Observations

A Monthly Publication Of The
CHESTER COUNTY ASTRONOMICAL SOCIETY

Vol. 28, No. 1 ***Three-Time*** *Winner of the Astronomical League's Mabel Sterns Award ☼ 2006, 2009 & 2016* *January 2020*

In This Issue

Happy New Year!

Best wishes for a bright and happy start to the third decade of the 21st century!
Image retrieved from http:piqsels.com

Membership Renewals Due

01/2020	Kellerman Kovacs McElwee
02/2020	Ruggeri
03/2020	Angelini DellaPenna Fulton Sterrett Zandler Zibinski
04/2020	Hepler Imburgia Miller Rossomando

January 2020 Dates

2nd • First Quarter Moon, 11:45 p.m. EST, and the Lunar X is visible around 4 p.m. EST.

4th • The Quadrantid meteor shower peaks in the early morning hours.

10th • Full Moon, the Full Wolf Moon or the Child Moon, 2:21 p.m. EST.

17th • Last Quarter Moon, 7:58 a.m. EST.

24th • New Moon, 4:42 p.m. EST.

27th • Venus and Neptune are separated by only 0.1 degree.

CCAS Upcoming Nights Out

In addition to our monthly observing sessions at the Myrick Conservancy Center, BRC (see pg. 2), CCAS has several special "nights out" scheduled over the next few months. Members are encouraged to help out during these events any way they can. See below for more information.

☼ **Friday, March 27, 2020** - CCAS Monthly Observing Session, Myrick Conservancy Center, Brandywine Red Clay Alliance. The observing session starts at sunset.

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

☼ **Friday, May 22, 2020** - CCAS Monthly Observing Session, Myrick Conservancy Center, Brandywine Red Clay Alliance. The observing session starts at sunset.

Winter Society Events

January 2020

14th • CCAS Monthly Meeting, Room 113, Merion Science Center (former Boucher Building), West Chester University. The meeting starts immediately after at 7:30 p.m. Member Speaker: John Conrad, NASA Solar System Ambassador, "Lunar Science: Historical Overview and Current and Future Missions to the Moon."

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

23rd-24th • The von Kármán Lecture Series: Spitzer—Final Voyage, Jet Propulsion Laboratory, Pasadena, California. Live stream of free lecture presented by NASA & Caltech.

24th • West Chester University Planetarium Show: "Venus, the Evening Star," in the Schmucker Science Building. The show starts at 7 p.m. and runs approximately one hour in length. For more information and reservations, visit the WCU Public Planetarium Shows webpage.

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

February 2020

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

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

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

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

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

Minutes from the November 12, 2019, CCAS Monthly Meeting

by Ann Miller, CCAS Public Relations

- The November 12, 2019 meeting of CCAS was called to order by David Hockenberry.
- The meeting was started with a raffle of the game "Moon Mission" and T-shirt of Heavenly Bodies. Congratulations to the winners Mike Turco and Keith Baker.
- David thanked Frank Angelini for hosting the "Transit of Mercury" at Observatoire Quattrostelle. Great day of viewing. Next transit of Mercury in this area will occur in 2052.
- The Executive Committee is scheduling a meeting. If you have any suggestions or concerns that you would like the committee to address, please talk to one of the members.
- The December meeting will be a holiday party hosted by Don and Barb Knabb on Saturday, December 7, 2019. Don will send an email with further details. There will be no regular meeting on the second Tuesday of the month of December.
- Bruce Ruggeri, program chair, asked the members to contact him or David with suggestions for topics or of specific speakers for next years' meetings.
- Don Knabb, observing chair, introduced a freeware program called Mitaka that he saw demonstrated in a NightSky Network Webinar. The program has mapped the Milky Way Galaxy and the Universe in 3D. Don took us on a tour of the galaxy right to Sagittarius and our galactic black hole. Don then zoomed out to show us the known Universe.
- Bruce introduced our evening's speaker and CCAS member, Phil Rossomondo. Phil spoke on "Intrastellar Space Travel-Science Fiction or Future Reality." Phil discussed the challenges to Intrastellar Space Travel including propulsion, space craft size, faster than light travel, and overcoming human physical limitations.

January 2020 CCAS Meeting Agenda

by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on January 10, 2020, starting at 7:30 p.m. The meeting will be held in Room 113, Merion Science Center (former Boucher Building), West Chester University. 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.

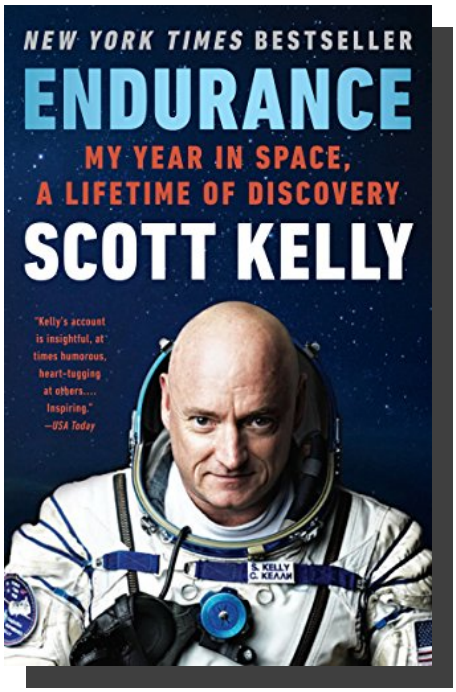
As for future meetings, we are looking for presenters for our 2020 season. If you are interested in presenting, or know someone who would like to participate, please contact me at programs@ccas.us.

