Observations

A Monthly Publication Of The CHESTER COUNTY ASTRONOMICAL SOCIETY

Vol. 27, No. 6 ***Three-Time*** *Winner of the Astronomical League's Mabel Sterns Award ☼ 2006, 2009 & 2016* *June 2019*

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The Leo Triplet: M65, M66 & NGC 3628

Image courtesy of longtime CCAS Member Pete LaFrance

June 2019 Dates

3rd • New Moon, 6:01 a.m. EDT

4th • Two moon shadows are visible on Jupiter just after it rises

10th • Jupiter is at opposition

10th • First Quarter Moon, 1:59 p.m. EDT, and the Lunar Straight Wall is visible

17th • Mars and Mercury are very close just after sunset

17th • Full Moon, the Full Strawberry Moon or the Trees Fully Leaved Moon, 4:38 a.m. EDT

25th • Last Quarter Moon, 5:46 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.

☼ **Saturday, June 8, 2019** - CCAS Special Observing Session at Bucktoe Creek Preserve, Avondale, PA, from 8:30 to 10:00 p.m. The event is open to be public but registration for non-CCAS members is required through The Land Conservancy for Southern Chester County website.

☼ **Friday, July 12, 2019** - Friday Night Lights at ChesLen Preserve, Coatesville, PA. CCAS members who want to assist with the astronomy portion of this event must bring a telescope or mounted astronomical binoculars to qualify for free admission. Members must contact Don Knabb by June 9th.

Spring/Summer Society Events

June 2019

30th • End of Cherry Springs Star Party, Coudersport, PA.

7th • CCAS Monthly Observing Session, Myrick Conservancy Center, BRC. The observing session starts at sunset.

8th • CCAS Special Observing Session at Bucktoe Creek Preserve, Avondale, PA, from 8:30 to 10:00 p.m. The event is open to be public but registration for non-CCAS members is required through The Land Conservancy for Southern Chester County website. A small fee is required by The Land Conservancy of Southern Chester County to attend this event.

20th-21st • The von Kármán Lecture Series: Such Stuff as Dreams are Made On—Designing Tomorrow's Space Missions Today, at the Jet Propulsion Laboratory, Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

20th • Open call for articles and photographs for the July 2019 edition of Observations.

20th • Solstice (northern summer/southern winter begins), 11:54 a.m. EDT.

26th • Deadline for newsletter submissions for the July 2019 edition of Observations.

July 2019

11th-12th • The von Kármán Lecture Series: Apollo 50th Anniversary, Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

12h • 9th Annual Friday Night Lights at ChesLen Preserve, Coatesville, PA, this is a fundraiser for the Natural Lands Trust where music is provided. Several local astronomy clubs are setting up telescopes for the concert goers to view the night sky during the event. If you are not a member of CCAS you must purchase tickets from the Natural Lands Trust. CCAS members who want to assist with the astronomy portion of this event must bring a telescope or mounted astronomical binoculars to qualify for free admission.

13th • WCU Astronomy Department Apollo 50 Year Celebration - WCU Campus Main Quad.

20th • Open call for articles and photographs for the August 2019 edition of Observations.

26th • CCAS monthly observing session at Myrick Conservancy Center, BRC. The observation session starts at dusk.

26th • Deadline for newsletter submissions for the August 2019 edition of Observations.

CCAS Monthly Meeting Minutes

by Bea Mazziotta, CCAS Secretary

- The May 14, 2019, meeting was held in Rm 113 of the Merion Science Center, WCU. Club President Dave Hockenberry welcomed 19 members & attendees.
- He presented Kathy Buczynski with the NASA Night Sky Network certificate and pin for exceptional community outreach.
- After thanking Don and Barb for years of generously hosting the club's annual social events, Dave asked members to volunteer to host future events.
  - Kathy Buczynski suggested perhaps looking for an outside venue, such as a park, for the picnic. Going to a restaurant again for the holiday party was also mentioned. Please contact Dave directly if you would like to host or have location ideas.
- Don Knabb reviewed some upcoming events, which include Saturday, May 25, 2019, at Welkinweir and Saturday, June 8, 2019, at Bucktoe Creek Preserve. A complete list of upcoming observing sessions and star parties is on the CCAS website.
  - Don announced that a new lending scope, a 12" Dobsonian, is now available to club members. An 8" Dynascope free to anyone interested. It will require some work.
  - Don took us on a quick tour of some of his favorite objects in the May night sky. These include IC 4665, the Summer Beehive, in Ophiuchus; M6 and M7 as well as some other open clusters and M22, one of the brightest visible globular clusters.
- The guest speaker was Chris D'Andrea. He is a Physics and Astronomy professor at Haverford College and the co-Chair of the Supernova Group in the DES (dark energy survey).
- His topic was Supernovae, the different types, how they occur, and what they leave behind. In a Type I supernova a binary star accretes matter from its companion until a runaway nuclear reaction ignites.
- In a Type II supernova, a star runs out of nuclear fuel and collapses under its own gravity. Other types have also been discovered in recent years.
- These unimaginably massive explosions give rise to new stars and planets. Though they are seen only every 50 years or so in our Milky Way (we are overdue), scientists say one happens every second somewhere in the universe.

