



# Observations

A Monthly Publication Of The  
CHESTER COUNTY ASTRONOMICAL SOCIETY

Vol. 28, No. 6 **Three-Time Winner of the Astronomical League's Mabel Sterns Award** ☼ 2006, 2009 & 2016 June 2020

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## Waning Crescent Moon Over Philadelphia



Taken May 19, 2020, at approximately 5:19 a.m. EDT by CCAS member Janet Holloway from her home near the Philadelphia Art Museum. According to Janet, the waning crescent moon symbolizes "surrender, rest and recuperation," a mindset she reports experiencing during the Covid-19 pandemic.

## Membership Renewals Due

06/2020	Crabb Hebding
07/2020	Barasatian Bissinger & Family Hockenberry & Miller Hunsinger McGuigan Morgan Piehl
08/2020	Bogard Borowski Buki Johnston & Stein Knabb Kruss Lurcott, L. Tiedemann Tredinnick Trunk Zulitti

## June 2020 Dates

- 5th** • Full Moon, the Full Strawberry Moon or the Full Sockeye Moon, 3:12 p.m. EDT
- 11th** • Two moon shadows are visible on Jupiter at 11:33 p.m.
- 13th** • Last Quarter Moon, 2:23 a.m. EDT
- 20th** • Summer Solstice, 5:43 p.m. EDT
- 21st** • New Moon, 2:41 a.m. EDT.
- 23rd** • The Beehive Cluster is near the Moon.
- 28th** • First Quarter Moon, 4:15 a.m. EDT.



## 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.

☼ **Monthly observing sessions at Myrick Conservancy Center, BVA, and special observing dates have been cancelled until further notice as part of the national effort to limit the spread of the coronavirus. For more information about future observing opportunities, contact our Observing Chair, Don Knabb.**

## Spring/Summer Society Events

### June 2020

**9th** • CCAS Monthly Meeting, ONLINE via [Zoom.us](https://zoom.us). Meet & Greet online for members from 7:00 to 7:30 p.m. The meeting starts immediately after at 7:30 p.m. CCAS Member Speaker: John Conrad, NASA Solar System Ambassador, "Lunar Science: Historical Overview and Current and Future Missions to the Moon."

**18th-19th** • The von Kármán Lecture Series: [Making a Mars Rover](#), Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

**20th** • Summer Solstice, 5:43 p.m. EDT.

**20th** • Open call for articles and photographs for the July 2020 edition of [Observations](#).

**26th** • Deadline for newsletter submissions for the July 2020 edition of [Observations](#).

### July 2020

**9th-10th** • The von Kármán Lecture Series: [A Day in the Life of the Deep Space Network](#). Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

**20th** • Open call for articles and photographs for the August 2020 edition of [Observations](#).

**26th** • Deadline for newsletter submissions for the August 2020 edition of [Observations](#).

## Minutes from the May 12, 2020, CCAS Monthly Meeting

by Bea Mazziotti, CCAS Secretary

- Dave Hockenberry welcomed 27 members and guests to the May 2020 CCAS meeting. Zoom was again the platform though several joined via YouTube.
- Club President Dave Hockenberry presented Frank Angelini with the Astronomical League Double Star Certificate. Frank has successfully observed, recorded and drawn the League's list of 100 double stars. Congratulations Frank! It is of note that Frank has also completed the League's Asterism Observing Program.
- Dave announced that the club will have a June virtual meeting Via Zoom.
- Don Knabb noted that members might be interested in viewing NASA Solar System Treks. <https://trek.nasa.gov/>
- Bruce Ruggeri, program chair, introduced the evening's speaker, Scott Engle, PhD. He is a Villanova University graduate and an assistant professor in their Astronomy and Planetary Science Dept. He works extensively in observational astrophysics. One of his main areas of research involves using these observations to detail small star evolution and gauge their suitability to host potentially habitable exoplanets. He has also worked closely with Professor Edward Guinan, May's guest speaker, on the Red Thumbs Mars Garden Project.
- His topic was The Drake Equation. This is an argument, based on a series of probabilities, used to stimulate thought and dialogue on the potential number of active, communicative extraterrestrial civilizations in our galaxy. The equation summarizes the main concepts that scientists must consider when asking if other intelligent life exists beyond our planet. The equation is meant to guide the conversation rather than provide a precise answer to this intriguing question.

## June 2020 CCAS Meeting Agenda

by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on June 9, 2020, starting at 7:30 p.m. The meeting will be held ONLINE via [Zoom.us](https://zoom.us). CCAS Member Speaker: John Conrad, NASA Solar System Ambassador, "Lunar Science: Historical Overview and Current and Future Missions to the Moon."

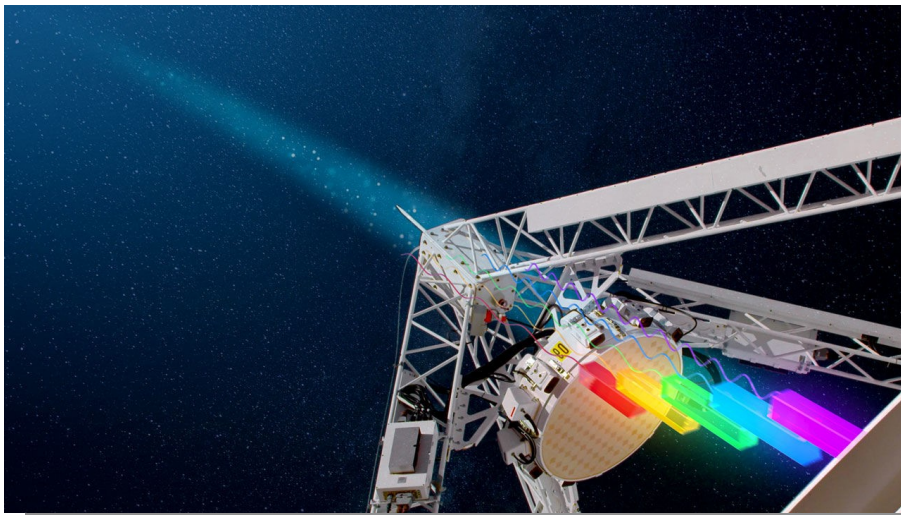
Please note that inclement weather or changes in speakers' schedules may affect the program. In the event there is a

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 Fall 2020 season. If you are interested in presenting, or know someone who would like to participate, please contact me at [programs@ccas.us](mailto:programs@ccas.us).

