



Observations

A Monthly Publication Of The
CHESTER COUNTY ASTRONOMICAL SOCIETY

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My Favorite Image



Even after all these years, this is still my favorite photo taken at a CCAS observing event. Don Knabb shot this image of his nephew David, on May 10, 2008. The image was featured in the December 2008 edition of the *AL Reflector* magazine.
For more of my thoughts and memories, see my farewell article on pg. 17.— John Carl Hepler, Ph.D. (retiring) newsletter editor

Membership Renewals Due

10/2026	Abbott Kraynik Lane Lester Levin Na Payton Richardson Vish, D. Vish, S. Wirth
11/2026	Baker Buczynski Catinella Harner Holenstein Kurz Leiden Marks Prasad Packirisamy Skupien Suchower Ward
12/2026	Damerau DeAngelo DellaPenna Kovic Myruski O'Leary

October 2026 Dates

- 3rd • Last Quarter Moon (9:25 p.m. EDT).
- 5th • The Moon passes 1.2° north of Mars, 2 a.m. EDT.
- 6th • The Moon passes 0.2° north of Jupiter, 2 a.m. EDT.
- 10th • New Moon (11:50 a.m. EDT).
- 11th • The Moon passes 3° north of Venus, 11 p.m. EDT.
- 12th • Mercury is at greatest eastern elongation (25°), 6 a.m. EDT.
- 18th • First Quarter Moon (12:12 p.m. EDT).
- 23rd • Venus is in inferior conjunction, midnight EDT.
- 28th • Full Moon, the Hunter's Moon (12:11 a.m. EDT).



CCAS Upcoming Nights Out

In addition to our monthly observing sessions at the Myrick Conservancy Center, BRC (for directions, see pg. 13), CCAS schedules special "nights out" throughout the year. Members are encouraged to help out during these events any way they can. See below for more information.

- ☼ Saturday, October 3, 2026: CCAS Special Observing Event: West Goshen Township Park, 1023 Fern Hill Road, West Chester, PA, 6:30 p.m. EDT to 10 p.m. EDT.
- ☼ Friday, October 16, 2026: CCAS Special Observing Session with WCU Mather Planetarium, 8:00 p.m. EDT to 10:00 p.m. EDT.
- ☼ Saturday, October 24, 2026: CCAS Special Observing Event, Wolf's Hollow County Park, Atglen, PA, 6:30 p.m. EDT to 10 p.m. EDT.

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

Autumn Society Events

October 2026

2nd • West Chester University Planetarium Show: "To The Moon & Mars," 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.

3rd • Downingtown Library Solar Saturday, 10:00 a.m. to 12:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

3rd • CCAS Special Observing Event: West Goshen Township Park, 1023 Fern Hill Road, West Chester, PA, 6:30 p.m. EDT to 10 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

8th • Middletown Free Library Fund Raiser, 6:00 p.m. EDT to 9:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

9th • CCAS Monthly Observing Session, Myrick Conservancy Center, Brandywine Red Clay Alliance. The observing session starts at sunset. For more information, contact our Observing Chair, [Don Miller](#).

10th • Downingtown Library Solar Saturday, 10:00 a.m. to 12:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

13th • CCAS Monthly Meeting, in Room 112, Merion Science Center, WCU. The meeting starts at 7:30 p.m. Guest Speaker: Dr. Jeffrey Johnson, Johns Hopkins University Applied Physics Laboratory, and Mars 2020 Mission Team, "Revealing Mars from Rover Exploration: Perseverance and Curiosity."

16th • CCAS Special Observing Session with WCU Mather Planetarium, 8:00 p.m. EDT to 10:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

20th • Open call for articles and photographs for the November 2026 edition of [Observations](#).

20th • Middletown Free Library Solar Tuesday, 2:00 p.m. to 3:30 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

21st • Downingtown Library Solar Wednesday, 10:00 a.m. to 12:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

23rd • CCAS Special Observing Session: WC Courthouse Sidewalk Event, West Chester, PA. For more information, contact our Observing Chair, [Don Miller](#).

24th • CCAS Special Observing Event, Wolf's Hollow County Park, Atglen, PA, 6:30 p.m. EDT to 10 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

26th • Deadline for newsletter submissions for the November 2026 edition of [Observations](#).

28th • Downingtown Library Solar Wednesday, 10:00 a.m. to 12:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

30th • West Chester University Planetarium Show: "Spectacular Saturn," in the Schmucker Science Building. The show starts at 7 p.m. and runs approximately one hour in length.

September 2026 Meeting Minutes

by *Bea Mazziotta, CCAS Secretary*

- The first CCAS meeting of the 2026/2027 year was held at WCU on September 8, 2026. Club President Dave Hockenberry welcomed members and guests.
- Dave announced that John Hepler will be stepping down from his positions as Webmaster and Editor of the club newsletter. He thanked John for his many years (20+) of service to CCAS and noted the numerous awards John has won during his tenure.
- Dave announced that the club would be implementing a new website and newsletter format in the coming months.
- He noted that anyone technologically adept and interested in helping with the transition to the new website platform could contact him or any club officer. Similarly, those interested in getting involved with the newsletter were also welcome to reach out.
- Don Knabb, club treasurer, informed everyone that a club member Ishku Varada was the 2026 first place winner of the Horkheimer /O'Meara Journalism Award. He noted that the York Star Party will take place in October and that he will send out information and links. He also reminded members that they were welcome to attend the monthly Delaware Astronomical Book Club on line. The meetings are not recorded thus not available to view at a later time. He will continue to send monthly emails with details about the books and authors.
- Don Miller, Observing Chair, reviewed the upcoming September night sky objects including the Harvest Moon, the Ring Nebula, the Dumbbell Nebula, M56 globular cluster and an improved view of Saturn's rings.
- Solar observing is ongoing as well.
- Dave introduced the evening's speaker Dr. Theodore (Teddy) Kareta. Dr. Kareta is a planetary astronomer who focuses on asteroid, comets and interstellar objects within our solar system. He has worked with NASA on both DART and OSIRIS-REx missions. He is also a science advisor to NASA's JPL Spacecraft Mission Design School. He is currently an assistant Professor of Astrophysics and Planetary Science at Villanova University.
- His presentation was titled "Visitors or Neighbors?: The Origin and Properties of the Quasi-Satellites and 'Mini-Moons' of the Earth." His research is helping us understand more about our 'big' moon as well as the potential hazards of the 'small' visitors traveling near Earth.

October 2026 CCAS Meeting Agenda

by *Bruce Ruggeri, CCAS Program Chair*

Our next meeting will be held on October 13, 2026, in person (and via Zoom & YouTube) at West Chester University's Merion Science Center, Room 112. The meeting starts at 7:30 p.m. EDT. The Science Center is located at 720 S. Church St., West Chester, PA. Our guest Speaker is Dr. Jeffrey Johnson, Johns Hopkins University Applied Physics Laboratory, and Mars 2020 Mission Team, "Celebrating Milestone Anniversaries in Revealing Mars from Rover Exploration: Perseverance

and Curiosity."

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 the 2026-2027 season. If you are interested in presenting, or know someone who would like to participate, please contact me at programs@ccas.us.

October 2026 Guest Speaker Bio & Presentation

by Bruce Ruggeri, CCAS Program Chair

Our in-person and Zoom monthly CCAS meeting is scheduled for Tuesday, October 13, 2026, and will commence at 7:30 p.m. EDT. If you are able to join us in person, our meetings are held at West Chester University's (WCU) Merion Science Center, Room 112. The Science Center is located at 720 S. Church St. in West Chester.

Our guest speaker this month is Dr. Jeffrey R. Johnson, Johns Hopkins University Applied Physics Laboratory, and Mars 2020 Mission Team. His presentation, description, and brief biosketch are below.

Presentation Title: Celebrating Milestone Anniversaries in Revealing Mars from Rover Exploration: Perseverance and Curiosity.



Jeffrey R. Johnson, Ph.D.

Presentation Synopsis: The Mars 2020 Perseverance rover landed near the base of an ancient river delta in western Jezero crater in February 2021 to investigate environments that may once have supported microbial life and to collect samples for possible return to Earth. Af-

ter more than 2,000 Martian days (sols), Perseverance has explored the crater floor, the delta, the upstream river valley, and terrain beyond the crater rim. Along the way it has examined a wide range of rock types dating back nearly 4 billion years and has collected about three dozen rock cores. Some of these samples contain organic compounds and features that may represent biosignatures. Definitive conclusions about possible past life, however, will require detailed laboratory analyses on Earth.