Former CCAS President Receives Founder's Award

by Dave Hockenberry, CCAS President

Former CCAS President Roger Taylor received the CCAS Founder's Award at the March 2019 monthly meeting. Roger is the sixth recipient of the award, which was created in April 2006 in honor the Society's founder, Edwin T. Lurcott.

New Lending Scope

by Don Knabb, CCAS Treasurer & Observing Chair

New Lending Scope: 12" Orion Dobsonian Telescope

We have a new lending scope available. This is a really nice scope, but it is quite large and is not easy to handle. It is a scope that should be used by experienced observers who know how to handle a large scope. Also, the scope does not come with any eyepieces, so anyone wishing to borrow the scope will need to supply their own eyepieces.

This is a 12 inch Orion Dobsonian. It sat in a garage for several years before it came to us. I had the mirror recoated because it had substantial deterioration. Also, I donated a red dot finder and the club supplied a "Y" adapter so the scope has both a correct-image telescopic finder and the red dot finder.

I had the scope out at our Hoopes Park star party and the image was excellent. I would like to keep it for one more clear night since I promised to give my neighbor a look through it.

If you are interested to borrow the scope send me an email at observing@ccas.us. If we have several members interested to borrow it, we will need to take turns with it.

Theorist Calculates Merging Black Holes

by Adrian Cho, Science Magazine

Just a month into a renewed observing campaign with a trio of detectors, physicists today announced they have spotted more gravitational waves—fleeting ripples in space set off when two massive objects such as black holes spiral into each other. The collaboration has now bagged 13 merging black hole pairs, as well as two pairs of neutron stars. But even as detections accumulate, one theorist has made an advance that could change how the team analyzes the signals and make it easier to test Albert Einstein's theory of gravity, general relativity.

To interpret their signals gravitational wave hunters compare them to computer simulations. Now, Sean McWilliams, a theoretical astrophysicist at West Virginia University in Morgantown, has calculated an exact mathematical formula for the signal, or waveform, produced by two merging black holes.

"It's a big step forward," says Neil Cornish, a gravitational wave astronomer at Montana State University in Bozeman who was not involved in the work. "It's going to allow for more accurate waveforms for doing analysis. But it also gives us more insight into what's going on" in a black hole merger.

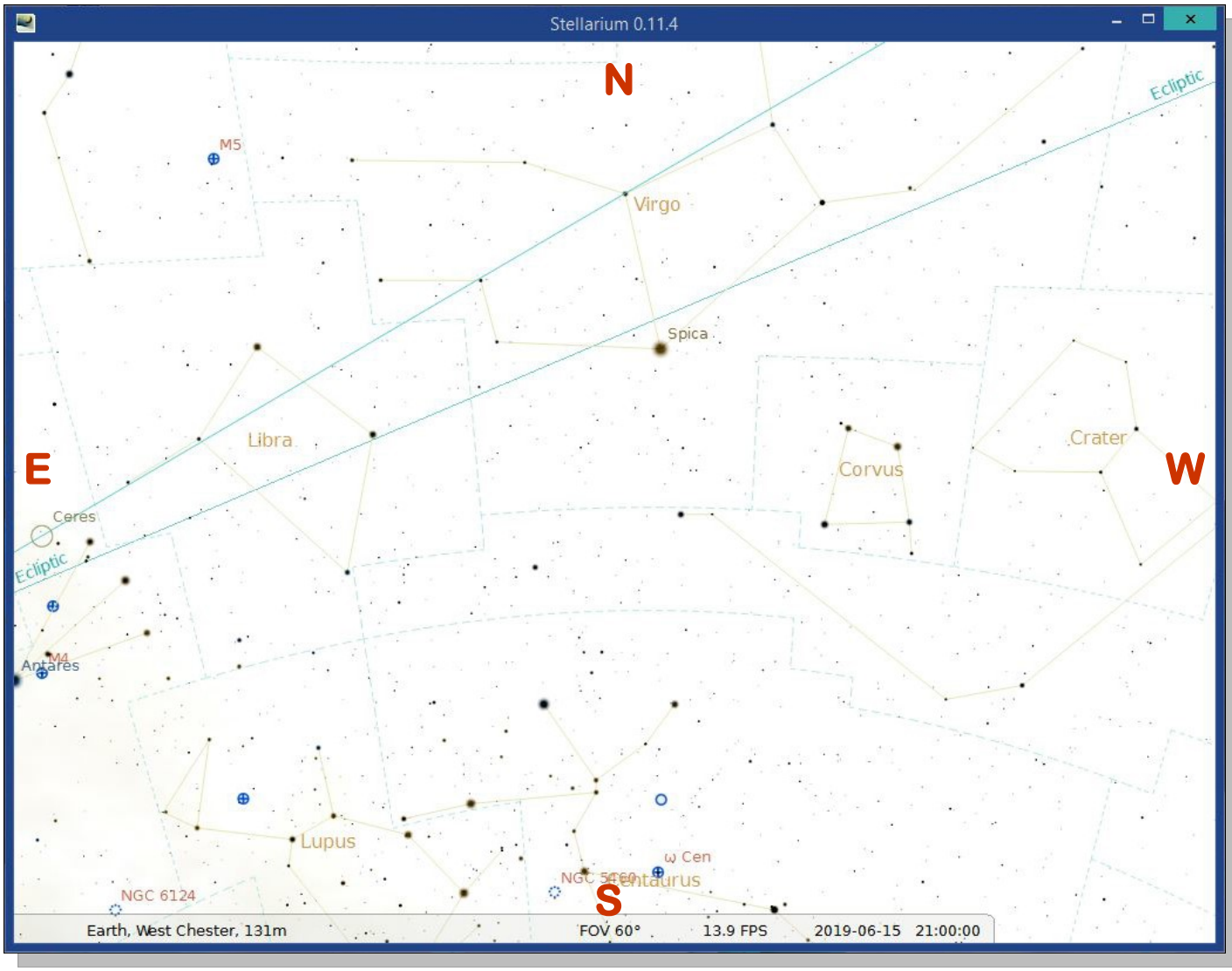
In 1916, Einstein predicted that as two stars orbit each other they'd radiate gravitational waves, although he figured the waves would be too feeble to detect. In 2015, physicists with the Laser Interferometer Gravitational-Wave Observatory (LIGO) spotted a burst of waves