## Mysterious Radio Bursts Reveal Missing Matter in Cosmos

by Daniel Clery, *Science Magazine*



Fast radio bursts, imagined here in a staggered arrival of frequencies at a detector of the Australian Square Kilometre Array Pathfinder telescope. Image Credit: ICRAR and CSIRO/Alex Cherney

Roughly half of the “normal” matter in the universe—the stuff that makes up stars, planets, and even us—exists as mere wisps of material floating in intergalactic space, according to cosmologists. But astronomers had no good way to confirm that, until now. A new study has used fast radio bursts (FRBs)—powerful milliseconds long pulses of radio waves coming from distant galaxies—to weigh intergalactic matter, and the results match up with predictions.

“Using FRBs as a probe has been an exciting prospect for a while,” says astronomer Paul Scholz of the University of Toronto, who was not involved with the work. “Now that we’ve built up a sample of local FRBs, we’re starting to be able to do this. It’s certainly exciting.”

Over the past few decades, cosmologists have compiled an inventory of the stuff that makes up the universe. Some 68% is [dark energy](#), a mysterious force accelerating the universe’s expansion. Another 27% is clumps

of [dark matter](#) that hold galaxies together. Just 5% is so-called normal matter.

Cosmologists know how much normal matter there should be; they can calculate it from how much the big bang should have produced and from the microwave ripple of this cosmic event that still echoes through space. But they can only see about half of it glowing as galaxies and dense gas clouds. The rest, a rarified, intergalactic gas of just one or two atoms in the volume of a typical office room, has been almost impossible to detect.

That was until the first FRB burst on the scene in 2007. Because these sporadic blasts are so bright and short, FRBs were originally thought to come from an instrumental glitch, or a source on Earth. (Some early “FRBs” were found to come from a microwave oven at an observatory.) But as detections of FRBs piled up, astronomers realized they were coming from distant corners of the universe.

Pinpointing them was difficult because of their rarity: Observers had to be pointing in the exact right direction to catch one, and they wouldn’t have time to focus other scopes on the source. These days, telescopes that [view large portions of the sky continuously](#) are bagging more FRBs.

FRBs revealed their distant origins through a phenomenon known as dispersion. An FRB pulse begins as a range of bunched-up frequencies, but as it travels, “it feels every electron along its path,” says astronomer Sarah Burke-Spolaor of West Virginia University, who was not involved with the work. Low frequencies experience more drag from electrons than high ones, so when the pulse reaches a radio telescope on Earth, low frequencies lag behind. The amount of lag tells astronomers how many electrons the pulse has traveled through, which can be correlated to the total amount of matter.

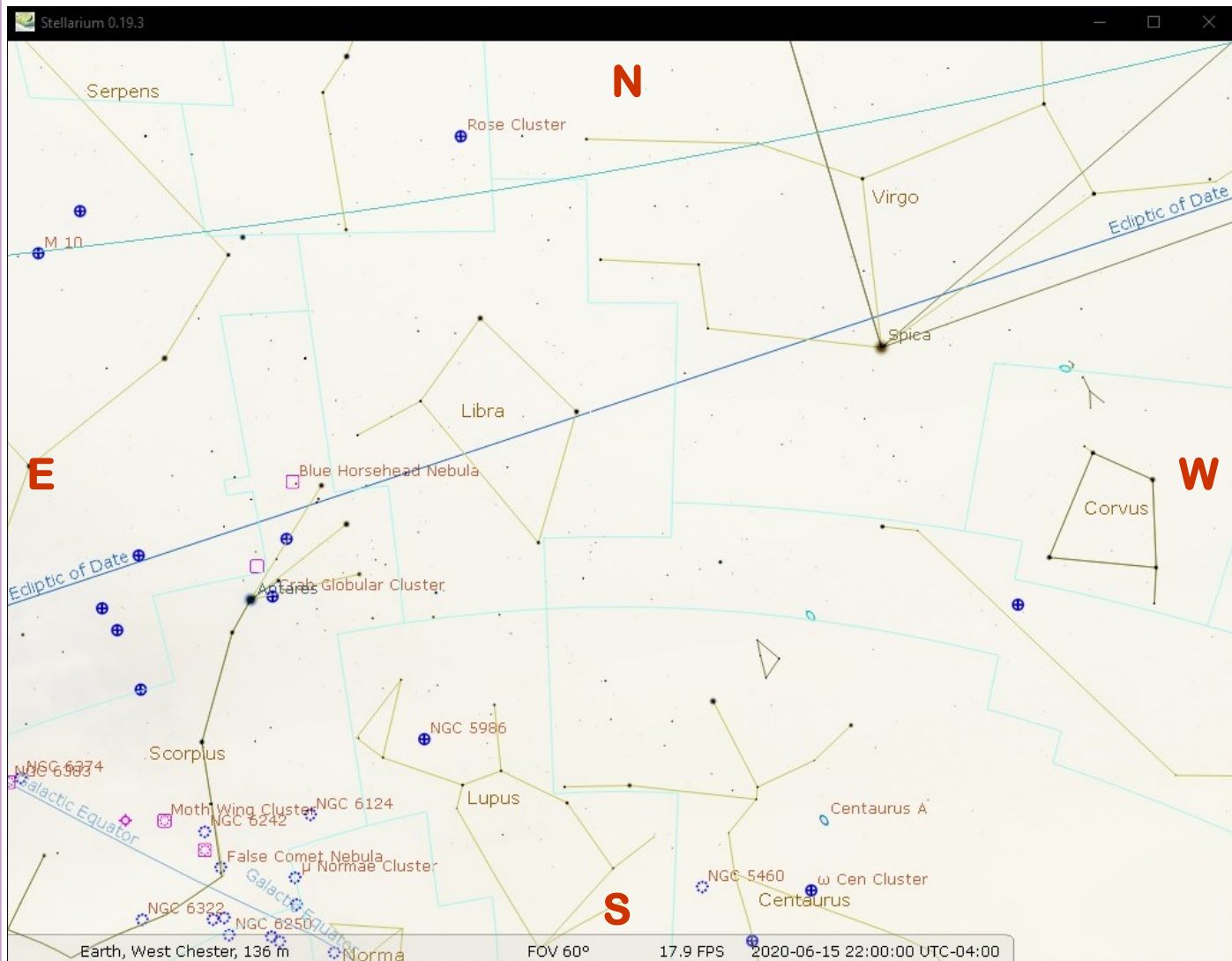
The technique can reveal the density of matter across the cosmos, but only if the distance to the FRB’s source is known. Up until recently, only a handful of FRB sources have been pinpointed—either because they happened to be one of the rare, repeating FRBs, or because they were spotted with a telescope array that could focus multiple instruments on the source galaxy. Today in *Nature*, a team of astronomers report the [discovery of four new FRBs with known source galaxies](#), identified with the Australian Square Kilometre Array Pathfinder (ASKAP), an array of 36 radio dishes in

*(Continued on page 9)*

# The Sky Over Chester County

June 15, 2020 at 10:00 p.m. ET

Note: This screen capture is taken from Stellarium, the free planetarium software available for download at [www.stellarium.org](http://www.stellarium.org).