After more than five years on Mars, Perseverance continues its exploration beyond the rim of Jezero crater, it is building a detailed record of the region's environmental history while as-

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October 2026 Light Pollution News Roundup

by Bill McGeeney, Host of Light Pollution News Podcast

This month, I had some really insightful conversations with Dark Sky Consulting's John Barentine and ecologist, Lin Meng. I was also joined by remote sensing researcher Zhe Zhu for the first show this month. We had some great conversations this month. Be sure to check out [Solar Days](#) and [Lighting for Reassurance!](#) As always, you can find all of the links to this show and beyond over at [LightPollutionNews.com](#). Light Pollution News is a listeners supported show, which means that all of the work here is solely fueled by supporters like yourself. If you like what we're doing, please consider sharing this update.

So, let's jump into it! Did you hear about the Sunshine Protec-

tion Act of 2025? I'm sure you did, but were you aware that it was not only reintroduced this summer, but it breezed through the House on July 14th. The bill seeks to enshrine permanent Daylight Saving Time under the sponsorship of two Florida Representatives: House Rep Vern Buchanan and Senator Rick Scott.

However, the bill stalled in the Senate. An interesting twist came in how places like Disney World and Universal, which built entire event seasons around darkness, would be affected by losing one hour of night. Permanent DST would leave those parks with 2 ½ hours of usable nighttime programming. Conversely, the American Academy

of Sleep Medicine backed the other solution, a permanent Standard Time under the competing, and no less sappy sounding, Sunshine for Our Kids Act. Science appears to be in alignment that Standard Time is healthier than permanent Daylight Saving Time. The U.S. tried permanent DST in 1974, loved it initially, then reversed course within ten months when northern states suffered through 9 AM sunrises. Oof!

In the wonderful world of ecology, of which we have a tremendous amount but were only able to cover select stories this month, Dr. Meng's team found areas with artificial light correlated with pollen seasons

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STAR CHART FOR MID-LATITUDES OF THE NORTHERN HEMISPHERE

What's Out Tonight?

OPTIMIZED FOR 1½ HOURS
AFTER SUNSET
but can be used after that for several more hours.

October 2026 Sky Chart

FREE

Visit: WhatsOutTonight.com

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absolutely not to be sold. Please

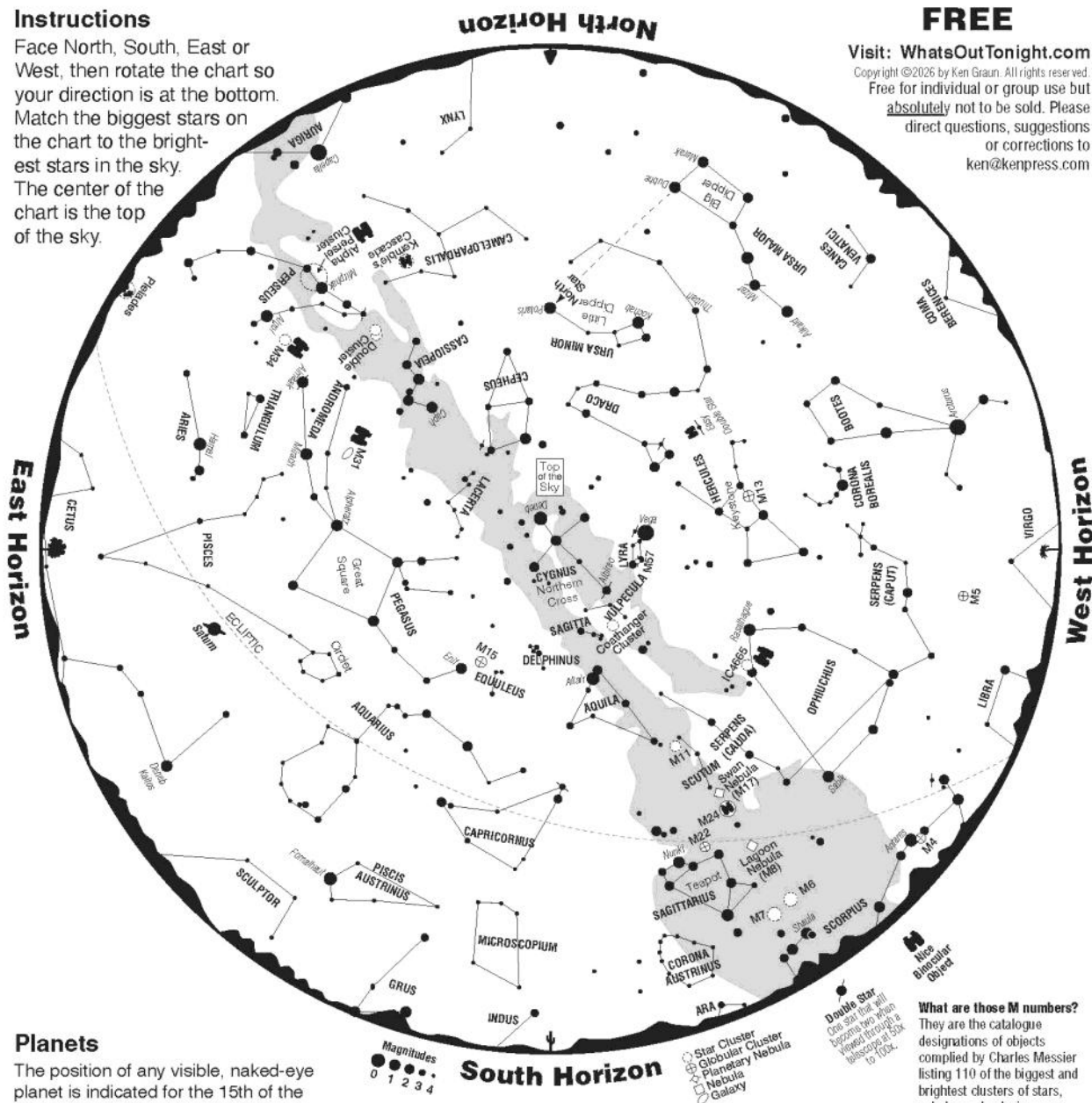
direct questions, suggestions

or corrections to

ken@kenpress.com

Instructions

Face North, South, East or West, then rotate the chart so your direction is at the bottom. Match the biggest stars on the chart to the brightest stars in the sky. The center of the chart is the top of the sky.



Planets

The position of any visible, naked-eye planet is indicated for the 15th of the month with a size matching its magnitude. If the planet moves significantly during a month, other positions will be noted with dates. The ECLIPTIC is the path of the Sun through the sky but the planets and Moon move along it, too. It passes through the constellations of the zodiac.

October 2026 Planet Notes (15th of each month)

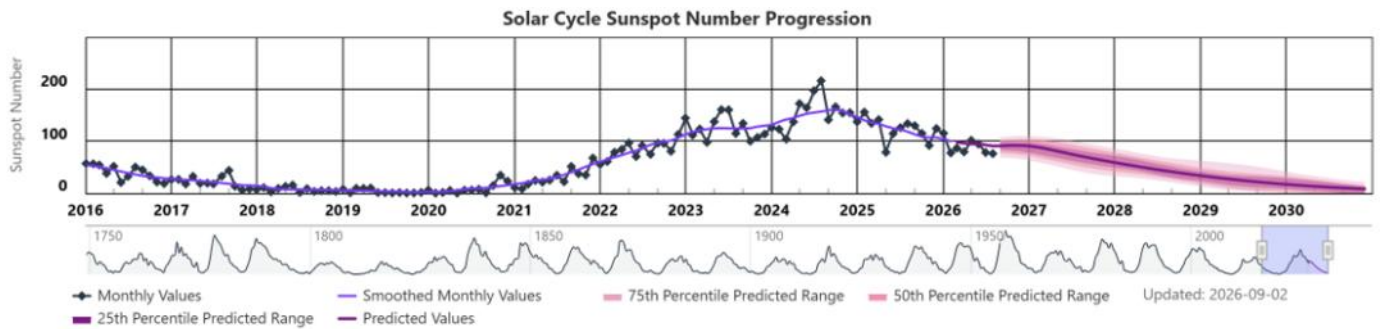
Venus is not visible because it sets with the the Sun. Mars, at magnitude +1.0, in Cancer, rises in the east around 1:30 AM. Jupiter, at magnitude -1.9, in Leo, rises in the east about 2:30 AM. Saturn, at magnitude +0.4, in Cetus, rises in the east at sunset.