(Continued on page 7)

The Sky Over Chester County

June 15, 2019 at 9:00 p.m. ET

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



Date	Civil Twilight Begins	Sunrise	Sunset	Civil Twilight Ends	Length of Day
06/01/2019	5:02 a.m. EDT	5:34 a.m. EDT	8:23 p.m. EDT	8:24 p.m. EDT	14h 48m 56s
06/15/2019	4:58 a.m. EDT	5:31 a.m. EDT	8:30 p.m. EDT	9:03 p.m. EDT	14h 59m 32s
06/30/2019	5:02 a.m. EDT	5:35 a.m. EDT	8:33 p.m. EDT	9:06 p.m. EDT	14h 58m 08s

Moon Phases					
			New Moon	06/03/2019	6:01 a.m. EDT
First Quarter	06/10/2019	1:59 a.m. EDT	Full Moon	06/17/2019	4:30 a.m. EDT
Last Quarter	06/25/2019	5:46 a.m. EDT			

June 2019 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

3	**New Moon, 6:01 a.m. EDT**
4	**Two moon shadows are visible on Jupiter just after it rises**
10	**First Quarter and the Lunar Straight Wall is visible, 1:59 a.m. EDT**
10	**Jupiter is at opposition**
17	**Full Moon, the Full Strawberry Moon or the Trees Fully Leaved Moon, 4:30 a.m. EDT**
17	**Mars and Mercury are very close just after sunset**
19	**The Moon is 1 degree away from Jupiter**
25	**Last Quarter Moon, 5:46 a.m. EDT**
26	**The Lunar Curtiss X is visible around 1 a.m.**

The best sights this month: Jupiter takes center stage during June and we'll be enjoying the king of the planets all summer! Watch as the four Galilean moons shift their position from night to night, even from hour to hour if you are star gazing for a long evening. Stay up a bit late and peer toward the center of our Milky Way Galaxy as the constellations of summer rise into the southern sky. This area of the sky is filled with wondrous sights.

Mercury: Mercury is visible all month but as always it is a race between having enough darkness to see Mercury but seeing it while it is still high enough above the horizon to be out of the atmospheric "muck". On June 17th Mercury and Mars are only ¼ degree apart. Use binoculars to help you find this elusive planet.

Venus: Our sister planet continues to fall toward the sunrise during June and will soon pass behind the Sun.

Mars: The red planet is falling farther behind us in our race around the Sun and is getting dimmer and smaller. But a worthwhile sight will be on the evening of June 28th as the sky darkens look toward the west for a nice lineup of Mercury, Mars, Pollux and Caster.

Jupiter: Jupiter reaches opposition on June 10th so it will be visible all night. The last few nights when I get up to use the litter box in the middle of the night, I gaze out the window and see Jupiter shining so very brightly in the south. I am looking forward to seeing the king of the planets in the eyepiece of a telescope.

Saturn: By the end of June Saturn will be rising during evening twilight. The ringed planet is to the left of the Teapot asterism of Sagittarius and is also easily seen during my middle-of-the-night observing sessions out the window.

Uranus and Neptune: Neither gas giant is in good viewing position during June.

The Moon: The Moon is full on June 17th. 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.

Constellations: Ah, the summer sky. Yes, you must stay up later to see the stars but at least you won't be shivering! Say goodbye to Leo the Lion as he dives into the west. Look for Scorpius if you have a clear southern horizon and see the bright star Antares shining like a red heart in the big bug of summer. In the east, we have bright Vega in Lyra followed by the birds of summer: Cygnus the Swan and Aquila the Eagle.