Date	Civil Twilight Begins	Sunrise	Sunset	Civil Twilight Ends	Length of Day
06/01/2020	5:03 a.m. EDT	5:35 a.m. EDT	8:25 p.m. EDT	8:57 p.m. EDT	14h 49m 50s
06/15/2020	5:00 a.m. EDT	5:33 a.m. EDT	8:33 p.m. EDT	9:05 p.m. EDT	14h 59m 50s
06/30/2020	5:04 a.m. EDT	5:37 a.m. EDT	8:35 p.m. EDT	9:07 p.m. EDT	14h 57m 45s

Moon Phases					
			Full Moon	06/05/2020	3:12 p.m. EDT
Last Quarter	06/13/2020	2:23 a.m. EDT	New Moon	06/21/2020	2:41 a.m. EDT
First Quarter	06/28/2020	4:15 a.m. EDT			

## June 2020 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

3	<b>Venus passes between the Earth and the Sun, appearing in the morning sky in a week</b>
5	<b>Full Moon, the Full Strawberry Moon or the Full Sockeye Moon, 3:12 p.m. EDT</b>
11	<b>Two moon shadows are visible on Jupiter at 11:33 p.m.</b>
13	<b>Last Quarter Moon, 2:23 a.m. EDT</b>
20	<b>Summer solstice, 5:43 p.m. EDT</b>
21	<b>New Moon and a penumbral lunar eclipse is visible from Africa and Asia</b>
23	<b>The Beehive Cluster is near the Moon</b>
27	<b>The Lunar X is visible around 8 p.m.</b>
28	<b>First Quarter Moon and the Lunar Straight Wall is visible</b>

**The best sights this month:** Although Mercury is the only planet visible during evening hours, there are several interesting events to gaze at during June. Comet PanSTARRS (C/2017 T2) is visible all month at magnitude 8 as it passes near three galaxies through the month. On June 23<sup>rd</sup> the Moon is near the Beehive Cluster, which will be a nice view in binoculars, and the elusive Lunar X is visible around 8 p.m. on June 27<sup>th</sup>.

**Mercury:** Look for tiny Mercury with binoculars on June 4<sup>th</sup> as the glow of the Sun fades from the sky when it will be at its greatest eastern elongation. During the first week of June Mercury sets about an hour and 45 minutes after the Sun.

**Venus:** We said goodbye to the “evening star” at the end of May and on June 3<sup>rd</sup> Venus passes between the Earth and the Sun, or nearly so (if it was exactly between the Earth and the Sun we’d be watching a transit). Then in about a week our sister planet rises before the Sun and by the 3<sup>rd</sup> week of June Venus rises nearly an hour and a half before the Sun.

**Mars:** Mars rises around 1 a.m. during June and is best observed just before sunrise.

**Jupiter:** Jupiter and Saturn are rising earlier every night and by month’s end will rise about an hour after sunset. They will not be well positioned for

observing until several hours after they rise, so we need to wait a bit before we can gaze upon them without losing several hours of sleep. But when I get up to use the litter box in the middle of the night I look out our bedroom door and see both gas giants shining brightly through the trees!

**Saturn:** Saturn rises only 15 minutes behind Jupiter and they are only about 6 degrees apart in the sky.

**Uranus and Neptune:** Neptune is near Mars so it rises in the wee small hours of the night. Uranus rises two hours later and both gas giants are best observed just before the sky begins to brighten with the glow of dawn. Or, like me, you can wait until August when they will be in good position for evening observing.

**The Moon:** The Moon is full on June 5<sup>th</sup>. Native Americans called this the Full Strawberry Moon. This name was universal to every Algonquin tribe. However, in Europe they called it the Rose Moon. Native Canadians called this the Trees Fully Leaved Moon or the Sockeye Moon. On June 5<sup>th</sup> there is a weak penumbral lunar eclipse but it is not visible from the U.S. Then to close out the month look for the Lunar X around 8 p.m. on June 27<sup>th</sup>.

**Constellations:** Sunset is so late during June that we need to stay up late to see the stars, but the warm nights and the fireflies make it worth the effort. Leo the Lion is running into the west as if he is fleeing from Hercules in the east. And if you stay up a bit later look to the south for bright red Antares in the constellation Scorpius the Scorpion. In the east the big birds of summer, Aquila the Eagle and Cygnus the Swan are rising. But I’ll spend most of my time staring at Sagittarius and Scorpius in the southern sky for the next few months, enjoying their brief time above the horizon.

**Messier/deep sky:** For a telescopic treat seek out M3 in Canes Venatici in the southwest, one of the three brightest globular clusters in the northern sky. Then switch to a low power/wide field eyepiece and swing over to the east where M39, a loosely structured open cluster is rising with Cygnus. The rest of the evening you can spend in the southern sky enjoying open clusters M6, the Butterfly Cluster, and M7, Ptolemy’s Cluster. To see nebulas, nearby are M8 the Lagoon Nebula and M20 the Trifid Nebula.

**Comets:** Comet PanSTARRS (C/2017 T2) contin-

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## Anniversary of 200-Inch Hale Telescope

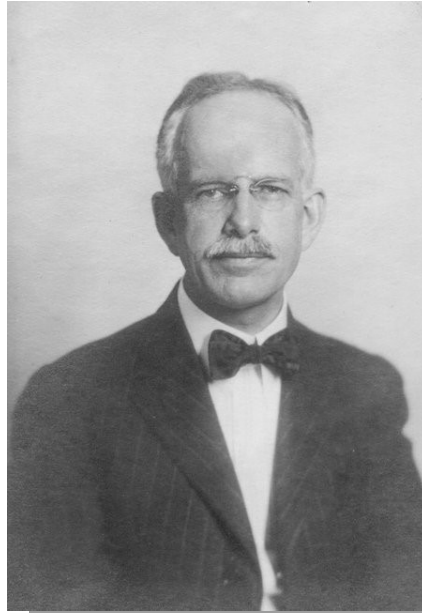
by Whitney Clavin, Caltech

[Editor's Note: In recognition of the 72nd anniversary of the dedication of the 200-inch Hale Telescope at the Palomar Observatory, I've included an edited version of an article published in 2018 by Caltech.]