Distances planets are from the Earth on the 15th of this month:

Venus: 26,000,000 miles, Mars: 145,000,000 miles, Jupiter: 533,000,000 miles, Saturn: 785,000,000 miles.

October 2026 Observing Highlights

by Don Miller, CCAS Observation Chair



Key Events this month:

Saturn will be at opposition on October 4th (at opposition for superior planets, they are closest to the Earth and thus have the best viewing condition).

On October 6th, **Jupiter** will be occulted by the moon 4:21 a.m. (beginning) and ends at 5:25 a.m. You will need a good view towards the eastern sky given the low altitude of the moon and Jupiter.

Mercury will be at greatest eastern elongation on October 12th. Being an inferior- and the inner-most-planet, viewing it is challenging due to their closeness to the sun and its glare. At greatest elongation, Mercury is separated to its maximum extent from the sun and thus the best opportunity for viewing it.

The **Orionid meteor shower** is at its maximum on October 22nd-23rd. This will be challenging one to enjoy due to the moon being 92% illuminated on that date. The moon will set at 4:29 a.m. so observing between that time and sunrise at 6:14 a.m. will be ideal (and necessary). This meteor shower is the

result of the famous comet Halley. Expect 10-20 meteors per hour at a high speed, thus leaving persistent trails and the occasional fireball. The average size of each particle in this shower is under 1 mm.

Discussion:

October is for me that magic time of year for observing outdoors. The weather is cool without being cold. The air is starting to take on the clarity of winter without the brutality of those nights (I've had winter nights where my telescope mount has stopped responding due to the cold). So if you can, get outside and enjoy the night sky at a wonderful time of year, with or without a telescope or binoculars. Have fun!

Sun:

The sun's activity is continuing on downward side of the solar maximum for this cycle, but it is still

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Sunrise/Sunset & Moon Phases for October 2026

Date	Civil Twilight Begins	Sunrise	Sunset	Civil Twilight Ends	Length of Day
10/01/2026	6:31 a.m. EDT	6:58 a.m. EDT	6:44 p.m. EDT	7:11 p.m. EDT	11h 45m 49s
10/15/2026	6:45 a.m. EDT	7:12 a.m. EDT	6:22 p.m. EDT	6:50 p.m. EDT	11h 09m 48s
10/31/2026	7:02 a.m. EDT	7:30 a.m. EDT	6:01 p.m. EDT	6:29 p.m. EDT	10h 30m 44s

Moon Phases

Last Quarter	10/03/2026	9:25 a.m. EDT	New Moon	10/10/2026	11:50 a.m. EDT
First Quarter	10/18/2026	12:12 p.m. EDT	Full Moon	10/26/2026	12:11 a.m. EDT

Through the Eyepiece: Globular Cluster M15

by Don Knabb, CCAS Treasurer & ALCOR

With Pegasus flying upside down across the October sky this is a great time to view globular cluster M15. Yes, I said upside down since the “great square” represents Pegasus’ body, the stars off the top of the square are his legs and the string of stars to the right (west) are his neck and head.

Just off Pegasus’ nose is globular cluster M15, also known as NGC 7078. It was discovered by Jean-Dominique Maraldi in 1746. He described it as “A nebulous star, fairly bright and composed of many stars”. Charles Messier, who cataloged it on June 3, 1764, couldn’t make this out and described it as “nebula without stars,” so that it remained to William Herschel in 1783 to resolve this fine star cluster. It is estimated to be 13.2 billion years old, one of the oldest globular clusters.

M15 can be found extremely easily: Get out your star map or app and find the 2nd magnitude star Epsilon Pegasi, named Enif, and Theta Pegasi southeast (lower left) of it. Follow the line from Theta over Epsilon and extend it perhaps $\frac{1}{2}$ the distance that was between those stars and you will find the fuzzy object that is M15.

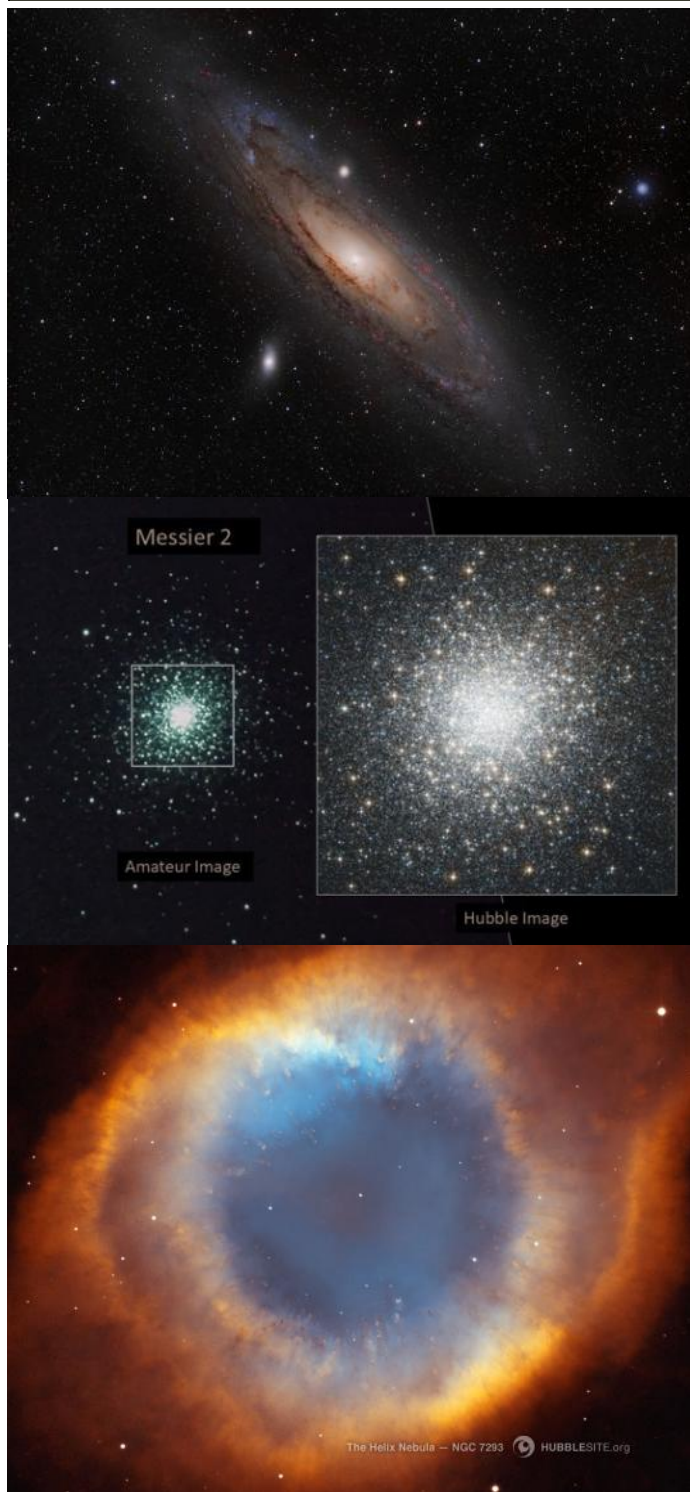
At its apparent visual brightness of magnitude 6.2, M15 is about at the limit of visibility for the naked eye under very good conditions. In Chester County skies we need binoculars or a telescope to see this mass of stars. It appears as a round mottled nebula in 4-inch telescopes, with at best the very brightest

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Here is a picture of M15 taken with my Seestar S50. Image credit: Don Knabb

Observing (Cont'd)



Select Night Sky Objects and Events: If you own a pair of binoculars, use them on M31 (Andromeda Galaxy) and M2 (globular) which are both fantastically placed at this time of year. Astrophotographers will enjoy them immensely as targets. Yes, Hubble shows a bit more than we can see but the view is still stunning. The Helix Nebula (NGC 7293) is a bit low in the sky but is a fantastic planetary. An OIII filter is recommended for better detail. Image credits: Andromeda (Trevor Jones); M2 (amateur: K. Hartnett; Hubble Image: NASA, ESA, STScI and A. Sarajedini (University of Florida); Helix Nebula (hubblesite.org)

(Continued from page 5)

showing a lot of activity. As the writing of this highlight, the sunspot number is 23. The sun has been relatively quiet as of late. In September so far, there have only been one C1.4 (sent a minor CME toward the Earth) and M1.0 flares. The last X-class flare was in July. Go to this URL for the latest solar activity report: <https://earthsky.org/sun/sun-news-activity-solar-flare-cme-aurora-updates/>

Moon:

- Last Quarter: 3rd
- New Moon: 10th
- First Quarter: 18th
- Full Moon: 26th

The full moon this month is known as the Hunter's Moon for obvious reasons.