Messier/deep sky: There are many wonderful deep sky objects to see during June. My favorites this time of year are the globular clusters. Look for M3 and M5 high overhead, then find M4 near Antares in Scorpius and M22 in Sagittarius. Then seek M10 and M12 in Ophiuchus. Of course, I cannot forget to mention the brightest globular cluster in northern skies, M13 in Hercules. There are many nice other globular clusters, but M13 in Hercules is an amazing object if the skies are dark and clear. As astronaut Dave Bowman said when he looked into the monolith in orbit around Jupiter in the movie 2001,

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Through The Eyepiece: Globular Cluster M22 in Sagittarius

by Don Knabb, CCAS Treasurer & Observing Chair

Image credits: ESA/Hubble, Creative Commons file

With summer arriving we now get our best view of the southern constellations. In Sagittarius is Messier 22, also known as M22 or NGC 6656. M22 is the third brightest and most easily resolved globular cluster in the sky. M22 is the nearest globular cluster to Earth and is approximately 10,000 light years from us. It contains at least a half a million stars.

M22 is a very remarkable object. It is easily viewed with any set of binoculars and individual stars can be resolved in a telescope at least 4 inches in diameter. Under good conditions at higher magni-

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Eyepiece (Cont'd)

Sky map created using Stellarium planetarium software

(Continued from page 6)

fication you will see an eyepiece full of stars with a bright central region.

It's not hard to find M22. Late at night during June, or a bit earlier in July and August find a viewing location with a clear southern horizon. Look for the "teapot" of Sagittarius. Just to the left of the star that is the top of the lid of the teapot is a fuzzy spot – that is M22. In a dark sky location M22 is a naked eye object, but you'll need your binoculars to see it in Chester County skies.

M22 is an elliptical globular cluster. It was one of the first globulars to be discovered in 1665 by Abraham Ihle and it was included in Charles Messier's catalog of comet-like objects in 1764. The cluster lies a third of the way between Earth and the center of the Milky Way and is home to some of the oldest stars in the universe.

Although the Hercules Cluster M13 is widely recognized as the most striking globular cluster visible from northern latitudes, M22 is actually brighter but harder to see due to its position low in the southern sky in our area. As viewed from Earth, M22 spans an area the size of the full moon, but only the central region is visible through telescopes.

Information sources:

http://en.wikipedia.org/wiki/Messier_22
http://www.seds.org/messier/m/m022.html
http://www.stardoctor.org/M22.html
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.

Black Holes (Cont'd)

(Continued from page 3)

from two black holes that merged 1.3 billion light-years away, using their huge optical instruments in Hanford, Washington, and Livingston, Louisiana. The Virgo detector near Pisa, Italy, joined the hunt in August 2017, enabling the collaboration to triangulate to the sources of the events on the sky.

As two black holes spiral ever closer, they emit ripples in space that speed up. The waves' intensity peaks as the two objects collide, and then peter out as the final, merged black hole undulates and settles down. To decipher the signal and determine the black holes' masses and other parameters, scientists compare it to a catalog of simulated signals, a tack they have taken because of the complexity of the problem.

According to general relativity, gravity arises when mass and energy warp space-time. And a black hole is the ultra intense gravitational field left behind when a massive star collapses to an infinitesimal point. So when two black holes swirl together, warping begets warping and renders the mathematics "nonlinear" and intractable.

Or so many scientists assumed. McWilliams says he has found a way to calculate the signal mathematically after all, as he reports in a paper in press at Physical Review Letters.

The calculation involves special distances from the center of the black hole. Famously, nothing can escape a black hole if it draws closer than a characteristic distance called the event horizon. At a distance about 1.5

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NASA Night Sky Notes: Jupiter Shines in June

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.

Jupiter stakes its claim as the king of the planets in June, shining bright all night. **Saturn** trails behind Jupiter, and the **Moon** passes by both planets mid-month. **Mercury** puts on its best evening appearance in 2019 late in the month, outshining nearby **Mars** at sunset.

Jupiter is visible almost the entire evening this month. Earth will be between Jupiter and the Sun on June 10, meaning Jupiter is at **opposition**. On that date, Jupiter rises in the east as the Sun sets in the west, remaining visible the entire night. Jupiter will be one of the brightest objects in the night sky, shining at magnitude -2.6. Its four largest moons and cloud bands are easily spotted with even a small telescope.