When George Ellery Hale climbed Mount Wilson, a nearly 6,000-foot peak rising high above Pasadena, in 1903, he had a vision for building a new and bigger window to the cosmos. He had already built the world's largest telescope at the University of Chicago's Yerkes Observatory, but Hale wanted a superior vista to the stars and would soon oversee construction of the 60-inch telescope on Mount Wilson, which would be, for nearly a decade, the world's largest. Over the coming decades, he would help build the world's largest telescope twice more: the 100-inch Hooker Telescope at Mount Wilson, completed in 1917, and the 200-inch Hale Telescope at Caltech's Palomar Observatory, which was dedicated in 1948, 10 years after Hale's death.

That might sound like more than a lifetime of accomplishments for one person, but Hale's vision was also responsible for helping transform a small Pasadena vocational school called Throop University—founded in 1891—into Caltech, one of the top science and engineering universities in the world.

George Ellery Hale was born in 1868 in Chicago. His father, a wealthy elevator manufacturer, instilled in Hale a love for tools and public affairs; his mother, an appreciation for classic literature such as *The Iliad* and *The Odyssey* and stories like *Robinson Crusoe* and *Grimm's Fairy Tales*. Hale's passion for astronomy



George Ellery Hale (June 29, 1868 – February 21, 1938) Image Credit: Caltech Archives

began at a young age, when he transformed his bedroom into a laboratory and built a small telescope for observing the spectral lines of the sun. After high school, he studied physics at MIT—returning home during his summers off to continue his solar research in a special lab built for him by his father on a lot next to their home.

Hale then went on to become a professor of astrophysics at the University of Chicago, where he persuaded the streetcar magnate Charles T. Yerkes to donate funds for the university's 40-inch refracting telescope, the Yerkes Observatory, which opened in 1897.

Hale, like other astronomers of his time, knew that bigger and bigger telescopes would ultimately be needed to collect more light from the beckoning cosmos. With more light-collecting power, telescopes can study astronomical objects in more detail and see farther into

space. After earning support from the Carnegie Institution of Washington, Hale oversaw the construction of the 60-inch telescope at Mount Wilson, which at the time—before light pollution took over Los Angeles—was a pristine site for astronomical viewing. The 60-inch, and the subsequent observatories Hale would help build, were all reflecting telescopes, meaning they consisted of mirrors instead of the lenses used in refracting telescopes like Yerkes. Refracting telescopes have limits to their size because the lenses become too heavy, while reflecting telescopes are easier and cheaper to make in large sizes.

Discoveries made using the 60-inch include astronomer Harlow Shapley's revelation that our sun is not at the center of our Milky Way galaxy but rather located about halfway out, toward the edge of its spiral disk.

Despite the challenges of building the 60-inch on Mount Wilson—a harrowing endeavor that, at times, involved cutting roads into the mountain for horse- and mule-drawn carts—Hale wanted to build a still larger telescope at the same location. Securing funding from philanthropists John Hooker and Andrew Carnegie, Hale oversaw construction of the 100-inch Mount Wilson telescope, which opened in 1917.

Using the 100-inch, astronomer Edwin Hubble made observations that showed our universe consists of not just one galaxy but many and that galaxies are racing away from each other, indicating the expansion of the

(Continued on page 7)

## Telescope Anniversary (Cont'd)



*Dedication of the Hale Telescope, June 1948. Image Credit: Caltech Archives*

*(Continued from page 6)*

universe. Other discoveries include Shapley's first realistic estimate of the size of our Milky Way galaxy and the first evidence of dark matter, a finding from Caltech's Fritz Zwicky, the namesake of the Zwicky Transient Facility.

In the 1920s, Hale once again made the case that an even larger telescope was needed to further explore the hidden universe. In a 1928 *Harper's Magazine* article, he wrote, "Like buried treasures, the outposts of the Universe have beckoned to the adventurous from immemorial times. ... Each expedition into remoter space has made new discoveries and brought back permanent additions to our knowledge of the heavens." That same year, Hale had secured funds from the Rockefeller Foundation for a 200-inch

telescope at Palomar Mountain.

The 200-inch project was enormously complex, requiring many innovations. For example, the mirror—a 200-inch, 14.5-ton piece of Pyrex glass—was carefully ground and shaped in the optical shop at Caltech, where it resided for 11.5 years in part due to delays caused by World War II. When the mirror was originally delivered to Caltech by train in 1936, thousands of people lined the tracks to watch it pass.

The 200-inch was dedicated as the Hale Telescope on June 3, 1948, and opened in 1949. It remained the world's largest working telescope until 1993, when the W. M. Keck Observatory in Hawaii opened.

"The 200-inch is where our knowledge of the expansion of the universe went from a first

detection to the opening of a new field—observational cosmology," says Andy Boden, deputy director of Caltech Optical Observatories, who explains that much of the research around the expansion of the universe was done with this telescope. Other findings include the determination of the chemical compositions of stars, which led to the discovery of how elements are made in stars, and the first signs of black holes, previously only theorized. Today, the telescope is still a major workhorse in astronomy.

Somehow, in the midst of revolutionizing astronomy, Hale helped found Caltech. As a member of the board of trustees of the Throop College of Technology (the university's name as of 1913), Hale recruited two well-known scientists—chemist Arthur A. Noyes from MIT and physicist Robert A. Millikan from the University of Chicago—to Pasadena, and the three would transform Caltech into a renowned science university. Throop was renamed the California Institute of Technology in 1920, around the time that Millikan, Noyes, and Hale were recruiting the brightest minds to the Institute.

Today, 150 years after the birth of one of Caltech's founders, the Institute is still a leader in observational astronomy and instrumentation. Caltech is a partner in the [Thirty Meter Telescope](#) (TMT), which, when completed in the late 2020s, will be one of only a few new extremely large telescopes, dwarfing those in operation today.