Book and Video Series Review: *Endurance* by Scott Kelly, and *A Year in Space* Video Series

by Don Knabb, CCAS Treasurer & Observing Chair

Spaceflight is hard. If you have any doubt about that, read *Endurance, My Year in Space, A Lifetime of Discovery* by Scott Kelly. Scott Kelly is a veteran of four spaceflights and holds the record for an American for consecutive days spent in space (however the American who holds the record for the most time spent in space is Peggy Whitson). Endurance is the story of Kelly's life and the year he spent on the International Space Station (ISS).

Barb and I both read this book, and then I discovered that Netflix is streaming *A Year in Space*, a series of 12 episodes that documents Kelly's year on the ISS. So we both watched the series. We enjoyed both the book and the show and recommend them for anyone with an interest in spaceflight.



Book Cover

Endurance is a very personal account of Kelly's life and his efforts that got him to spend a year on the ISS. The chapters alternate between Kelly's account of the launch and his time on the ISS with chapters that are an autobiography of his childhood and path to becoming an astronaut. Kelly delves deep into his psyche and shares his feelings on an intimate level.

The nitty gritty details of daily life on the ISS are fascinating. From his arrival to departure the details Kelly provides give us a look at how hard spaceflight really is and how much day to day effort it takes to keep the ISS in orbit and suitable for humans. He spends a lot of time on the effects of carbon dioxide and the toll it takes on his performance. Kelly had to repair the carbon dioxide scrubber more than once, and he also was the maintenance guy for the space toilet.

The most chilling story is when Kelly details his spacewalks. These are grueling procedures that push humans to the limit of their endurance. The incredible views are in stark contrast to the physical difficulties and pain that is experienced while spending many hours in what is essentially your own little spaceship.

The video series *A Year in Space* is well done, and is a short series of 12 episodes, each being only 15 minutes long. The views in the Soyuz capsule and the ISS are amazing. The video series is a nice complement to the book.

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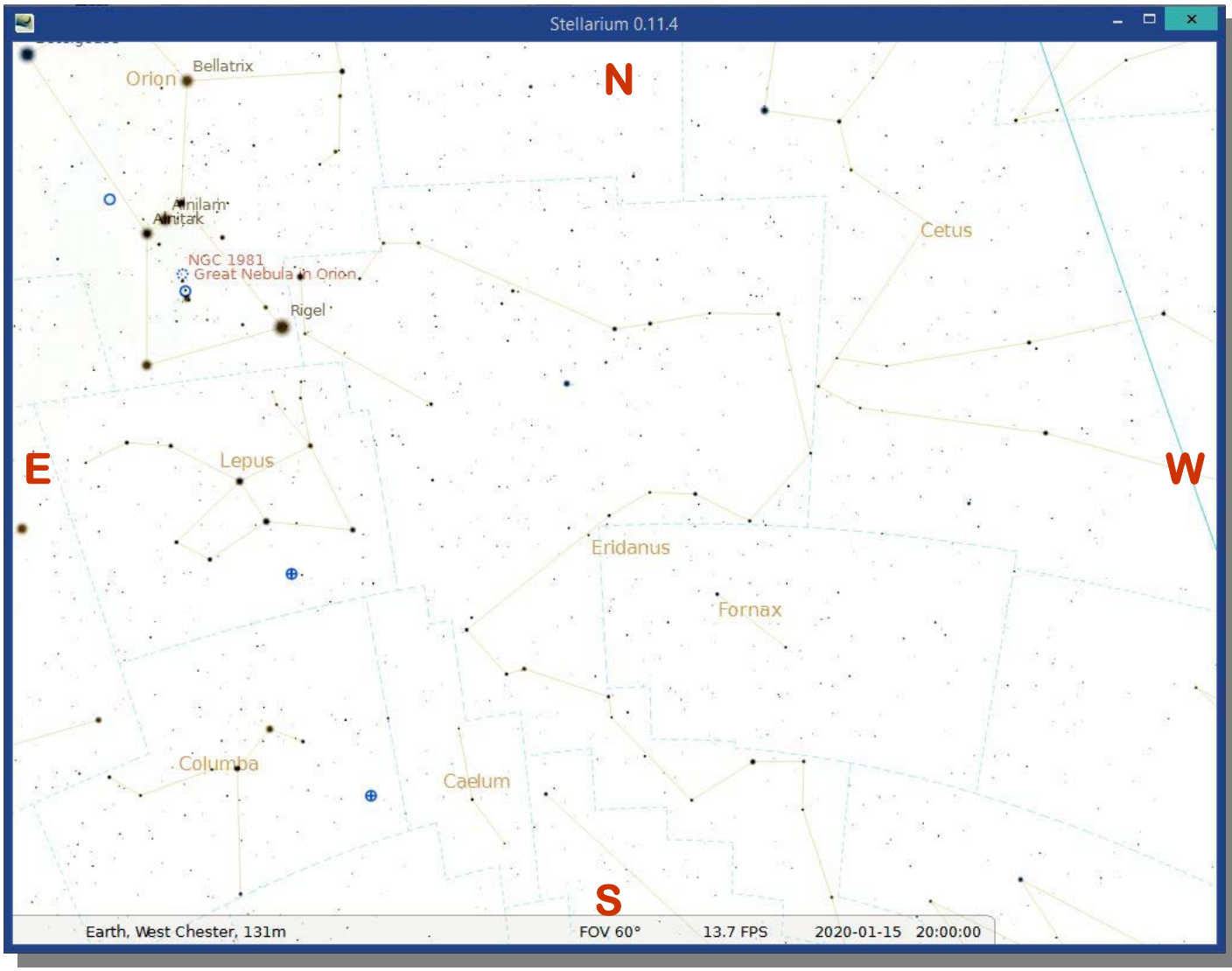
The Sky Over Chester County