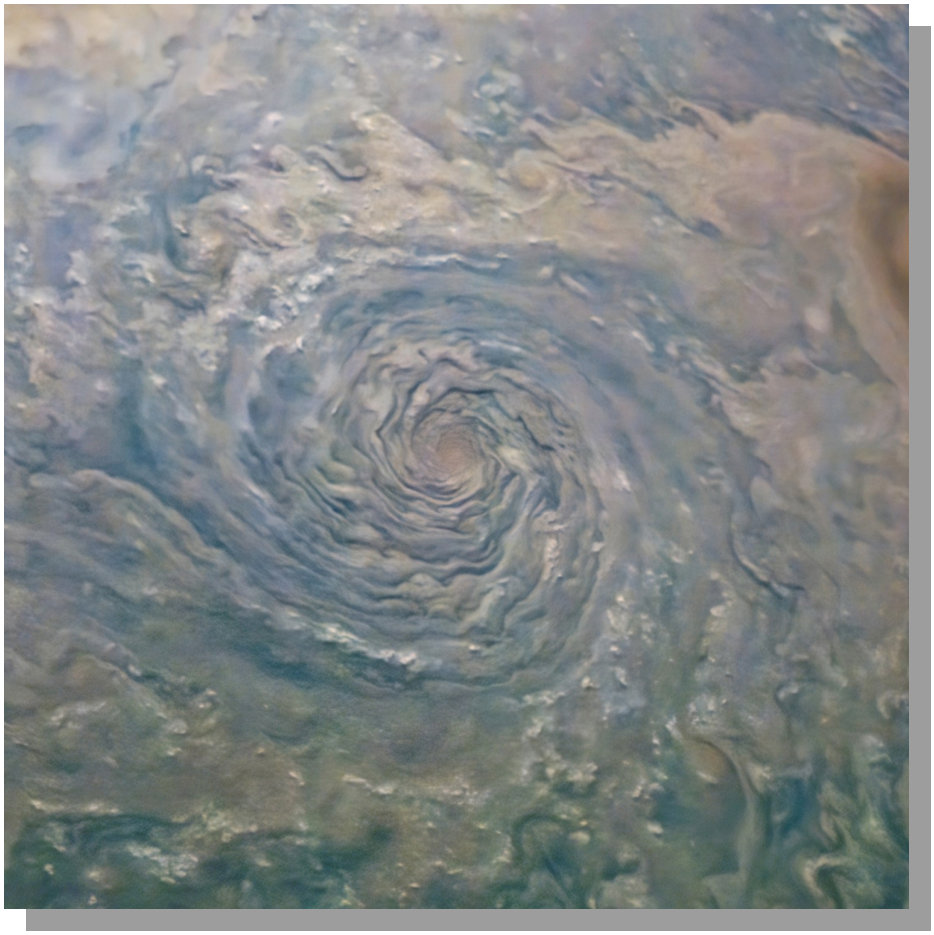
What if your sky is cloudy or you don't have a telescope? See far more of Jupiter than we can observe from Earth with NASA's **Juno** mission! Juno has been orbiting Jupiter since 2016, swooping mere thousands of miles above its cloud tops in its extremely elliptical polar orbits, which take the probe over 5 million miles away at its furthest point! These extreme orbits minimize Juno's exposure to Jupiter's powerful radiation as it studies the gas giant's internal structure, especially its intense magnetic fields. Juno's hardy

JunoCam instrument takes incredible photos of Jupiter's raging storms during its flybys. All of the images are available to the public, and citizen scientists are doing amazing things with them. You can too! Find out more at bit.ly/JunoCam

Saturn rises about two hours after Jupiter and is visible before midnight. The ringed planet rises earlier each evening as its own opposition approaches in July. The **Moon** appears near both gas giants mid-month. The Moon's tour begins on June 16 as it approaches Jupiter, and its visit ends on June 19 after swinging past Saturn.

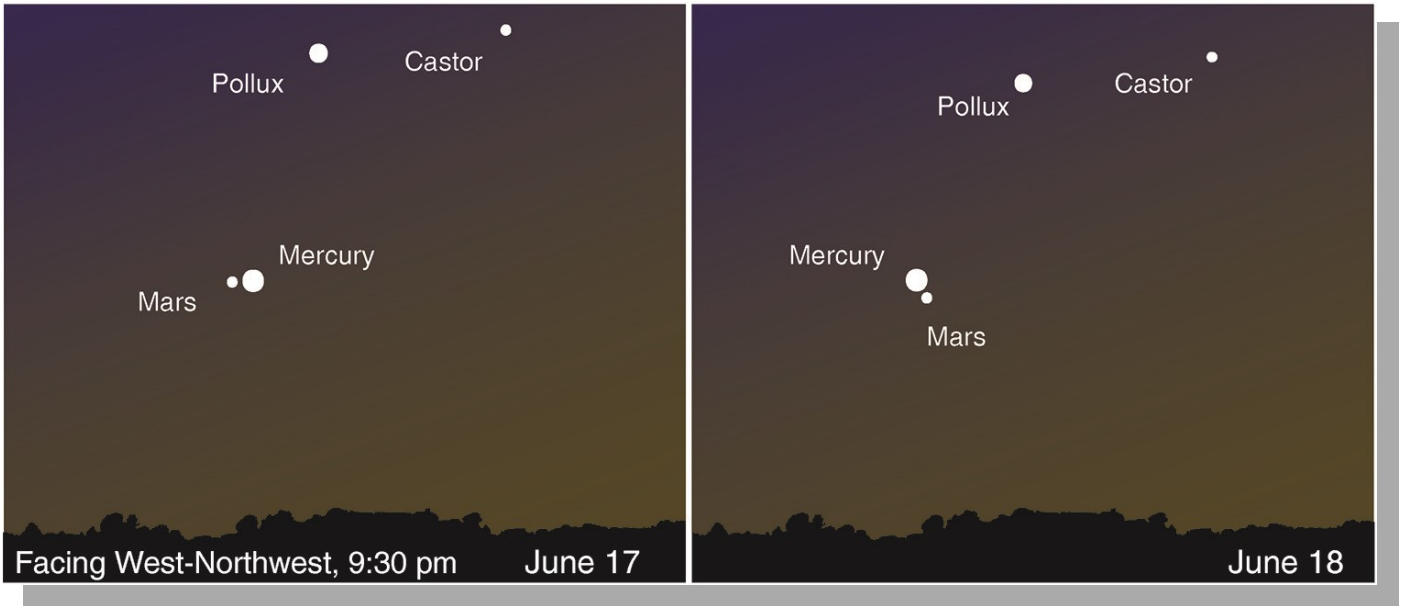
Mercury is back in evening skies and will be highest after sunset on June 23, just two days after the summer solstice! Spot it low in the western horizon, close to the much dimmer and redder **Mars**. This is your best chance this year to spot Mercury