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**Book Review: Artemis, by Andy Weir**  
by Don Knabb

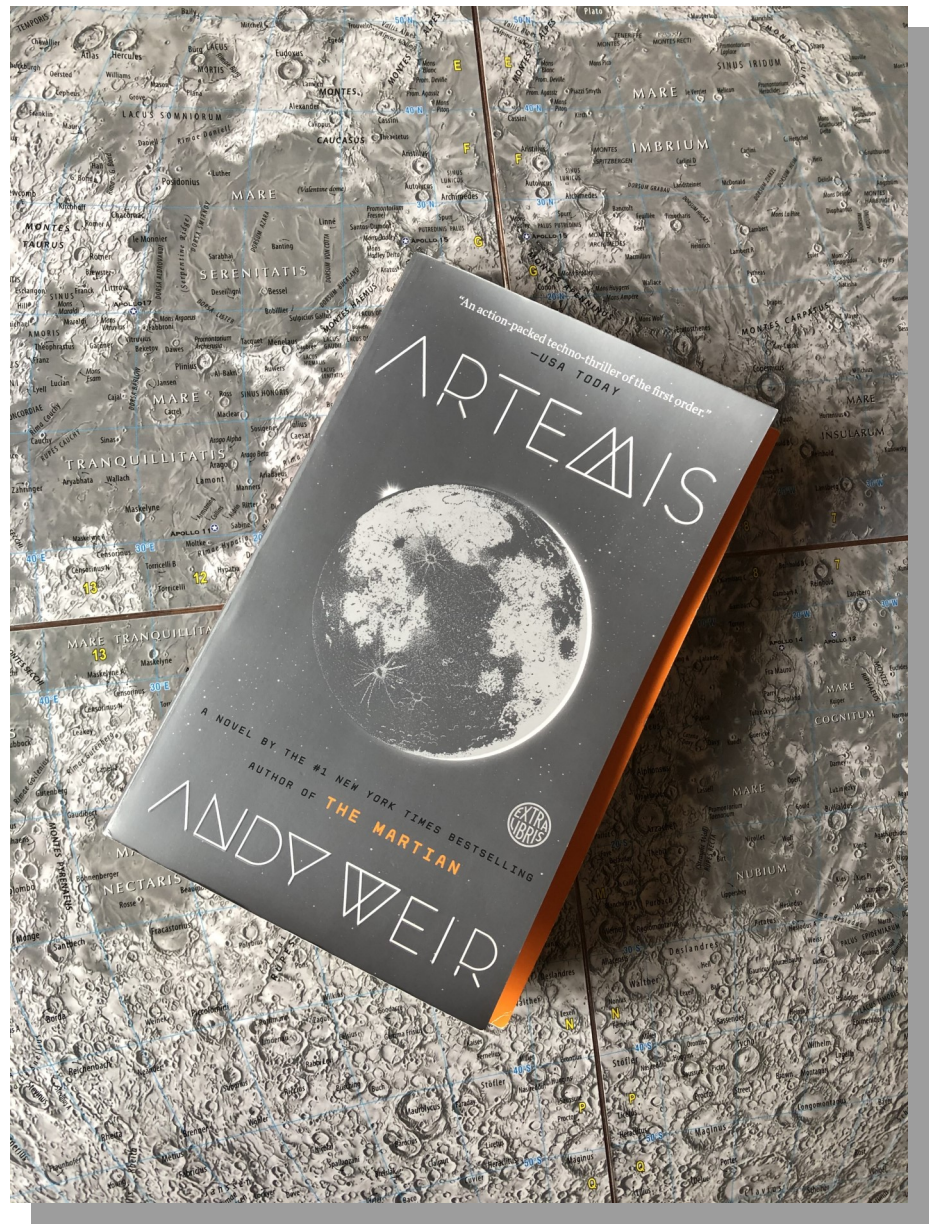
During these strange times we are bombarded by news, and most of it is not good. So while I'm not hiding from what is happening around us, I need a bit of relief at times. Reading a good book is one way to escape to a world other than our own. And although I enjoy non-fiction, I also enjoy a good romp through space with good guys and bad guys, spacesuits and moon rovers.

So if you need a bit of relief, I highly recommend the latest book by the author of *The Martian*, Andy Weir. *Artemis* was published in 2018 and although Barb read it just after we bought it, I just recently read it. Instead of being set on Mars, *Artemis* is set on the Moon in the near future. As with *The Martian*, Weir tried very hard to create a world in which the technology is plausible based on our current space-flight programs.

There are plenty of reviews online, so I don't need to say much beyond that I thoroughly enjoyed the book. It moves fast and held my interest from page 1 to the end. In terms of pure pleasure, I put Weir's writing right up there with CCAS club member Jack McDevitt's writing. Here is the story line as printed on the back of the book:

*"Jasmine Bashara never signed up to be a hero. She just wanted to get rich.*

*Not crazy, eccentric-billionaire rich, like many of the visitors to her hometown of Artemis, humanity's first and only lunar colony. Just rich enough to move out of her coffin-sized apartment and eat something better than flavored algae. Rich enough to*



Artemis Cover Art

*pay off a debt she's owed for a long time.*

*So when a chance at a huge score finally comes her way, Jazz can't say no. Sure, it requires her to graduate from small-time smuggler to full-on criminal mastermind. And it calls for a particular combination of cunning, technical skills, and large explosions—not to mention sheer brazen swagger. But Jazz has never run into a*

*challenge her intellect can't handle, and she figures she's got the 'swagger' part down.*

*The trouble is, engineering the perfect crime is just the start of Jazz's problems. Because her little heist is about to land her in the middle of a conspiracy for control of Artemis itself.*

*Trapped between competing forces, pursued by a killer and the law alike, even Jazz has to*

*(Continued on page 11)*



## Radio Bursts (Cont'd)

(Continued from page 3)

Western Australia.

Using those and one of the previously pinpointed FRBs, scientists calculated the density of normal matter across a large swath of the local universe. The researchers found that, if extrapolated across the universe, there was enough normal matter to account for the half that was missing, in line with theoretical predictions.

“To see how well the FRB experiment is working with even a small sample was both surprising and gratifying,” says team member Xavier Prochaska of the University of California’s Lick Observatory. “It checks off this fundamental aspect of cosmology. Crisis averted!”

The FRB technique could also be used to map variations in matter density across the universe. That could help theorists understand how matter clumps together into the “cosmic web,” the [network of galaxy clusters strung across the universe](#). So far, astronomers can see the glowing galaxies that make up the web, but not the gas between them. The ASKAP researchers hope to build up a collection of about 100 FRBs with known sources over the next year, so they will know not just that the normal matter is there, but exactly where it is hiding.