January 15, 2020 at 8:00 p.m. ET

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



Date	Civil Twilight Begins	Sunrise	Sunset	Civil Twilight Ends	Length of Day
01/01/2020	6:51 a.m. EST	7:22 a.m. EST	4:45 p.m. EST	5:16 p.m. EST	9h 23m 37s
01/15/2020	6:50 a.m. EST	7:20 a.m. EST	4:59 p.m. EST	5:29 p.m. EST	9h 38m 52s
01/31/2020	6:41 a.m. EST	7:10 a.m. EST	5:18 p.m. EST	5:46 p.m. EST	10h 07m 49s

Moon Phases					
First Quarter	01/02/2020	11:45 p.m. EST	Full Moon	01/10/2020	2:21 p.m. EST
Last Quarter	01/17/2020	7:58 a.m. EST	New Moon	01/24/2020	4:42 p.m. EST

January 2020 Observing Highlights

by Don Knabb, CCAS Treasurer & Observing Chair

2	**First Quarter Moon, 11:45 p.m. EST, and the Lunar X is visible around 4 p.m. EST**
3	**The Lunar Straight Wall is visible**
4	**The Quadrantid meteor shower peaks in the early morning hours**
7	**The waxing gibbous Moon is between the horns of Taurus the Bull**
10	**Full Moon, the Full Wolf Moon or the Child Moon, 2:21 p.m. EST**
17	**Last Quarter Moon, 7:58 a.m. EST**
24	**New Moon, 4:42 p.m. EST**
27	**Venus and Neptune are separated by only 0.1 degree**

The best sights this month: January starts off with two lunar events. On the 2nd the Lunar X is visible around 4 p.m., then the next evening the Lunar Straight Wall is visible. Late in the month, we have a great opportunity to find distant Neptune when it is only 0.1 degree away from Venus.

Mercury: Mercury passes behind the Sun on January 10th and will become visible late in the month in the glow of the fading sunset.

Venus: Our sister planet sets about 3 hours after sunset and is brilliant in the west as the sky darkens. On January 27th Venus is only 0.1 degree away from Neptune, which will make finding the distant gas giant less difficult than normal.

Mars: The red planet rises about 3 hours before dawn and shines at magnitude 1.5.

Jupiter: Jupiter passed behind the Sun at the end of December and can be found low in the east just before dawn at month's end.

Saturn: Saturn passes behind the Sun on January 13th, then at the end of the month it is rising about an hour before sunrise.

Uranus and Neptune: Uranus is high in the south just after nightfall. Neptune can be found right next to Venus on January 27th.

The Moon: Full Moon is on January 10th. According to Native Americans, the full Moon during January is the Full Wolf Moon. Amid the cold and deep snows of midwinter, the wolf packs howled hungrily outside Indian villages; so it was named the Full Wolf Moon. Sometimes it was also referred to as the Old Moon or the Moon after Yule. Some called it the Full Snow Moon, but most tribes applied that name to the next full Moon. Native Canadians called this the Child Moon.

The Lunar X will be visible around 4 p.m. on January 2nd, and the next evening the Lunar Straight Wall is visible.

Constellations: As the last blush of twilight drains from the sky, look toward the west for Cygnus the Swan, also known as the Northern Cross. The Swan is diving headfirst toward the horizon, so it looks like a cross in the sky, with bright Deneb at the top of the cross. In the eastern sky the most recognized constellation of the winter climbs into view, Orion the Hunter. Look for his three-star belt extending straight up from the horizon. Orange Betelgeuse is to the left of the belt with blue-white Rigel to the right. About an hour behind Orion follow the line made by the belt down toward the horizon for the brightest star in the night sky, Sirius the Dog Star, twinkling through the atmosphere.

