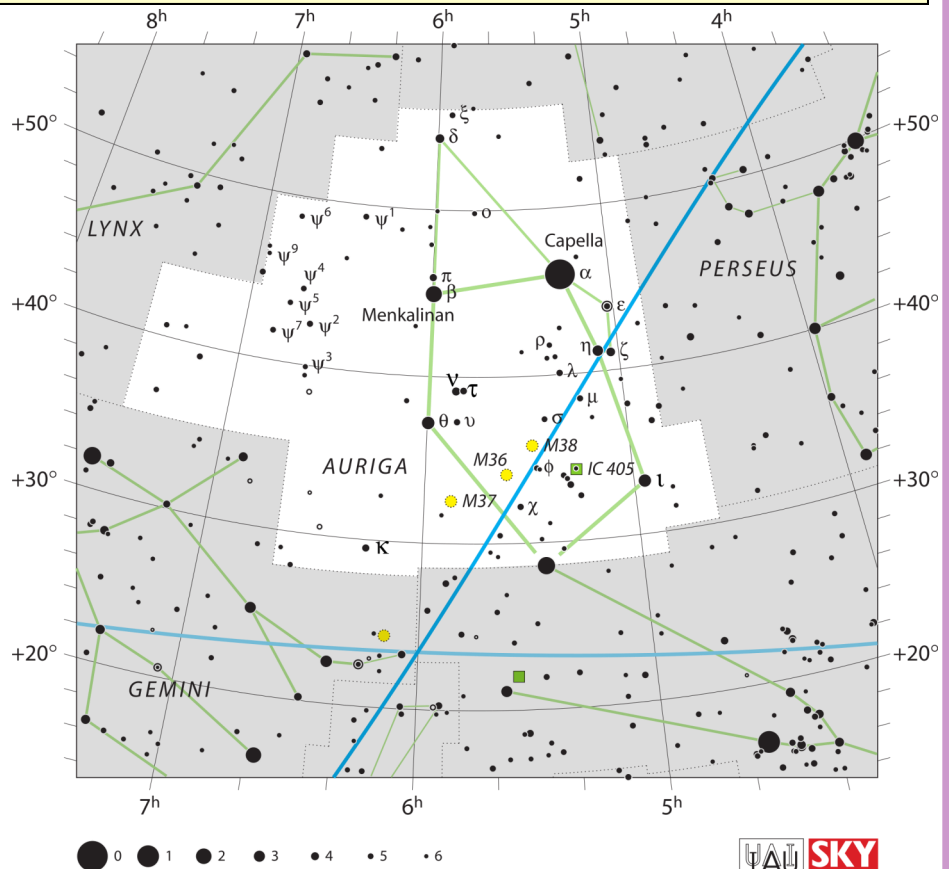
As autumn begins and the time arrives when the leaves start to turn color and fall to the ground, I always look forward to the bright star Capella rising in the east not long after sunset. I often ask myself, is that a plane, a UFO, or Capella? Capella, in the constellation Auriga, is the 6th brightest star in the sky. Auriga is called the Charioteer, or sometimes the Wagoneer. Auriga is one of the oldest constellations going back to Babylonian times.

Here's today's trivia for you: What other meanings are associated with the word Auriga? How about "a Roman slave chauffeur"? Or the name of a spaceship in the movie *Alien: Resurrection*? This is according to Wikipedia.....

When I see Capella, rising in the glow of West Chester on our northeastern horizon, I know the deep sky wonders of the autumn and winter sky are not far behind. The first of these deep sky objects I look for are the three open star clusters in Auriga; M36, M37 and M38.

Open clusters, also called galactic clusters, contain fewer and younger stars than globular clusters. Also unlike globular clusters, open clusters are generally confined to the plane of our galaxy. I like to look at all three in a short time span and compare the unique appearance of each cluster to the others.

Auriga has many open clusters and other objects because the Milky Way runs through it. M36, M37 and M38 are all visible in binoculars or a small telescope in suburban skies. A large



Map credit: IAU and Sky & Telescope magazine (Roger Sinnott & Rick Fienberg) - *The Constellations*, IAU Auriga chart, https://commons.wikimedia.org/wiki/File:Auriga_IAU.svg

er telescope resolves individual stars. The clusters are about 4100, 4400, and 4200 light years

distant, respectively. Their apparent visual magnitudes are

(Continued on page 11)



Image credit: CCAS member Pete LaFrance, from his observatory in Avondale, PA

Eyepiece (Cont'd)



Image credit: CCAS member Pete LaFrance, from his observatory in Avondale, PA

(Continued from page 10)

6.3, 6.2, and 7.4, respectively.

M36, known as the Pinwheel Cluster, is a rather faint cluster of about 50 to 60 stars, in a very compact area. A large scope is necessary to resolve the individual stars. The brightest members are arranged in chains that give

the cluster a crab-like appearance.

M37, which has no common name, is considered the most spectacular of the three Messiers. Binoculars will only show a large fuzz ball, you really need a telescope to delve deep into this cluster. A medium sized

scope should reveal at least twelve red giants, with the brightest one found at the center of the cluster. Some observers find this star more orange than red. The cluster is considered to be about 200 million years old.