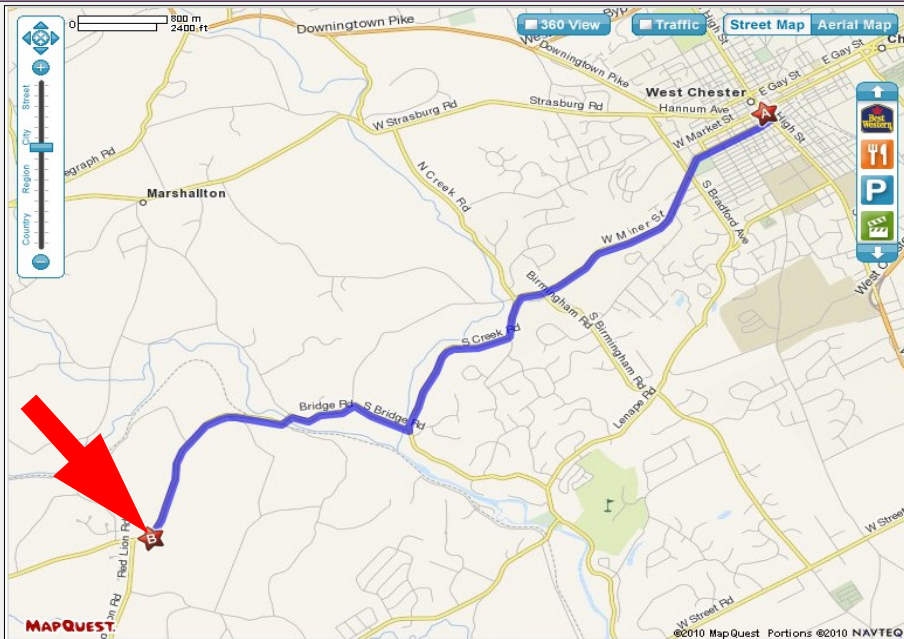
## Observing (Cont'd)

(Continued from page 5)

ues to be in excellent viewing position through all of June. At 8<sup>th</sup> magnitude it passes near three galaxies: M109 on the 17<sup>th</sup>, M106 on the 24 and NGC 4449 on the 27<sup>th</sup>. I observed T2 in mid-May with a good sized Dobsonian from a dark site but with a nearly first quarter Moon and it was an easily visible fuzzy gray blob. To find T2 use your favorite astronomy app or you can find a sky chart in the June issue of Astronomy magazine.

**Meteor showers:** There are no major meteor showers during June. If you do happen to see a very slow meteor late in the month it could be a Böotid meteor, but this shower is so sparse and unpredictable it cannot be called a meteor shower.

## 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.

## Through the Eyepiece: The Serpens-Ophiuchus Double Cluster or the Tweedledum and Tweedledee Clusters

by Don Knabb, CCAS Treasurer & Observing Chair



Here is a screen shot from the free planetarium software Stellarium.

At nearly any summer or fall star party one of the favorite objects for observing in binoculars or a wide field telescopic view is the famous Double Cluster in Perseus. The Double Cluster is the common name for the naked-eye open clusters NGC 884 and NGC 869, which are close together in the constellation Perseus.

But another beautiful double cluster is the Serpens-Ophiuchus Double Cluster, or more easily called the S-O double cluster.

This pair of open clusters is made up of NGC 6633 and IC 4756. These open clusters have been named the Tweedledum and Tweedledee clusters by astronomy author Steven James O'Meara. NGC 6633 is also called the Captain Hook Cluster or the Wasp-Waist Cluster. IC 4756 has other names also, such as Graff's Cluster or the Secret Garden Cluster.

I came across this pair of objects in the book *Summer Stargazing*, by Terence Dickinson.

Several years ago I was researching objects for a program that Barb and I presented at Hickory Run State Park that we called "Binocular Stargazing". The idea of the program was that when most people go camping they carry a pair of binoculars, and many people are not aware that any pair of binoculars will reveal a host of beautiful objects in the sky.

I created the sky chart using

*(Continued on page 11)*

## Eyepiece (Cont'd)

(Continued from page 10)

Stellarium, the free planetarium software. Note that NGC 6633 is identified as the Tweedledum Cluster and IC 4756 is labeled as Graff's Cluster. The double cluster is easy to find with binoculars if you scan between Ophiuchus and Aquila. On a very clear night with no Moon, both clusters can be glimpsed at the very edge of naked eye visibility.

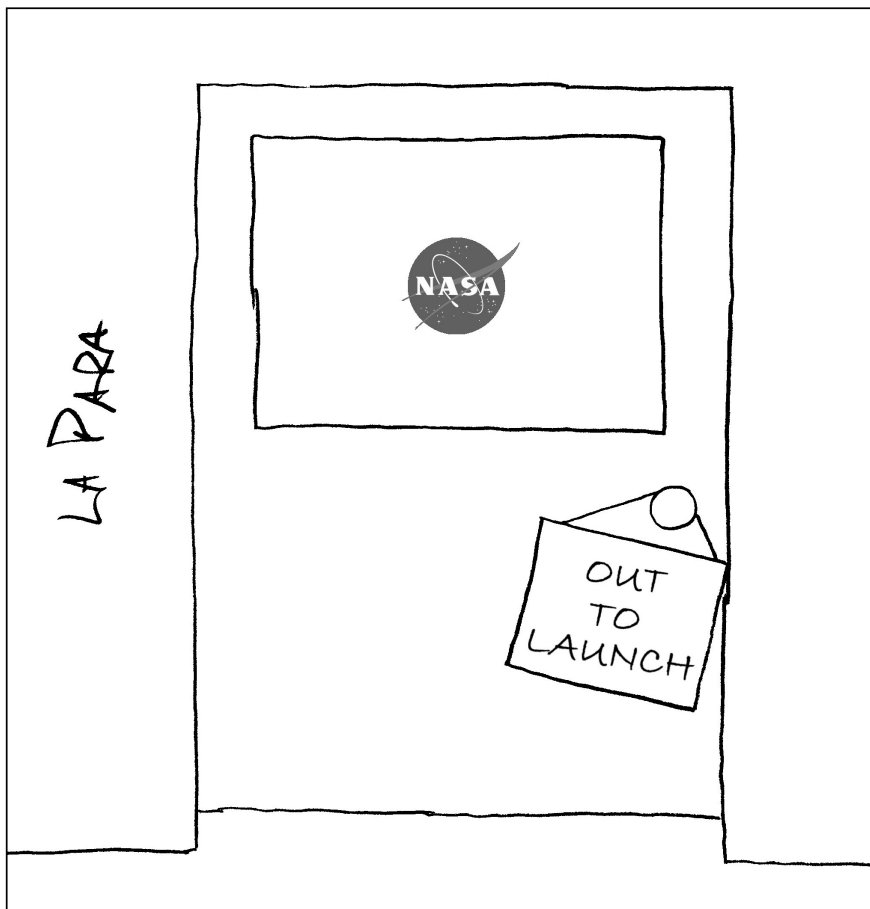
IC 4756 has an apparent magnitude of 4.6 and lies about 1600 light years away. It is estimated to be 700 million years old. NGC 6633 was discovered in 1745 by Philippe Loys de Chéseaux and was independently rediscovered by Caroline Herschel, and was included in her brother's catalog as H VIII.72. This cluster is nearly as large as the full moon, and contains 30 stars which make it shine at a total magnitude of 4.6; the brightest star is of mag 7.6. Its age is estimated at 660 million years.