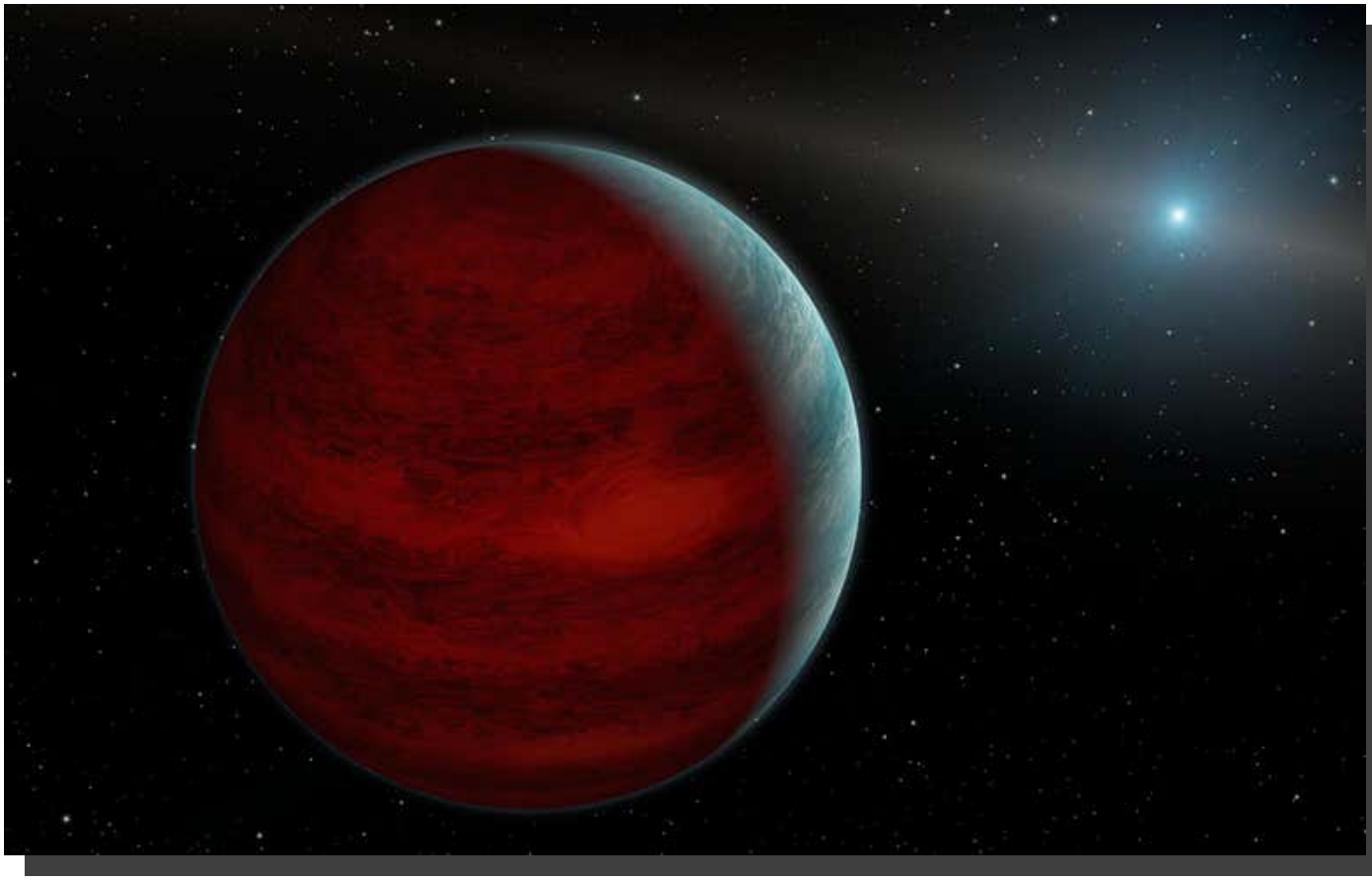
Messier/deep sky: Although there are many wonderful sights in the sky, if I could see only one, I would pick M42, the Great Orion Nebula. Set up your telescope and just stare at this, the brightest nebula in the sky. If you don't have a telescope M42 is still a nice sight in binoculars, but instead find the Beehive Cluster, M44, in the constellation Cancer. The stars of the Beehive will fill your eyepieces!

Comets: For an observing challenge, look for comet PanSTARRS (C/2017 T2) at the end of the month when this 9th magnitude fuzz ball passes less than 1 degree north of the Double Cluster. A sky chart can be found in the January issue of Astronomy magazine or use your favorite app to plot the comet's position.

Meteor showers: The Quadrantid meteor shower peaks around 3 a.m. on January 4th. The Moon will have set by the time the shower peaks. I have seen some amazing outbursts from this shower, so look if you can.