(Continued on page 9)



A giant storm in Jupiter's north polar region, captured by JunoCam on February 4, 2019. Image processing performed by citizen scientists Gerald Eichstädt and Seán Doran. Source: bit.ly/JupiterSpiral

Night Sky Notes (Cont'd)



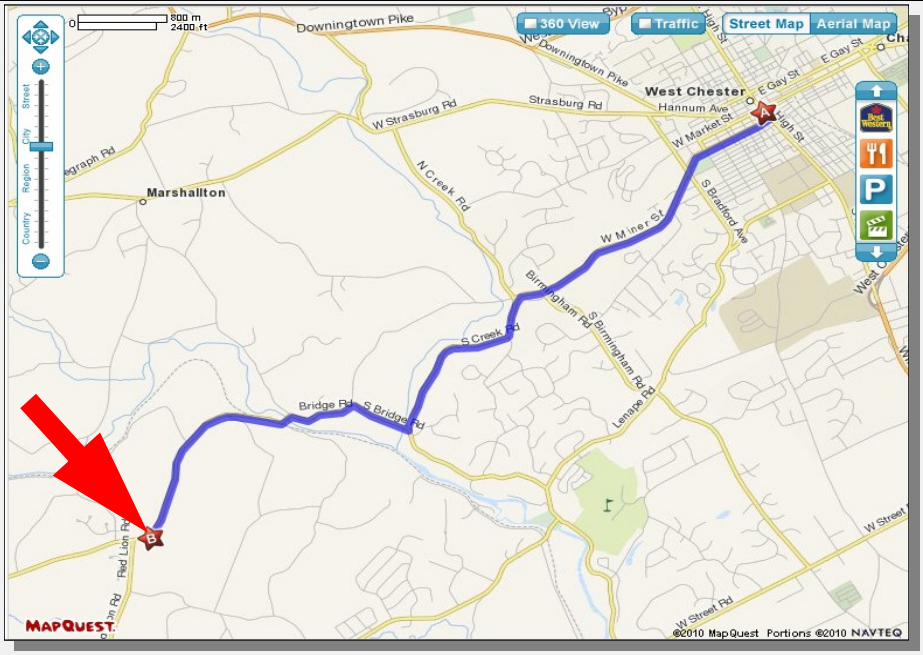
Mars and Mercury after sunset the evenings of June 17-18, 2019. Image created with assistance from Stellarium.

(Continued from page 8)

in the evening, and nearly your last chance to see Mars, too! The two smallest planets of our solar system pass close to each other the evenings of June 17-18, coming within just ¼ degree, or half the width of a full Moon, making for a potentially great landscape photo at twilight.

Discover more about NASA's current and future missions at nasa.gov

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).

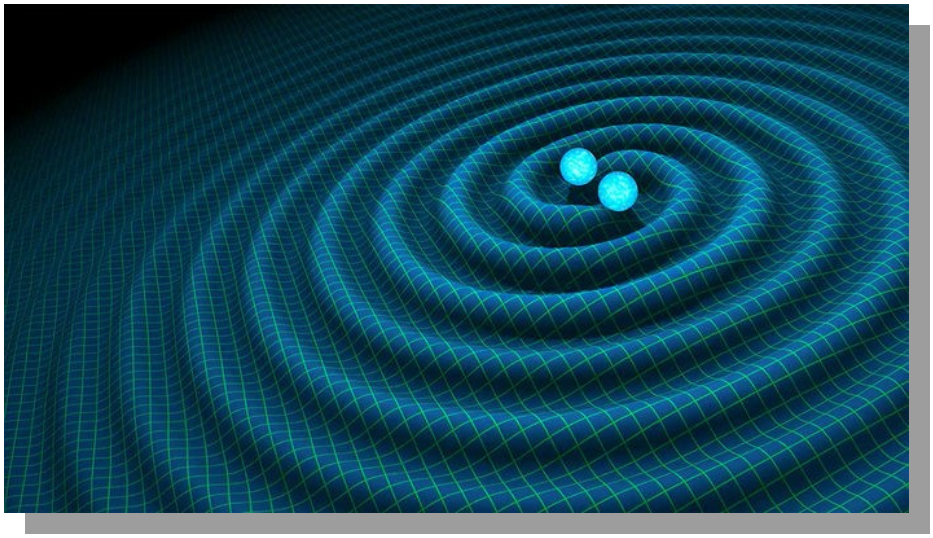
Black Holes (Cont'd)

(Continued from page 7)

times that of the event horizon, the black hole's gravity will bend passing light into a circular orbit, defining the "light ring." A distance roughly three times that of the event horizon marks the limit for a massive object to maintain a circular orbit and not spiral in, a threshold called the innermost stable circular orbit (ISCO).