An open cluster is a group of up to a few thousand stars that were formed from the same giant molecular cloud and have roughly the same age. More than 1,100 open clusters have been discovered within the Milky Way galaxy, and many more are thought to exist. They are loosely bound to each other by mutual gravitational attraction and become disrupted by close encounters with other clusters and clouds of gas as they orbit the galactic center. Open clusters generally survive for a few hundred million years. In contrast, the more massive globular clusters of stars exert a stronger

(Continued on page 14)

## Classic La Para

by Nicholas La Para



[Editor's Note: I thought this would be an appropriate choice of cartoons to celebrate the successful launch of SpaceX on Saturday, May 30, 2020. JCH]

## Artemis (Cont'd)

(Continued from page 8)

*admit she's in way over her head. She'll have to hatch a truly spectacular scheme to have a chance at staying alive and saving her city.*

*Jazz is no hero, but she is a very good criminal. That'll have to do."*

According to Weir, "None of my stories have a moral or a point to be made. I just want the reader to think "Well, that was cool!" when they're done."

I have a copy of *Artemis* should anyone care to borrow it.

## Anniversary (Cont'd)

(Continued from page 7)

"Hale's vision and leadership made Pasadena the center of the astronomer's universe," says George Djorgovski, a professor and executive officer for astronomy at Caltech. "Without him, Caltech—with its impact reaching far beyond astronomy—would not have existed. I think that Hale would have been proud to see where his vision led."

[Read the complete article a view more photos at https://www.caltech.edu/about/news/celebrating-caltechs-founder-and-builder-large-telescopes-82669](https://www.caltech.edu/about/news/celebrating-caltechs-founder-and-builder-large-telescopes-82669)

## NASA Night Sky Notes: Summer Triangle Corner—Vega

by David Prosper & Vivian White

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](https://nightsky.jpl.nasa.gov) to find local clubs, events, stargazing info and more.

If you live in the Northern Hemisphere and look up during June evenings, you'll see the brilliant star **Vega** shining overhead. Did you know that Vega is one of the most studied stars in our skies? As one of the brightest summer stars, Vega has fascinated astronomers for thousands of years.

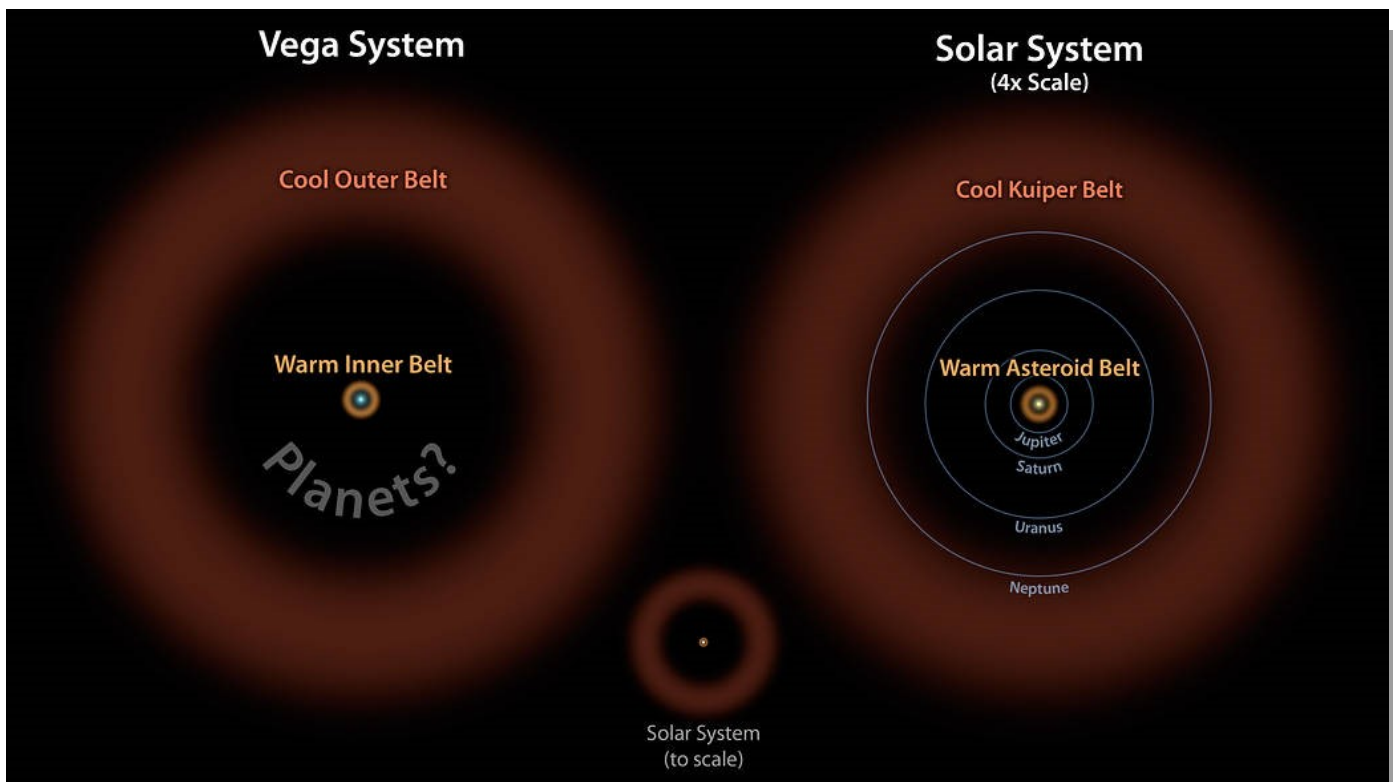
Vega is the brightest star in the small Greek constellation of Lyra, the harp. It's also one of the three points of the large "Summer Triangle" asterism, making Vega one of the easiest stars to find for novice stargazers. Ancient humans from 14,000 years ago likely knew



Vega for another reason: it was the Earth's northern pole star! Compare Vega's current position with that of the current north star, Polaris, and you can see how much the direction of Earth's axis changes over thousands of years. This slow movement of axial rotation is called **precession**, and in 12,000 years Vega will return to the northern