Planets: (description below is for the 15th of the month at 8 p.m.)

- Mercury: Not visible except as discussed above
- Venus: Not visible as it approaches inferior conjunction (between the Earth and the sun) on Oct. 24th
- Mars: Visible in Cancer/Gemini after midnight, the size will be small at approximately 6 arc-seconds
- Jupiter: Visible after midnight in Leo, approximately 33 arc-seconds in size
- Saturn: The king of the night sky in Cetus/Pisces with a size of approximately 20 arc-seconds (trivia question, what is the name of his consort?)
- Uranus: Rises at 8:34 p.m. in Taurus with a size of 3.8 arc-seconds
- Neptune: Is up all night in Pisces with a size of 2.5 arc-seconds

Speaker Bio (Cont'd)

(Continued from page 3)

sembling a sample collection that could provide the most compelling test yet of whether life ever existed on Mars.

The Mars Science Laboratory Curiosity rover landed in Gale crater in August 2012 near the base of the 5-km-high Mount Sharp with the goal of determining whether Mars once had conditions suitable for microbial life. After more than 5,000 sols of operation, Curiosity has explored a variety of terrains shaped by wind and water over billions of years. Analyses of Martian rocks have revealed diverse minerals, including clays, sulfates, and iron oxides, documenting major changes in the planet's

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Building an Extremely Budget-Friendly Star Tracker for Astrophotography

by CCAS Member Advay Kavathekar

Why does astrophotography have to cost so much? The Sky Watcher Star Adventurer 2i is often considered the standard, most affordable beginner equatorial tracking mount for any beginner astrophotographer, especially for those looking to use a common household DSLR camera.

This so-called affordable astrophotography mount might be inexpensive relative to other astrophotography gear, but sitting at \$400-\$500, it is not considered very budget-friendly when compared to visual astronomy—as you can find many high-quality 6" Dobsonians in the same price range—let alone any other hobbies one might want to pursue.

In light of this huge gatekeeper to the hobby, especially as an underfunded high schooler, I decided to tackle this issue by using my engineering skills and making a much more cost-effective option myself.

Many budget-friendly, home-made star trackers exist on the internet, but the design that stuck out most to me was the barn-door star tracker, also called a Scotch mount. It features an incredibly simple design of two boards attached to a hinge that slowly expands apart, at the same rate that the Earth rotates, effectively cancelling out the rotation of the Earth, for whatever light-gathering tool is sitting on the top board.

Now the key component of the barn-door tracker is the design of the motion system, because it specifically has to be able to push the two boards apart at the



The Bushnell Northstar 114 telescope tripod that was repurposed.

specific sidereal speed of roughly 1 degree every 4 minutes.

The most common type of motion system uses an extremely basic design of a screw with nuts, so that when rotation is applied to those nuts, the screw travels linearly, which pushes the top board up, achieving the desired tracking rate. Since I was faced with budget constraints, I



The current version 3 design of the tracker with the curved screw and 3d printed eq-wedge.

decided that this screw method would be optimal, as there were not many other budget-friendly options to begin with.

The standard size screw for tracking the Earth at a precise rate is a $\frac{1}{4}$ " screw, with twenty threads per inch, placed at 11.43 inches from the hinge point. The reason that the screw needs to be placed at such a precise distance from the hinge point is due to the fact that it is the easiest variable to change in this setup. This is because we need the boards to separate at 1 degree every four minutes, and it would be incredibly optimal to have the rotation speed also at a whole number of rotations per minute (rpm).

The math works out so that if this screw system is placed specifically 11.43 inches from the hinge point, the $\frac{1}{4}$ "-20 nut has to turn at exactly one rpm to match the speed of the sidereal day.

Another major thing to consider when deciding on this screw-powered motion system is the fact that it has to be curved, because the boards separate radially, and using a straight screw would induce unnecessary tangent error. After experimenting with methods to accurately add a curve to the screws, I found that common threaded rods, with the proper $\frac{1}{4}$ " size, are quite easy to bend only with your hands, and some curved boards to push off of.

To maintain the accuracy of the curve, I drew an arc of a circle on paper, precisely with a radius of 11.43 inches, and hand-bent the screw, which turned out to be quite precise. This now

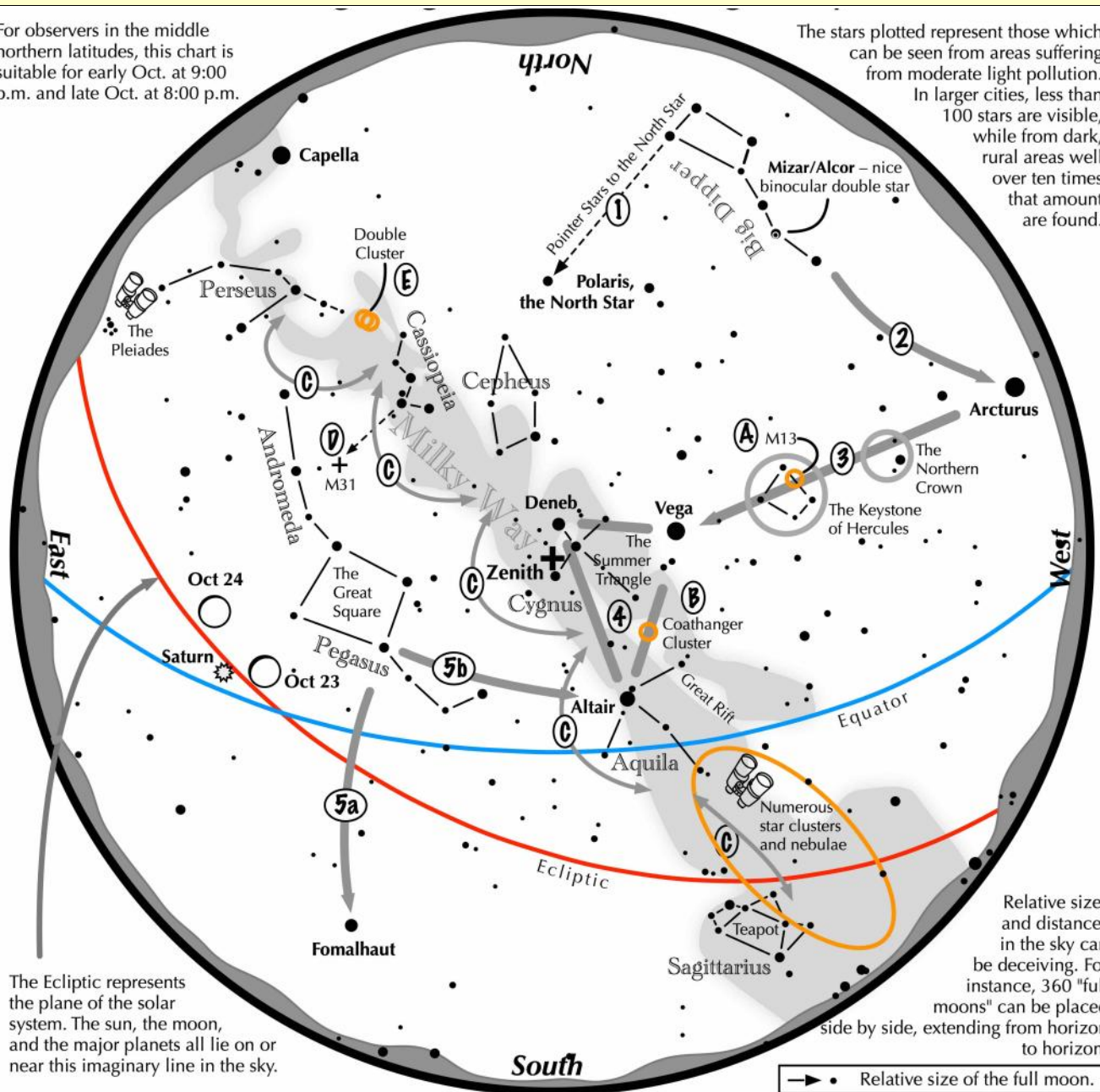
(Continued on page 12)

Navigating the mid-October Night Sky

courtesy of the Astronomical League

For observers in the middle northern latitudes, this chart is suitable for early Oct. at 9:00 p.m. and late Oct. at 8:00 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Navigating the October night sky: Simply start with what you know or with what you can easily find.