A Planet Orbiting an Exploded Star Has Been Discovered

by Layal Liverpool , NewScientist magazine



An artist's impression of the planet orbiting a white dwarf
NASA/JPL-Caltech

A giant planet is orbiting the remnants of an exploded star – called a white dwarf – 1200 light years away from Earth. The discovery is the first time an entire planet has been found orbiting a white dwarf.

The first hint that there may be planets orbiting white dwarfs came earlier this year, when researchers found a small piece of planet in orbit around a white dwarf. Now the same team has discovered evidence of a giant intact planet, similar in size to Jupiter.

Boris Gänsicke at the University of Warwick in the UK and his colleagues detected a mysterious disc of gas surrounding a white dwarf. The gas disc contained hydrogen, oxygen, and sulphur – a mixture that most likely came from the planet, whose atmosphere is being evaporated by radiation from the white dwarf.

The giant planet has an orbital period of 10 days and is surprisingly close to the white dwarf, suggesting it migrated inwards, says Gänsicke. A possible explanation is that the presence of other planets may have pushed it inwards.

Alternatively, another planet may have been absorbed by the exploding star, causing the orbit of the newly discovered planet to be pulled inwards, says Ben Zuckerman at the University of California, Los Angeles, who wasn't involved with the work.

"This confirms what we have been thinking for the past 25 years – white dwarfs have proper planetary systems around them," says Gänsicke. Jupiter and Saturn also migrated in and out during the early days of our solar system. Understanding other solar systems in space could help us understand how our own developed, he says.

Stars of low to medium mass like the sun become white dwarfs after they have burned up all their fuel and expelled all their outer material, leaving behind only the core of the star. This very hot white dwarf cools

(Continued on page 7)

Giant Radio Telescope Array Prepares to Begin Construction in Australia and South Africa

by Dennis Normile, Science magazine

An artist's impression of the Square Kilometre Array's radio dishes in southern Africa. It will add 133 dishes to the existing 64-dish MeerKAT array in South Africa. SKA ORGANISATION/SWINBURNE ASTRONOMY PRODUCTIONS

Officials with the Square Kilometre Array (SKA), which will be the world's biggest radio telescope, say they have nearly finalized designs and are planning for construction to begin in Australia and South Africa. Last month, at a final engineering meeting in Shanghai, China, designs were presented for the array's dishes and antennas, which a committee will review in the coming weeks—setting the stage for construction to begin.

"I'm feeling confident," of starting construction in early 2021, says Philip Diamond, SKA director general at the organization's headquarters near Manchester, U.K. The design review committee is expected to make suggestions, "but we're not expecting any showstoppers," he says.

The SKA, funded by 13 nations from around the world, will eventually consist of thousands of dishes scattered across southern Africa and a million sticklike antennas in Western Australia. Daunting early cost estimates convinced planners to start with a more limited array that is expected to cost €1.7 billion for construction and 10 years of operation. In this first phase, the SKA group will deploy 130,000 antennas in Australia and add 133 dishes to the 64 of the MeerKAT array, an SKA precursor instrument in South Africa that opened last year.

In addition to contributions to the consortium, individual countries will be building their own facilities to use the data. The Chinese Academy of Sciences's Shanghai Astronomical Observatory has had a team of researchers working on a big data center that will manipulate data initially processed in Australia and South Africa and then analyze it in cooperation with scientists worldwide, says Shen Zhiqiang, the observatory director. The SKA is going to produce "a huge amount of raw data," that will be beyond current data transmission and handling capabilities, he says.

The two arrays "have distinct scientific cases," says Douglas Bock, director of astronomy and space science for Australia's Commonwealth Scientific and Industrial Research Organisation in Sydney. The low-frequency antennas observe radio emissions from pulsars—spinning neutron stars—and the epoch of reionization, when light from the universe's first stars was ionizing the hydrogen in the space between galaxies. The dishes are tuned to observe at higher frequencies and could trace flows of hydrogen in star and galaxy formation. Observations with partial arrays could start in the mid-2020s.

If the review committee approves designs, the organization will next focus on getting member countries to ratify an SKA treaty that forms an international legal entity that can collect funding and award contracts. The Netherlands has already ratified. Bock says Australia is likely to ratify in January 2020. And Chi-

(Continued on page 11)

Exploded (Cont'd)

(Continued from page 6)

down gradually over the next billion years or so. Our sun is about 5 billion years away from becoming a white dwarf, says Zuckerman.

"This is an exciting discovery," says Carl Melis at the University of California, San Diego. He says it is surprising that giant planets would be able to survive in such close orbit to the remnants of their host star.

Journal reference: Nature, DOI: 10.1038/s41586-019-1789-8

NASA Night Sky Notes: The Orion Nebula — Window into a Stellar Nursery

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.

Orion is the last of a trio of striking star patterns to rise during the late fall and early winter months, preceded by the diminutive Pleiades and larger Hyades in Taurus. All three are easily spotted rising in the east in early January evenings, and are textbook examples of stars in different stages of development.