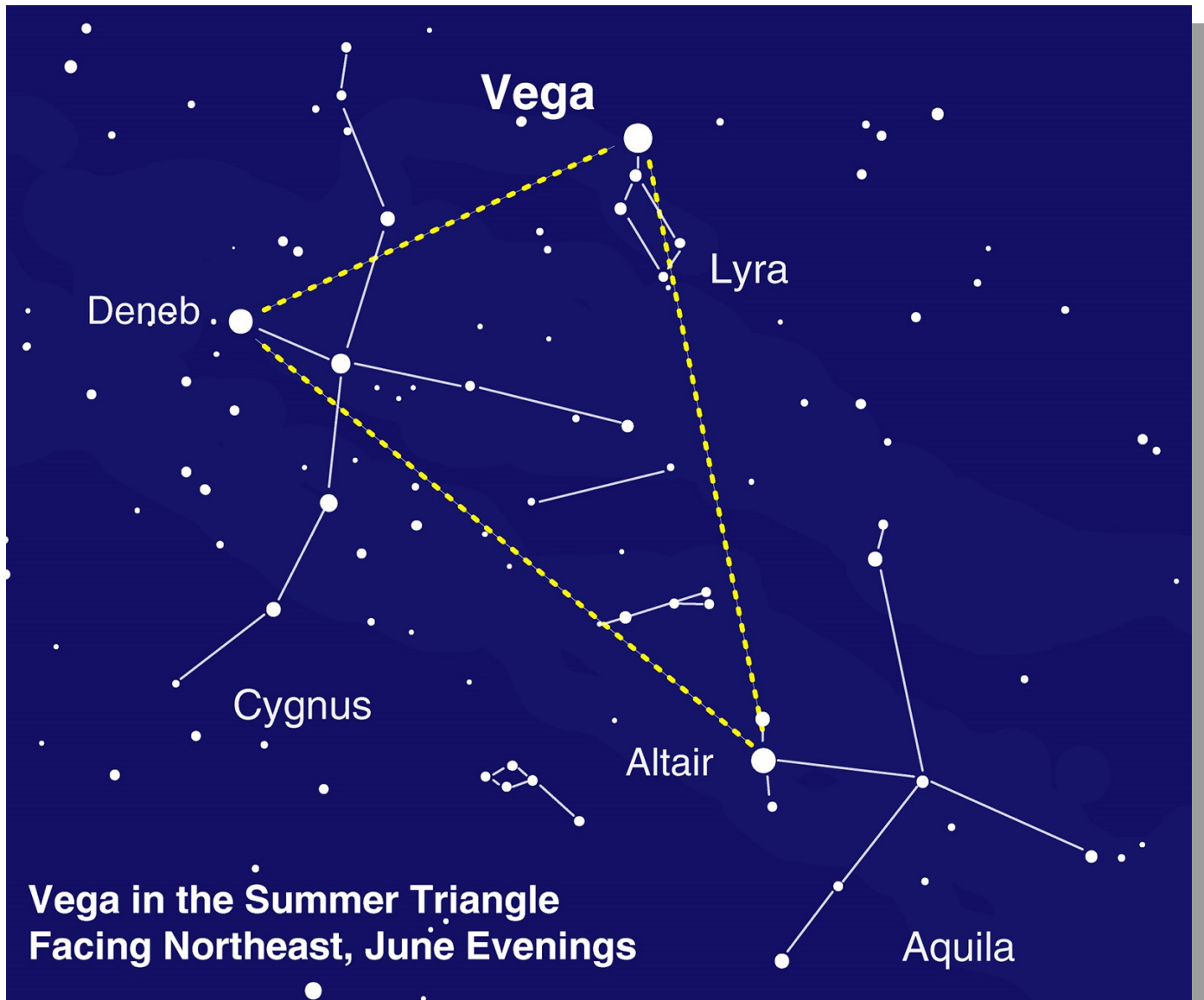
pole star position. Bright Vega has been observed closely since the beginning of modern astronomy and even helped to set the standard for the current magnitude scale used to categorize the brightness of stars. Polaris and Vega have something else in common, besides being once and future pole stars: their brightness varies over time, making them **variable stars**. Variable stars' light can change for many different reasons. Dust, smaller stars, or even planets may block the light we see from the star. Or the star itself might be unstable with active sunspots, expansions, or eruptions changing its brightness. Most stars are so far away that we only record the change in light, and can't see their surface.

(Continued on page 13)



Vega possesses two debris fields, similar to our own solar system's asteroid and Kuiper belts. Astronomers continue to hunt for planets orbiting Vega, but as of May 2020 none have been confirmed. More info: [bit.ly/VegaSystem](https://bit.ly/VegaSystem) Credit: NASA/JPL-Caltech

## Night Sky Notes (Cont'd)



*Can you spot Vega? You may need to look straight up to find it, especially if observing after midnight.*

*(Continued from page 12)*

NASA's TESS satellite has ultra-sensitive light sensors primed to look for the tiny dimming of starlight caused by transits of extrasolar planets. Their sensitivity also allowed TESS to observe much smaller pulsations in a certain type of variable star's light than previously observed. These observations of **Delta Scuti** variable stars will help astronomers mod-

el their complex interiors and make sense of their distinct, seemingly chaotic, pulsations. This is a major contribution towards the field of astroseismology: the study of stellar interiors via observations of how sound waves "sing" as they travel through stars. The findings may help settle the debate over what kind of variable star Vega is. Find more details on this research, including a sonification

demo that lets you "hear" the heartbeat of one of these stars, at: [bit.ly/DeltaScutiTESS](https://bit.ly/DeltaScutiTESS)

Interested in learning more about variable stars? Want to observe their changing brightness? Check out the website for the American Association of Variable Star Observers (AAVSO) at [aavso.org](https://aavso.org). You can also find the latest news about Vega and other fascinating stars at [nasa.gov](https://nasa.gov).

## CCAS Directions

### West Chester University Campus

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



### Eyepiece (Cont'd)

(Continued from page 11)

gravitational attraction on their members, and can survive for many billions of years.

Information credits:

- Dickinson, Terence 1996. *Summer Stargazing*. Firefly Books
- Stellarium planetarium software
- SkySafari Pro iPad app
- <http://www.deepskyforum.com/>  
NGC 6633 and Graff 1 The Tweedledum and Tweedledee Clusters

### CCAS Membership Information and Society Financials

#### Treasurer's Report

by Don Knabb

#### May 2020 Financial Summary

Beginning Balance	\$958
Deposits	\$70
Disbursements	-\$0
Ending Balance	\$1028

#### New Member Welcome!

Welcome new CCAS members Dexter Chisholm and Joan Odell from Unionville, PA. We're glad you decided to join us under the stars! Clear skies to you!

#### Membership Renewals

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

**Don Knabb**  
988 Meadowview Lane  
West Chester PA 19382

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

**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](mailto: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**

PENNSYLVANIA OUTDOOR



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](mailto:newsletter@ccas.us)

Or mail the contribution, typed or handwritten, to:

**Dr. John C. Hepler**  
21103 Stripper 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](mailto: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](mailto: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](mailto:treasurer@ccas.us)

### Sky & Telescope 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**.