- 1 Extend a line north from the two stars at the tip of the Big Dipper's bowl. It passes by Polaris, the North Star.
- 2 Follow the arc of the Dipper's handle. It intersects Arcturus, the brightest star in the early October evening sky.
- 3 To the northeast of Arcturus shines another star of the same brightness, Vega. Draw a line from Arcturus to Vega. It first meets "The Northern Crown," then the "Keystone of Hercules." A dark sky is needed to see these two dim stellar configurations.
- 4 Nearly overhead lie the summer triangle stars of Vega, Altair, and Deneb.
- 5 High in the east are the four moderately bright stars of the Great Square. Its two southern stars point west to Altair. Its two western stars point south to Fomalhaut.

Binocular Highlights

A: On the western side of the Keystone glows the Great Hercules Cluster, a ball of 500,000 stars. **B:** 40% of the way between Altair and Vega, twinkles the "Coathanger," a group of stars outlining a coathanger. **C:** Sweep along the Milky Way for an astounding number of fuzzy star clusters and nebulae amid many faint glows and dark bays, including the Great Rift. **D:** The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval. **E:** Between the "W" of Cassiopeia and Perseus lies the Double Cluster.



Astronomical League www.astroleague.org; duplication is allowed and encouraged for all free distribution.

Eyepiece (Cont'd)



Image made using Stellarium planetarium software

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stars visible, but otherwise unresolved in a fine star field. In larger telescopes more stars become visible; the outer parts are resolved, with a more irregular, non-circular outline. The compact core, however, stays unresolved even in large amateur telescopes, but the brightest stars can be glimpsed even there.

M15 is about 33,600 light-

years from Earth. M15 is perhaps the densest of all globular star clusters in our Milky Way galaxy. The core of this cluster has undergone a contraction known as core collapse and it has an area at its center with an enormous number of stars surrounding what may be a central black hole.

So, before Pegasus flies upside down into the west, grab your binoculars or telescope and en-

joy this beautiful collection of stars while it is well placed in the sky for extended viewing and contemplation.

Information credits:

- Dickinson, Terence 2006. *Nightwatch: a practical guide to viewing the universe*. Buffalo, NY. Firefly Books
- http://en.wikipedia.org/wiki/Messier_15
- <http://www.astr.ua.edu/gifimages/m15r.html>
- <http://www.seds.org/messier/m/m015.html>
- <https://science.nasa.gov/mission/hubble/science/explore-the-night-sky/hubble-messier-catalog/messier-15/>

Light Pollution (Cont'd)

(Continued from page 3)

starting 20 days earlier and running significantly longer ([See all of our Ecology News](#)). In light polluted areas, it was found that 27% of the pollen season days tended to be severe, versus 17% in areas with low levels of satellite measured light pollution. In a separate study looking at nighttime pollination on the Tibetan Plateau it was found that moth driven pollination activity dropped nearly 50% under artificial light, reducing seed maturation by 56%.

On the policy front, Breckenridge began enforcement of its lighting ordinance in January of this year. However, the cost to upgrade has become a source of consternation. One business owner spent \$8,000 upgrading its lighting to compliance. The most notable complaint involved simply finding the right fixture. Consumer hardware stores, perhaps unsurprisingly, proved of little help. Breckenridge adopted its lighting ordinance in 2007

and had a very generous 15-year runway to comply.

Elsewhere, Kentucky's House Bill 571 took effect on July 15th, requiring shielding on highway lights near farmland. Rockport, Massachusetts declined free LED lighting from energy provider, National Grid that would have saved \$40k annually. Rockport voted 823 to 82 to keep high pressure sodium lighting over the more efficient and cheaper operating LED fixtures.

Dr. Meng also discussed her team's new exploratory study looking to see if there was enough data to assess whether lighting policies had effect on communities. They looked at two pairs of cities: New York City and Newark, New Jersey; and Philadelphia and Washington, DC. New York and DC both had lighting policies on the books, while Newark and Philadelphia lacked any responsible lighting codes. Their exploratory study found that city lighting laws worked. Cities with policies saw spring leafing delayed 4

days and autumn color arriving 7 to 9 days earlier, signaling shorter, less disrupted growing seasons. It should be noted that the research here is very preliminary.

In satellite news, Dark Sky International, Environmental America, and Public Employees for Environmental Responsibility petitioned the FCC on July 8th for environmental reviews on planned orbital data center constellations. Separately, SpaceX disposed of 260 Starlinks in six months via atmospheric reentry and executed 355,000 collision avoidance maneuvers in the past year.

On the health front, a study of 222 schizophrenia outpatients found those in the brightest bedroom settings showed 4x higher odds of obesity, 3.4x higher odds of hypertension, and carried 22lbs more body weight.

In the auto world, do you think headlights were too bright? Well, you are right! Tesla exceeded legal headlight brightness by double the lumens on 20,000 vehicles, argued no one complained so it must be fine, and lost that argument two years later. GM tried the same for 725,000 SUVs. GM also failed.

On the culture front, we closed out this month with a discussion on Guy Ottewell, who published his Astronomical Calendar for 43 consecutive years and received an asteroid named in his honor on July 6th. Also, did you know that there's essentially an American Stonehenge? Artist Charles Ross spent decades building Star Axis in New Mexico. The facility is aligned to astronomical calculations in the tradition of Stonehenge.

Speaker Bio (Cont'd)

(Continued from page 7)

water history. Curiosity confirmed that ancient Mars hosted habitable environments within lake-deposited sediments and also detected preserved organic molecules. As the rover has climbed Mount Sharp, it has encountered layered deposits that record a transition from wetter conditions capable of sustaining lakes to progressively drier and more oxidizing environments. Now more than a decade into the mission, Curiosity continues to study sulfate-rich rocks higher

on the mountain, helping us understand how Mars evolved from a once potentially habitable world into the cold, dry planet observed today.

Biosketch: Dr. Jeffrey R. Johnson is a Principal Professional Scientist at the Johns Hopkins University Applied Physics Laboratory (APL) in Laurel, Maryland. As a geologist and planetary scientist, his interests are in understanding the surface composition and geology of

(Continued on page 13)

Budget-Friendly Star Tracker (Cont'd)

(Continued from page 8)

leaves us with the final major step: spinning this nut around the screw at precisely one rpm.

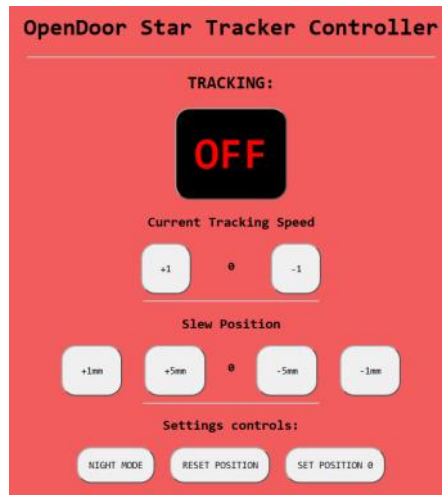
This can be done in multiple ways, such as with an electric motor, as seen in many current astrophotography mounts, or even by hand. For my design, I chose to use a basic electric stepper motor, as I have prior experience with controlling motors using microcontrollers, and I believe it will provide accurate speed adjustments.