As discussed in last month's Notes, the famous Orion Nebula (M42), found in Orion's "Sword," is a celestial nursery full of newly-born "baby stars" and still-incubating "protostars," surrounded by the gas from which they were born. Next to Orion we find the Hyades, in Taurus, with their distinctive "V' shape. The Hyades are young but mature stars, hundreds of millions of years old and widely dispersed. Imagine them as "young adult" stars venturing out from their hometown into their new galactic apartments. Bright orange Aldebaran stands out in this group, but is not actually a member; it just happens to be in between us and the Hyades. Traveling from Orion to the Hyades we then find the small, almost dipper-shaped Pleiades star cluster (M45). These are "teenage stars," younger than the Hyades, but older than the newborn stars of the Orion Nebula. These bright young stars are still relatively close together, but have dispersed their birth cocoon of

stellar gas, like teenagers venturing around the neighborhood with friends and wearing their own clothes, but still remaining close to home - for now. Astronomers have studied this trio in great detail in order to learn more about stellar evolution.

Figuring the exact distance of the Pleiades from Earth is an interesting problem in astrometry, the study of the exact positions of stars in space. Knowing their exact distance away is a necessary step in determining

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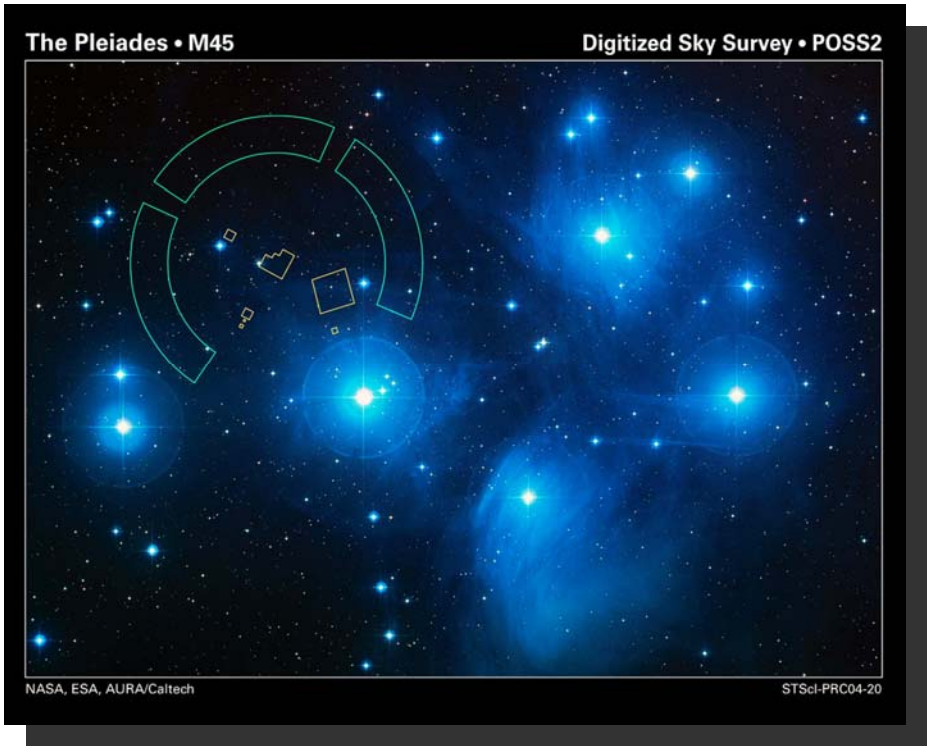
Caption: Locate Orion rising in the east after sunset to find the Orion Nebula in the "Sword," below the famous "Belt" of three bright stars. Then, look above Orion to find both the Hyades and the Pleiades. Binoculars will bring out lots of extra stars and details in all three objects, but you can even spot them with your unaided eye!

Night Sky Notes (Cont'd)



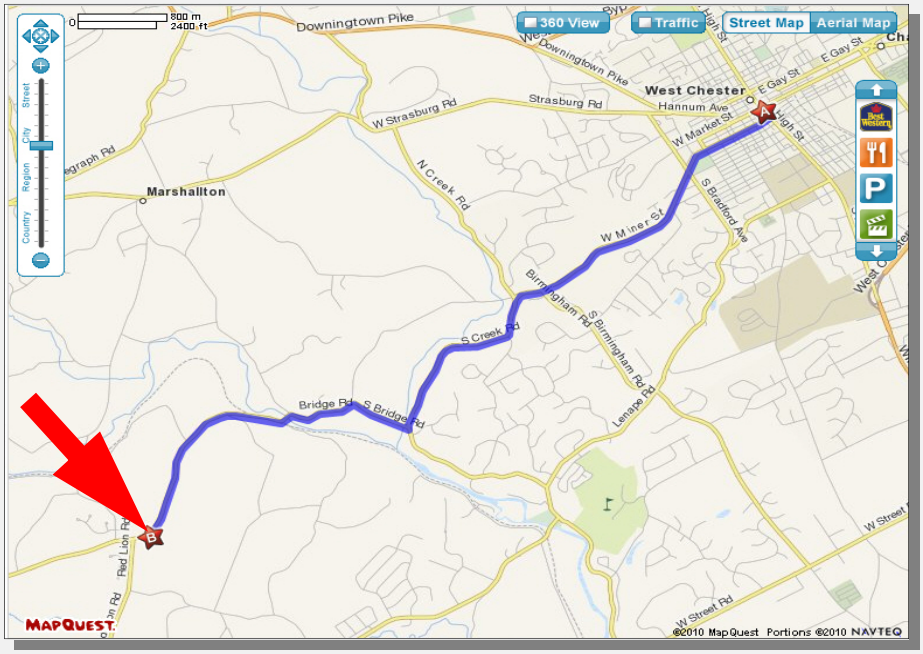
Caption: Close-up of the Pleiades, with the field of view of Hubble's Fine Guidance Sensors overlaid in the top left, which helped refine the distance to the cluster. The circumference of the field of view of these sensors is roughly the size of the full Moon. (Credit: NASA, ESA and AURA/Caltech)