M38, which carries the nickname Starfish Cluster, is just to the northwest of M36. Some observers have described this cluster of about a hundred stars as having a cross-shape or an oval shape.

So aim your binoculars or telescope toward Auriga and add M36, M37 and M38 to your Astronomical League Messier Observing Program list!

Information sources:

- Pasachoff, Jay M. 2000. *A Field Guide to the Stars and Planets*. New York, NY. Houghton Mifflin.
- http://en.wikipedia.org/wiki/Auriga_%28constellation%29
- <http://www.coldwater.k12.mi.us/lms/planetarium/myth/auriga.html>
- http://www.dibonsmith.com/aur_con.htm
- http://www.seds.org/Maps/Stars_en/Fig/auriga.html
- iPad app Sky Safari Pro

Evidence of Planet (Cont'd)

(Continued from page 9)

nia at Santa Cruz researcher Nia Imara. "And because of the uncertainties about how long it takes to orbit, we wouldn't know exactly when to look."

If this is a planet in this system, the authors point out that it must have survived the tremendous supernova explosion that created the compact stellar object in the X-ray binary.



Image credit: CCAS member Pete LaFrance, from his observatory in Avondale, PA

NASA Night Sky Notes: Measure the Night Sky

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.

Fall and winter months bring longer nights, and with these earlier evenings, even the youngest astronomers can get stargazing. One of the handiest things you can teach a new astronomer is how to measure the sky – and if you haven't yet learned yourself, it's easier than you think!

Astronomers measure the sky using degrees, minutes, and seconds as units. These may sound more like terms for measuring time - and that's a good catch! – but today we are focused on measuring **angular distance**. **Degrees** are largest, and are each made up of 60 **minutes**, and



each minute is made up of 60 **seconds**. To start, go outside and imagine yourself in the center of a massive sphere, with yourself at the center, extending out to the stars: appropriately enough, this is called the **celestial sphere**. A circle contains 360 degrees, so if you have a good view of the horizon all around you, you can slowly spin around

exactly once to see what 360 degrees looks like, since you are in effect drawing a circle from inside out, with yourself at the center! Now break up that circle into quarters, starting from due North; each quarter measures 90 degrees, equal to the distance between each cardinal direction! It measures 90 degrees between due North and due East, and a full 180 degrees along the horizon between due North and due South. Now, switch from a horizontal circle to a vertical one, extending above and below your head. Look straight above your head: this point is called the **zenith**, the highest point in the sky. Now look down toward the horizon; it measures 90 degrees from the zenith to the horizon. You now have some basic measurements for your sky.

(Continued on page 13)

Handy Sky Measurements

Hold your hand out in front of your face as far as you comfortably can, and measure:

1°



5°



10°



15°



25°



Measure the Sky with the Big Dipper

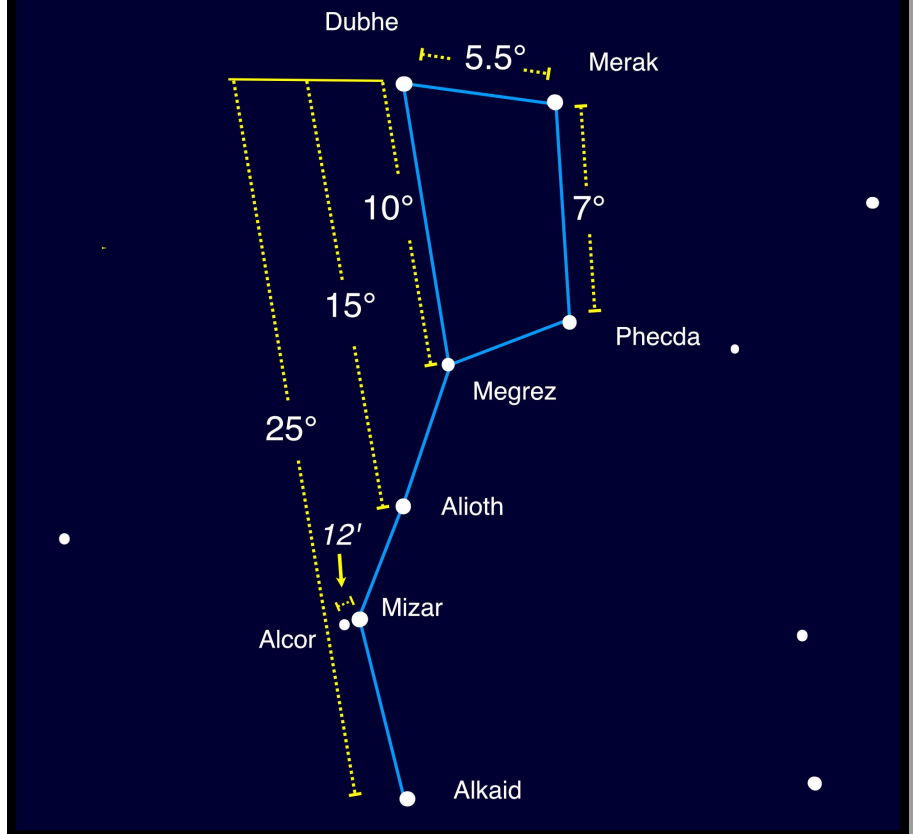


Image created with assistance from Stellarium

(Continued from page 12)