This motor increases usability tenfold, while only increasing the cost minimally, as they are quite cheap from online sellers. The motor moves the screw up and down by spinning a nut, with a 1:5 gear reduction (see photos). Specifically, I chose the 28BYJ-48 stepper motor, which has 2,048 steps per revolution.

This step per revolution is a very important factor in why I chose to use a stepper motor, because it means that I can send a command to the motor using a driver, telling it to move any amount of steps I want to, to match the sidereal day. With over 2000 steps in one rotation, it can achieve fine levels of speed adjustment for this 1 rpm tracking.

But this is contradictory to what I stated earlier. Why would it need speed adjustments if the math says it only needs to rotate at one rpm?

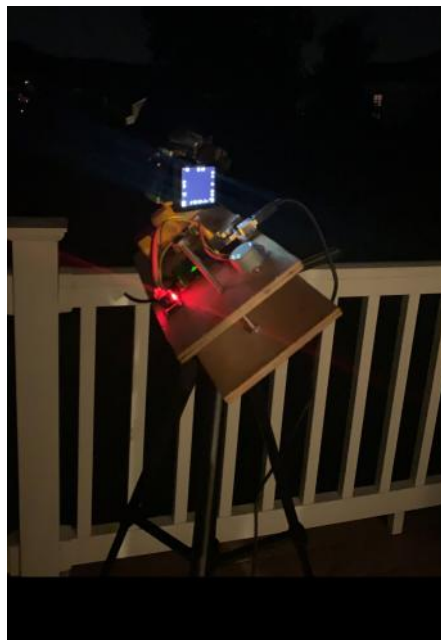
The reason is manufacturing errors: I can't make a hole precise enough to hit exactly 11.43 inches, and there are other small, speed-related issues such as screw friction or software slow-



The Wi-Fi controller page programmed in HTML and C++ for the ESP32 microcontroller.

downs. This adjustment would allow me to change the speed of the motor on the fly to get perfect tracking with pinpoint stars, especially when paired with the ESP32 microcontroller.

A microcontroller is a small circuit board with a small computer chip that you have to write code to give it specific instructions. It is about the size of a



The testing of the initial prototype with the DSLR and photography tripod

postage stamp, and I can use one to control the exact speed of the motor driver by sending specific electric pulses in the correct order. In this case, the ESP32 is a specific microcontroller that has built-in Wi-Fi and Bluetooth capabilities, which the more common Arduino microcontrollers lack.

This built-in Wi-Fi had the most influence on me and led me to choose this microcontroller, since it lets me control and adjust the tracking speed by connecting its Wi-Fi to my phone. This microcontroller is also quite budget-friendly and commonly found on the internet, as well as many in person DIY electronics stores, for just \$8 each.

Now, this leaves us with the polar alignment of the tracker and camera mount. I had many different iterations of this, as it was neither accurate nor easy to align for my first few versions. My first design was to simply point the tube of the door hinge at Polaris as best as I could, which surprisingly had much better polar alignment than expected, but it left a lot to be desired.

The second version featured a drinking straw attached parallel to the door hinge to align Polaris through, which worked much better, and also highlighted another issue with the design: the tripod. Up to this point, I had been using a cheap camera tripod that cost me around \$20, and it was not meant to hold the weight of two wooden planks, electronics, and the rest of the setup.

(Continued on page 15)

Speaker Bio (Cont'd)

(Continued from page 11)

planetary surfaces. Jeff received his B.S. degree in Geological Sciences from the University of Michigan. He earned his M.S. and Ph.D. in Geoscience at the University of Arizona, where his research concentrated on lunar telescopic observations, and mapping of Venus using radar images from the Magellan spacecraft.

As a post-doc at the University of Hawaii he investigated using thermal infrared spectroscopy to detect buried landmines. He then transitioned to the United States Geological Survey's Astrogeology Science Center in Flagstaff, Arizona, where he worked on the Mars Pathfinder mission, and various NASA-funded projects to study the

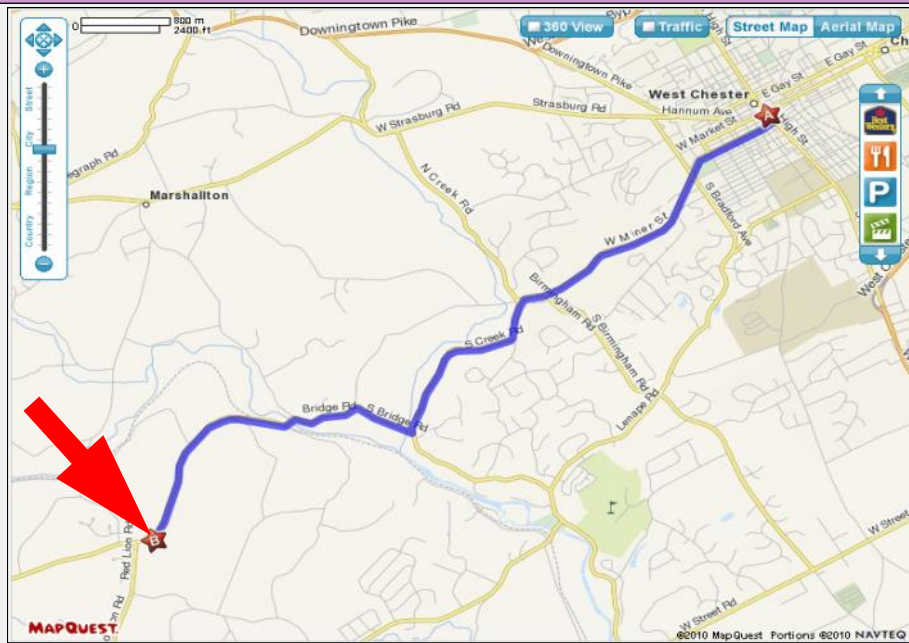
(Continued on page 18)

Classic La Para by Nicholas La Para

I DUNNO, WHAT'S HEISENBERG SAY? THE HIGGS BOSON: WHO NEEDS IT?
I DON'T NEED A TELESCOPE, I HAVE AN IPAD.
NO IMAGES FOR ME, I WANT VIRGIN PHOTONS
ALIENS FIND EARTH, DECIDE TO AVOID IT.
TORONTO REFRACTORS PLAY NEW YORK NEWTS.
ULSARS: THE BEAT GOES ON. EIGHT PLANETS, THAT'S ENOUGH FOR ANYONE.
NASA DONATES OLD SPACE SUITS TO GOODWILL.
ENTROPY ALWAYS WINS.