(Continued from page 8)

many other facts about the Pleiades. The European Space Agency's Hipparcos satellite determined their distance to about 392 light years away, around 43 light years closer than previous estimates. However, subsequent measurements by NASA's Hubble Space Telescope indicated a distance of 440 light years, much closer to pre-Hipparcos estimates. Then, using a powerful technique called Very Long Baseline Interferometry (VLBI), which combines the power of radio telescopes from around the world, the distance of the Pleiades was calculated to 443 light years. The ESA's Gaia satellite, a successor to Hipparcos, recently released its first two sets of

(Continued on page 11)

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 Kite Cluster – NGC 1664

by Don Knabb, CCAS Treasurer & Observing Chair

In the January issue of Sky and Telescope there is a nice article titled *A Tourist's Guide to the Winter Highlights*. I have seen many of the objects covered in the article, but a new one to me is NGC 1664, also known as the Kite Cluster or the 4H Cluster.

NGC 1664, also listed as Melotte 27 and Collinder 56, is an open cluster in the constellation Auriga. It is not far from the bright star Capella as you can see from the sky chart below in which NGC 1664 is above and to the right of Capella.

I have not seen The Kite Cluster, but it is at the top of my winter observing list when we get a break in the weather. However, I have found observing reports from several sources so I'll summarize the comments below.

One observer calls the Kite Cluster "a quaint cluster of over 100 dim stars" and "a firefly near the fireworks." The fireworks he is referring to are the open clusters M36, M37, and M38 in Auriga. These three clusters are beautiful, bright, and large. The Kite Cluster is not as impressive as those three clusters but as this observer says, "its subtlety is charming".

Another observer calls NGC 1664 "a unique-appearing open cluster that is often overshadowed by the wealth of other clusters in the region. The primary stars of the main cluster form a diamond-shaped outline with a trail of similar stars extending off one of the four corners. To my eye this appears strikingly like a flying kite with a tail."

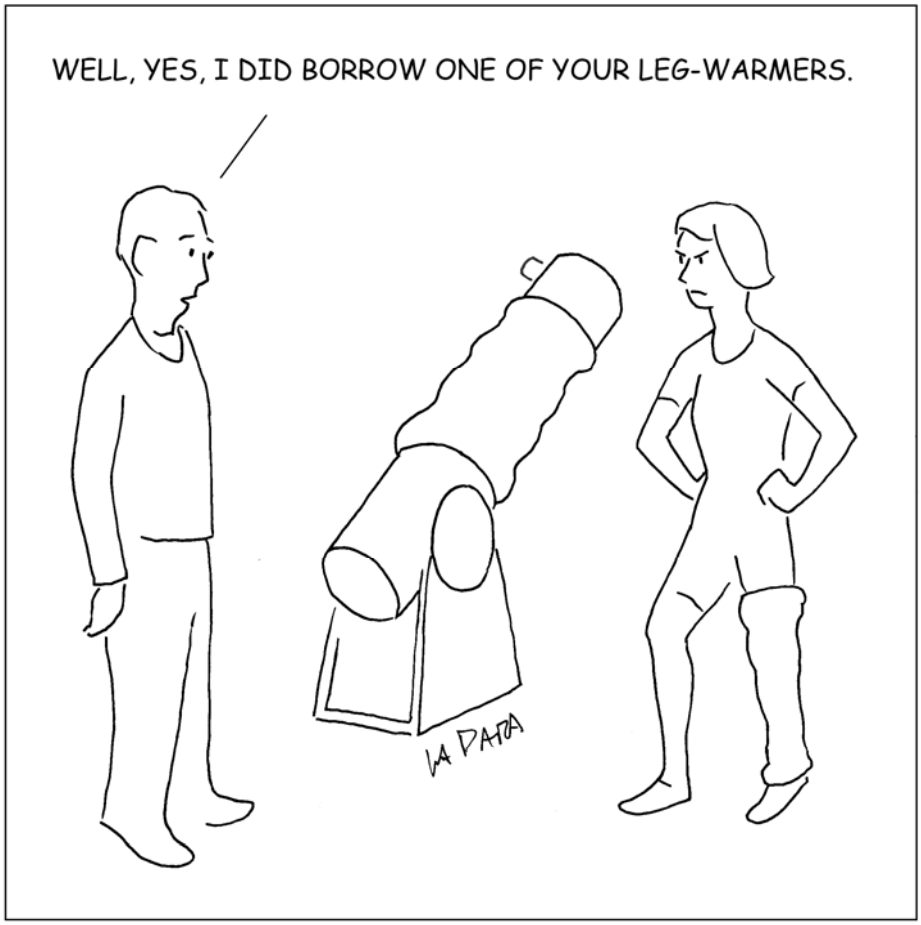
Star chart created with Stellarium planetarium software