Use a combination of your fingers held at arm's length, along with notable objects in the night sky, to make smaller measurements. A full Moon measures about half a degree in width - or 1/2 of your pinky finger, since each pinky measures 1 degree. The three stars of Orion's Belt create a line about 3 degrees long. The famed "Dig Dipper" asterism is a great reference for Northern Hemisphere observers, since it's circumpolar and visible all night for many. The Dipper's "Pointer Stars," Dubhe and Merak, have 5.5 degrees between them - roughly three middle fingers wide. The entire asterism

stretches 25 degrees from Dubhe to Alkaid - roughly the space between your outstretched thumb and pinky. On the other end of the scale, can you split Mizar and Alcor? They are separated by 12 *arc minutes* - about 1/5 the width of your pinky.

Keep practicing to build advanced star-hopping skills. How far away is Polaris from the pointer stars of the Big Dipper? Between Spica and Arcturus? Missions like Gaia and Hipparcos measure tiny differences in the angular distance between stars, at an extremely fine level. Precise measurement of the heavens is known as *astrometry*.

Discover more about how we measure the universe, and the missions that do so, at [nasa.gov](https://www.nasa.gov).

Shipyard (Cont'd)

(Continued from page 8)

resembles a three-dimensional spider web shape called the cosmic web. The filaments of the cosmic web intersect at the nodes, which equate to the galaxy shipyards in the analogy. "We believe that the filaments mediate the transfer of hydrogen gas from the diffuse medium of intergalactic space onto these hungry, newly forming protocluster structures in the nodes," Frye said.

Pointing to future research, Polletta said: "We are in the process of analyzing more observations on this and other Planck protoclusters with the goal of tracing the gas that gives birth to these newly forming stars and feeds the supermassive black holes, to determine its origin and explain the observed extraordinary activity."

Frye said she is looking forward to combining data from the Large Binocular Telescope with observations from NASA's the James Webb Space Telescope, to be launched in December.

"Protoclusters offer an opportunity to investigate key questions in astronomy that only this new observatory can answer," she said, "such as what mechanisms drive the prodigious star formation, and when will the hydrogen supply run out, forcing this galaxy shipyard to close its doors and turn into a supercluster similar to the one our Milky Way is in?"

Please see the paper for a full list of authors and funding information.

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 5)

Comets: There are no bright comets visible during November.

Meteor showers: The Leonid meteor shower is best viewed during the predawn hours of November 17th and 18th. We can expect up to 15 fast moving meteors per hour, however since Full Moon is only two days after the shower peak it will wash out the sky and reduce the number of meteors we see. But the Leonids are considered the fastest of any meteors so the chance of seeing a bright fireball is good.

CCAS Membership Information and Society Financials

Treasurer's Report by Don Knabb

Oct. 2021 Financial Summary

Beginning Balance	\$361
Deposits	\$258
Disbursements	-\$77
Ending Balance	\$542

New Member Welcome!

Welcome new CCAS members John Abbott, Middletown, PA, Lewis Levin, Ardmore, PA, and Will Lamm, Hunter Mills, Daniel Parker, Matt Toole, Long Vu, Julia Zug, from West Chester University.

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.

Join the Fight for Dark Skies!



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

International Dark-Sky Association
 3225 North First Avenue
 Tucson, AZ 85719
 Phone: 520-293-3198
 Fax: 520-293-3192
 E-mail: ida@darksky.org

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

<http://www.darksky.org>

Dark-Sky Website for PA



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

<http://www.POLCouncil.org>

Find out about Lyme Disease!

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

<http://www.LymePA.org>

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

Good Outdoor Lighting Websites

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



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

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

<http://www.starrynightlights.com>



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

Phone: 484-291-1084

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

Local Astronomy-Related Stores

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



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

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

Phone: 610-327-3500 or 888-947-2673
 Fax: 610-327-3553

<http://www.skiesunlimited.net>



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

4403 Main Street
Philadelphia, PA 19127

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

Hours:
 Tuesday thru Saturday: 10AM to 6PM
 Sunday and Monday: 11AM to 5PM

<http://www.spectrum-scientifics.com>

CCAS Information Directory

CCAS Lending Telescopes

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

CCAS Lending Library

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

Contributing to *Observations*

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

Or mail the contribution, typed or handwritten, to:

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

CCAS Newsletters via E-mail

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

CCAS Website

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

<http://www.ccas.us>

Dr. Hepler welcomes any additions to the site by Society members. The contributions can be of any astronomy subject or object, or can be related to space exploration. The only requirement is that it is your own work—no copyrighted material! Give your contributions to Dr. Hepler at (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
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 **\$54.95**.

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.