CCAS Directions



Brandywine Red Clay Alliance

1760 Unionville Wawaset Rd
West Chester, PA 19382
(610) 793-1090
<http://brandywinewatershed.org/>

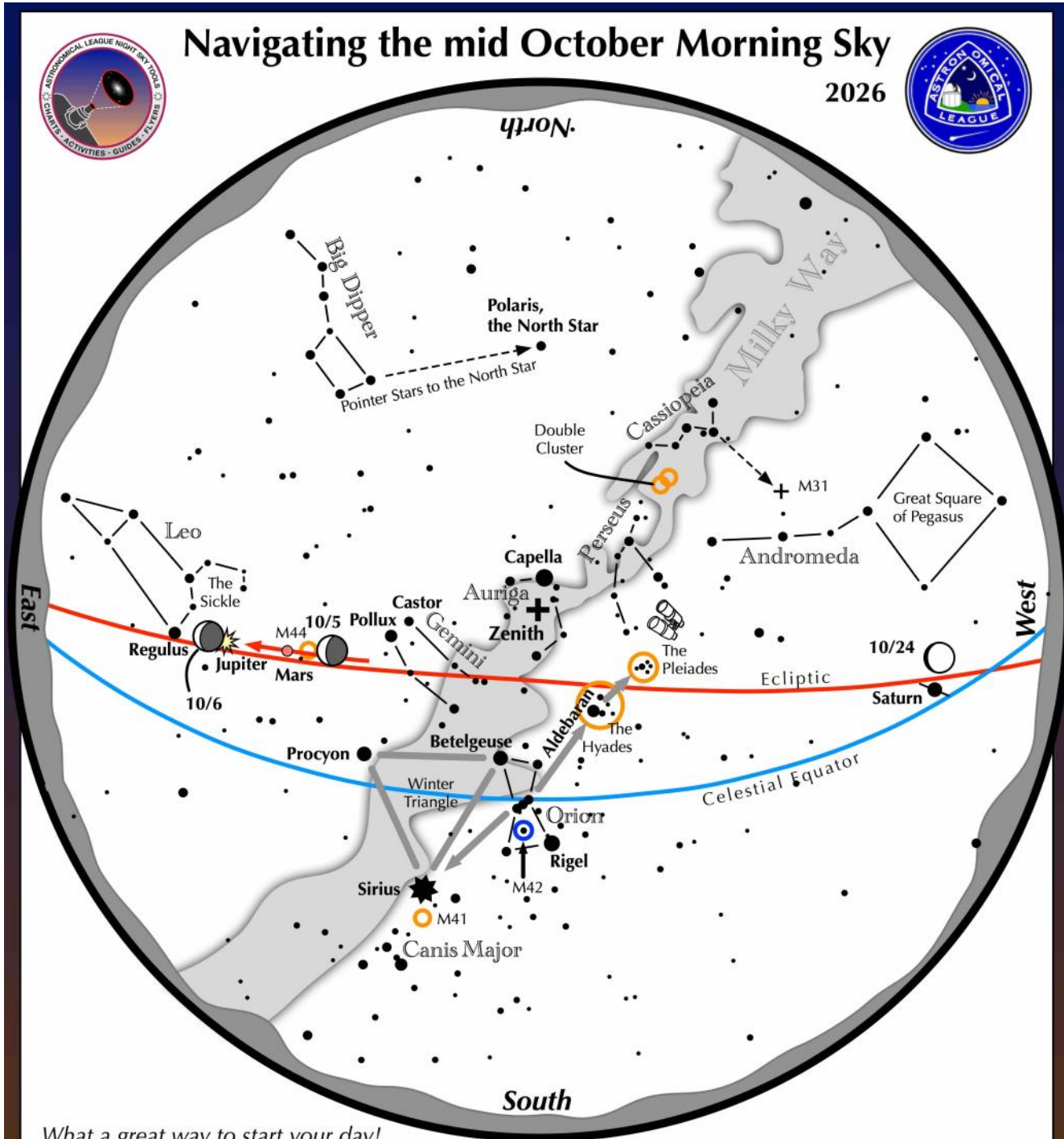
BRC was founded in 1945 and is committed to promoting and protecting the natural resources of the Brandywine Valley through educational programs and demonstrations for all ages.

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).



What a great way to start your day!

For observers in the middle northern latitudes, this chart is suitable for mid October at 5:00 a.m.

Late sunrises in October provide opportunities for early morning skywatching.

- Bright Jupiter shines high in the east.
- Crescent moon lies just west of Mars on October 5.
- The crescent moon glows next to and occults bright Jupiter on October 6.
- The near full moon glows in the west next to Saturn on October 24.
- During the first half of October, gaze high in the south and overhead to see these many celestial features: the Pleiades, the Hyades with Aldebaran, Orion, Capella and Auriga, the Winter Triangle with Sirius and Procyon, Gemini, and, in the east, Jupiter.

Astronomical League www.astroleague.org; duplication is allowed and encouraged for all free distribution.

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Budget-Friendly Star Tracker (Cont'd)

(Continued from page 12)

I now use a very stable, heavy tripod that I repurposed from a cheap second-hand telescope that I got for a great deal, for \$10. This tripod is much more secure, and with a 3D-Printed equatorial wedge, it functioned much better than the previous one.

For the current design, the polar alignment setup includes a small toy refractor with a 300mm focal length, which serves as a much more accurate polar alignment, and as a bonus, it cost me nothing, as I had it

from my earlier childhood, not that long ago. Finally, I mounted a 3D-Printed DSLR ball head to the front of the board to mount my Olympus DSLR to take long-exposure photos with.

To conclude, this tracker design is now nearing completion, as I am yet to fully complete programming the Wi-Fi control interface, mounting the micro-controller to the body of the tracker, and mounting the battery pack to the tripod. This entire tracker will be fully open-source, meaning the plans for the project will be available for anyone to

download and create their own budget star tracker. It ended up costing under \$30 for me, as I had some parts lying around, but it would only cost around \$40 to make it from scratch.

I hope to write a future update regarding this, with finished astrophotos taken with this homemade tracker.

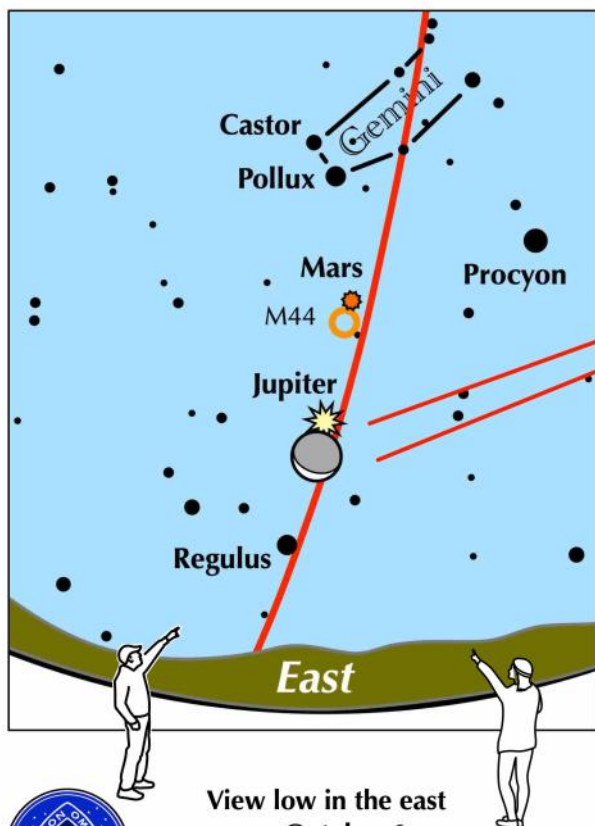
Thank you for reading. Clear skies.

[Editor's Note: All images courtesy of the author.]

Observing the Lunar Occultation of Jupiter

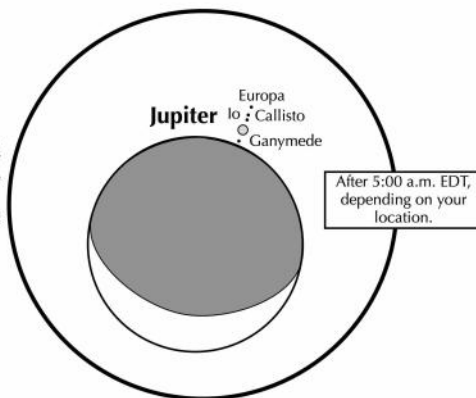
courtesy of the Astronomical League

In the early morning of October 6, try this challenge:



**View low in the east
on October 6
2 hours before sunrise**

**View through a
very low power
telescope**



**Moon occults Jupiter for the eastern US.
For the rest of us, it lies very close to Jupiter**

On the morning of October 6, the moon appears very close to Jupiter.

For those in the eastern half of the US, the planet and its Galilean satellites fully emerge from occultation after 5:00 a.m. The exact time depends on observing location.