Other observers have seen a heart-shaped balloon. Walter Scott Houston nicknamed NGC 1664 the "4-H cluster" because it had the appearance of a four-leaf clover that most farm children recognize as the symbol of the 4-H club.

(Continued on page 11)

Image credit: https://en.wikipedia.org/wiki/NGC_1664#/media/File:NGC1664.jpg

Classic La Para
by Nicholas La Para



Eyepiece (Cont'd)

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At lower magnification, NGC 1644 is described as "powdered sugar spread out over a 20' area." At higher power, about 40 stars can be counted. Some observers see a keystone, similar to the core of the constellation Hercules.

If you examine the image below, you will see a bright star near the center. That star is not part of the Kite Cluster but is a good place to start to see the cluster. The tail of the kite is just to the right of that bright star and the kite shape is at the top of the tail. The background star field in this area is rich, but I have no problem seeing the kite shape in the photo.

I am looking forward to seeking out this cluster as soon as we have a night that is clear and not so cold that I will be shivering at the eyepiece. I'd be interested to hear observing reports from club members if you accept this observing challenge!

Information credits:

https://observing.skyhound.com/archives/dec/NGC_1664.html
http://www.starobserver.eu/articles/ngc1664/
http://www.astronomy.com/observing/observing-podcasts/2014/01/the-large-magellanic-cloud-ngc-1664-and-ngc-1788
http://www.orrastrodrawing.com/NGC1664.html

Array (Cont'd)

(Continued from page 7)

na is expected to sign on in early spring, Shen says. Diamond says Italy, Portugal, South Africa, and the United Kingdom are expected to ratify by May 2020. The remaining six SKA members will join the treaty later.

The United States was initially involved but has since dropped out, at least officially. But many U.S. scientists and engineers are serving on the design review committee and contributing to the science plans, says Bryan Butler, a radio astronomer with the U.S. National Radio Astronomy Observatory (NRAO) in Socorro, New Mexico. Separately, U.S. astronomers are planning the Next Generation Very Large Array, which Butler says would rival the SKA in size and cost but observe at higher radio frequencies. The giant array would add dishes to NRAO's Very Long Baseline Array and Very Large Array across Mexi-

(Continued on page 12)

Notes (Cont'd)

(Continued from page 9)

data, which among other findings show the distance close to the values found by Hubble and VLBI, possibly settling the long-running "Pleiades Controversy" and helping firm up the foundation for follow-up studies about the nature of the stars of the Pleiades.

You can learn more about the Pleiades in the Universe Discovery Guide at bit.ly/UDGMarch, and find out about missions helping to measure our universe at 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).

Book & Video Review (Cont'd)

(Continued from page 3)

The book gets bogged down in crew details around the 2/3 point, but that doesn't last long. Barb and I both enjoyed the book and video series and suggest them for your winter reading list.

Array (Cont'd)

(Continued from page 11)

co and the U.S. Southwest. Backers are hoping to win approval for construction within 2 to 3 years. Butler expects the two groups to agree to share access to their instruments. "That is the path for U.S. participation in SKA," Butler says.

CCAS Membership Information and Society Financials

Treasurer's Report
by Don Knabb

Dec. 2019 Financial Summary

Beginning Balance	$799
Deposits	$45
Disbursements	-$0
Ending Balance	$844

New Member Welcome!

Welcome new CCAS members Janet Holloway from Philadelphia, Jeff Johnson from Chester Springs, and Hyunjin Christina Lee from Chesterbrook. We're glad you decided to join us under the stars! Clear skies to you!

Membership Renewals

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

Don Knabb
988 Meadowview Lane
West Chester PA 19382

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

CCAS Information Directory

Join the Fight for Dark Skies!

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

International Dark-Sky Association
3225 North First Avenue
Tucson, AZ 85719

Phone: **520-293-3198**
Fax: **520-293-3192**
E-mail: **ida@darksky.org**

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

http://www.darksky.org

Dark-Sky Website for PA

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

http://www.POLCouncil.org

Find out about Lyme Disease!

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

http://www.LymePA.org

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

Good Outdoor Lighting Websites

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

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

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

http://www.starrynightlights.com

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

Phone: **484-291-1084**

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

Local Astronomy-Related Stores

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

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

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

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

http://www.skiesunlimited.net

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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.**