Previous attempts to calculate the exact waveform from a black hole merger relied on a standard mathematical transformation, turning the problem of two orbiting black holes into one of a single body spiraling in a funnel-shaped energy landscape. But within the ISCO, the body stops spiraling, forcing researchers to correct its path with numerical simulations. McWilliams realized he could avoid that problem by skipping to the final merged black hole. He then used general relativity to calculate how a tiny test mass spirals into and perturbs the final black hole, enabling him to calculate the radiated signal from the ISCO inward.

Once the test particle reaches the light ring, tracing its trajectory becomes mathematically untenable. But McWilliams says the physics there can be ignored for a simple reason: All the churning of spacetime within the light ring cannot escape to influence the spreading gravitational waves. Essentially, the black hole itself slurps up all the nasty nonlinearities. McWilliams provides a pair of formulas that neatly match the simulations. "I'll be honest," he says, "I was rather floored how well it agrees with the results of numerical relativity."



Math may have caught up with the swirling mergers of black holes like the one in this simulation. R. HURT/CALTECH-JPL

Those formulas could prove valuable in tests of general relativity, McWilliams says, especially as black holes are objects made of pure gravitational energy, with no messy matter to get in the way. LIGO's and Virgo's observations have already confirmed general relativity's accuracy to an unprecedented level, but researchers should be able to push further as they hone their instruments' sensitivity. They'll need more precise predictions of the waveforms from general relativity, McWilliams says, and the exact formulas should be more accurate than the numerical simulations.

Lionel London, a gravitational wave theorist and LIGO team member at the Massachusetts Institute of Technology (MIT) in Cambridge, isn't so sure.

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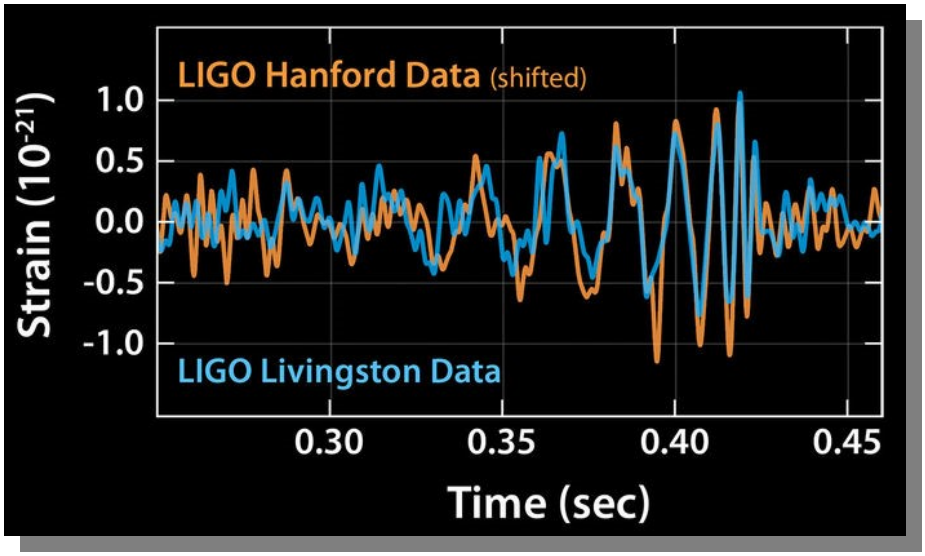
See the upcoming July 2019 edition of Observations for more about CCAS Member visits to the NASA Wallops Island Flight Facility near Chincoteague Island, Virginia.

Black Holes (Cont'd)



Two relatively simple formulas describe the peak and reverberation of gravitational wave signals like the first ones the Laser Interferometer Gravitational-Wave Observatory saw. CALTECH/MIT/LIGO LAB

(Continued from page 10)

McWilliams still has to rely on simulations to model the spiraling outside the ISCO, he notes, and that part of the signal is key to determining the masses of the initial black holes. The calculations also depend on certain simplifying assumptions, but do not provide estimates of the uncertainties carried with them, he says. The formulas are more of an "ansatz"—an educated guess at how the signal should look—than an exact solution to the problem, London says.

Cornish agrees it's too early to replace numerical relativity. Still, he says, the formulas will be useful and should spur physicists to explain why black hole mergers seem to be simpler than they had anticipated. "There's more to be learned."

In the meantime, LIGO and Virgo researchers will have no shortage of signals. During the first month of their third observing run, they have detected five new candidate events, including three black hole mergers, a second neutron star merger, and a possible black hole-neutron star merger spotted last week. The mixed merger would be another gem for scientists, as they lack even good estimates of how often such things should occur. "Because it's such an interesting astrophysical object, it's generating a lot of excitement, which I think it deserves," says Jessica McIver, a physicist and LIGO team member from the California Institute of Technology in Pasadena.

Still, the tantalizing signal is relatively weak. Researchers estimate that random noise should produce a similar spurious signal about once every 20 months, and there's a 14% chance that it originated in terrestrial vibrations. "If you ask me, 'Would you bet a coffee, your car, or your house on this?' I would say, 'I'd bet your car,'" says Salvatore Vitale, a physicist and LIGO member from MIT. To nail the case for the supposed mixed merger, astronomers would likely have to spot light and electromagnetic waves from it.

Buczynski Receives Night Sky Network Outreach Award

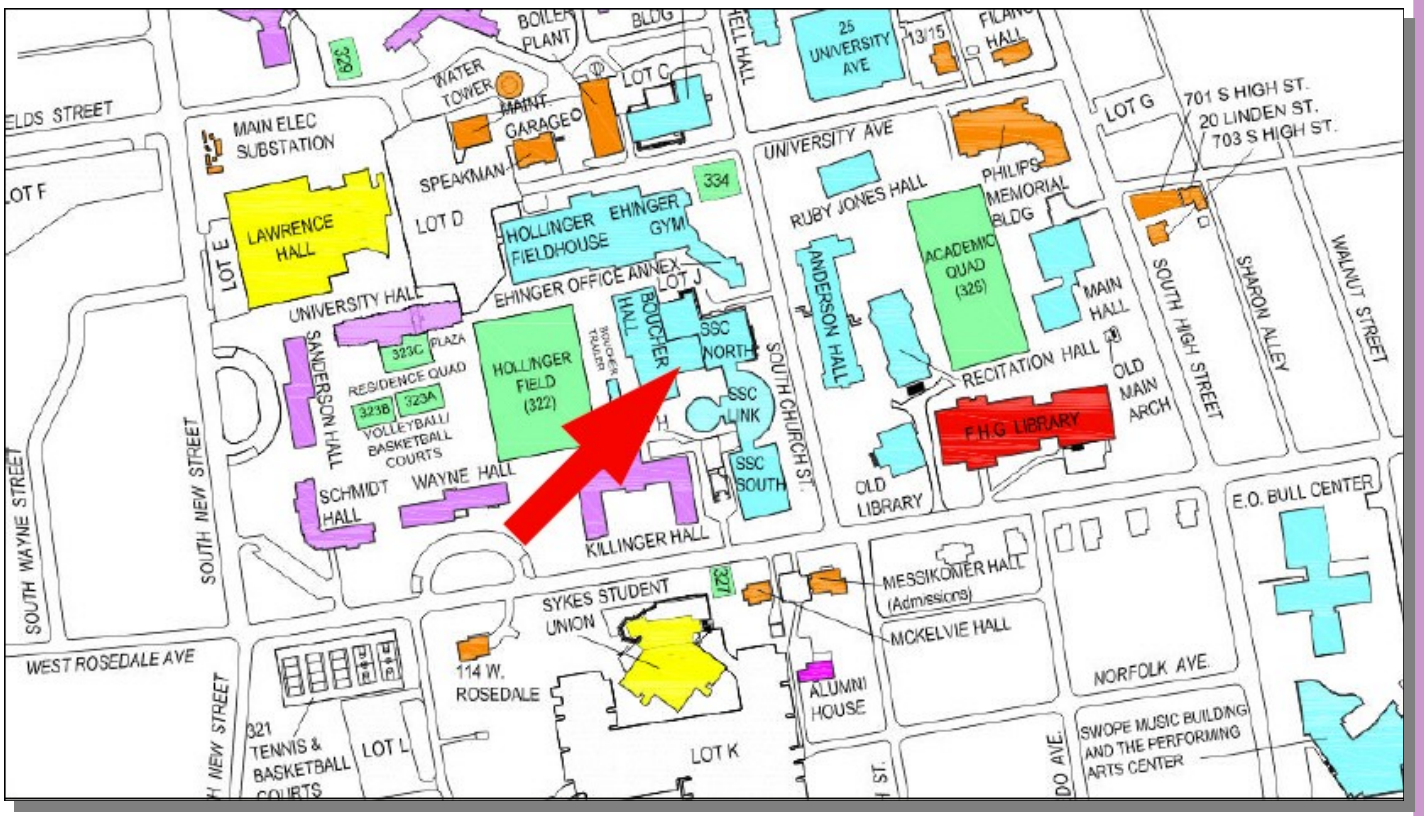
by Dave Hockenberry, CCAS President

CCAS President Dave Hockenberry presented former President and Education Chair Kathy Buczynski with her Night Sky Network Outreach Award certificate and pin at the May 14, 2019 monthly meeting.

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).



Black Hole Image (Cont'd)

(Continued from page 5)

A Space Odyssey," Oh my God, it's full of stars!" That's how I feel when I get a good look at M13.

Comets: There are no bright comets in the sky during June.

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 Boötid meteor, but this shower is so sparse and unpredictable it cannot be called a meteor shower.

CCAS Membership Information and Society Financials

Treasurer's Report

by Don Knabb

May 2019 Financial Summary

Beginning Balance	$1,348
Deposits	$45
Disbursements	-$0
Ending Balance	$1,393

New Member Welcome!

Welcome new CCAS members John & Margaret Quinn from Exton, Rangan Aylam & Janet Martin-Alyam from West Chester, and Marilyn Rossomando from Glenmoore, 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.

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

PENNSYLVANIA OUTDOOR LIGHTING COUNCIL

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!

Starry Night Lights

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

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LIGHTHOUSE OUTDOOR LIGHTING

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

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.**