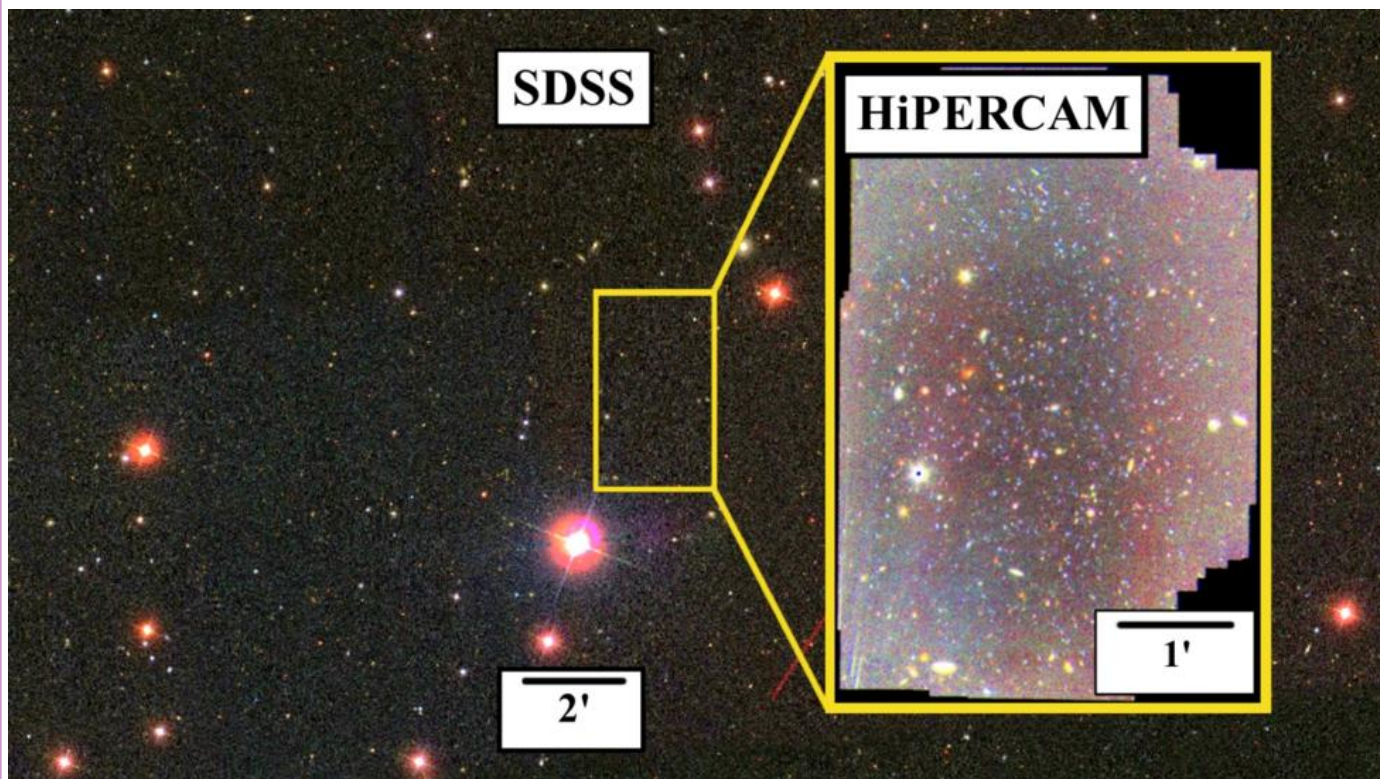
Those in the western US see Jupiter immediately next to the dark edge of the crescent moon.

About 5:35 a.m. EDT, Ganymede's shadow begins transiting the planet. It lasts until 9:15 a.m. EDT. Its exit can be seen by west coast telescope users.

And Mars can be found approaching the Beehive star cluster.

On Cloud 9: Have Astronomers Discovered the First Starless Galaxy?

By Robert Lea, courtesy of Space.com



An image of the candidate starless galaxy Cloud-9 as seen by HiPERCAM (Image credit: Trujillo, et al, CC BY 4.0)

Scientists are closer than ever before to confirming that a galaxy known as "Cloud 9" is the first "starless" or "failed" galaxy ever discovered by humanity.

A starless galaxy is one with virtually no stars despite possessing a wealth of gas and dust that would normally serve as the building blocks of stars. The dominant element of a starless galaxy would be [dark matter](#), the mysterious "stuff" that remains effectively invisible because it doesn't interact with light.

Located 14 million light-years away near the spiral galaxy [Messier 94](#) (M94), Cloud 9 is currently the best candidate for a starless galaxy humanity has discovered to date. It contains a vast cloud of hydrogen gas with an estimated mass of 1 million times that of [the sun](#), and dark matter with around 5 million so-

lar masses. Yet, the [Hubble Space Telescope](#) discovered in January this year that Cloud 9 emits virtually no starlight.

"But the most striking aspect of our research was the absolute emptiness of the image at the location of Cloud 9. When you look at an image reaching those depths and see nothing where a structure containing a million solar masses of gas should be, it is genuinely remarkable," team leader Ignacio Trujillo of the Instituto de Astrofísica de Canarias, Spain, told [Space.com](#).

"Most objects in the universe leave some trace of light. Cloud 9 does not. That silence is, in its own way, the most compelling result we could have obtained."

Trujillo explained that despite having enough raw material to build a small galaxy, Cloud 9

seems to have never formed any significant stellar population. "That combination — gas but no stars, sitting in a relatively normal environment — makes it one of the most compelling candidates for what theorists call a 'dark' or starless galaxy," Trujillo added. "The concept has been theoretically predicted for decades, but observationally confirmed cases remain elusive.

"The difficulty is obvious: if there are no stars, there is no visible light to detect, and the only way to find such objects is through their gas emission — typically neutral hydrogen observed at radio wavelengths — combined with extremely deep optical imaging to rule out the presence of even a faint stellar component."

Trujillo and colleagues set

(Continued on page 17)

Starless Galaxy (Cont'd)

(Continued from page 16)

about investigating Cloud 9 using the HiPERCAM camera on the [Gran Telescopio Canarias](#), the world's largest optical telescope. This led to them obtaining the deepest images ever taken of the Cloud 9 region, approximately ten times deeper than any previous optical imaging of this object.

"Honestly, the depth we achieved with HiPERCAM in just 2.36 hours of integration was striking," Trujillo said. What they saw left no questions about the nature of this galaxy.

"The result was clear: we detected absolutely no stellar emission within the region corresponding to the location of Cloud 9," Trujillo said. "Assuming an old, metal-poor stellar population — which would be the hardest kind to detect — we can set an upper limit on the total stellar mass of just 16,000 solar masses. Cloud-9 appears to be, within the limits of our observations, genuinely starless."

Though starless galaxies are on the verge of escaping the realms of the purely theoretical thanks to this investigation of Cloud 9, how they form is still something of a puzzle. However, scientists do have a pretty solid idea of how a galaxy could take shape without birthing stars.

"The leading theoretical explanation involves the ultraviolet background radiation that permeates the universe," Trujillo said. "After the [epoch of reionization](#), this radiation field heats the gas in low-mass dark matter halos to temperatures high enough that the gas cannot cool

efficiently and collapse to form stars."

The researcher added that simulations of this period of the cosmos predict that dark matter halos below a certain mass threshold, around 5 billion solar masses, should remain essentially starless.

"Cloud 9 has a halo mass consistent with this regime. In this picture, starless galaxies are not exotic anomalies but a natural and abundant prediction of standard cosmological models," Trujillo explained. "The challenge has simply been finding them."

As impressive as these results are, the jury is still out on Cloud 9 as a starless galaxy. Further investigation will be needed before scientists can firmly declare they have discovered the first starless galaxy."

On the stellar side, deeper space-based imaging would be particularly valuable because resolving individual stars avoids many of the problems associated with diffuse-light measurements," Trujillo concluded.

"Hubble has already provided extremely strong evidence, and future facilities such as the [James Webb Space Telescope](#) (JWST) could potentially push the search further, although the optimal filters and stellar tracers would need to be carefully chosen."

The team's research is available on the paper repository site [arXiv](#).

Time for a Change

by John Carl Hepler, Ph.D., CCAS
Webmaster & Newsletter Editor

With the October 2026 issue of the monthly newsletter and the website updates, I'm stepping down from my dual duties as newsletter editor and webmaster. This was a decision that was not made lightly, nor in haste. But changes in my employment situation and family responsibilities, especially over this past year, proved to be more mentally and emotionally taxing than I had anticipated.

I joined CCAS in March of 2003 and took over the responsibilities of updating and maintaining the organization's website in November 2004. Then in August 2008, I assumed responsibility for the publication of the monthly newsletter, which to me made sense as I had to publish the website each month anyway. As the old saying goes, "kill two birds with one stone."

Based on my calculations, I have **updated the website 267 times**, and **published the newsletter 219 times**. I won the Astronomical League's Webmaster of the Year award in 2005, and the Mabel Sterns newsletter award twice, in 2009 and in 2016. I think I'm the only person in the country to earn both honors.

Over the years, as my professional life changed, first to pursue a master's degree, and then a doctoral degree, each month's newsletter and website update were a labor of love. They helped me remain connected to CCAS while living remotely, first in western PA, then eastern shore Maryland, and finally ending up in Berks county PA.

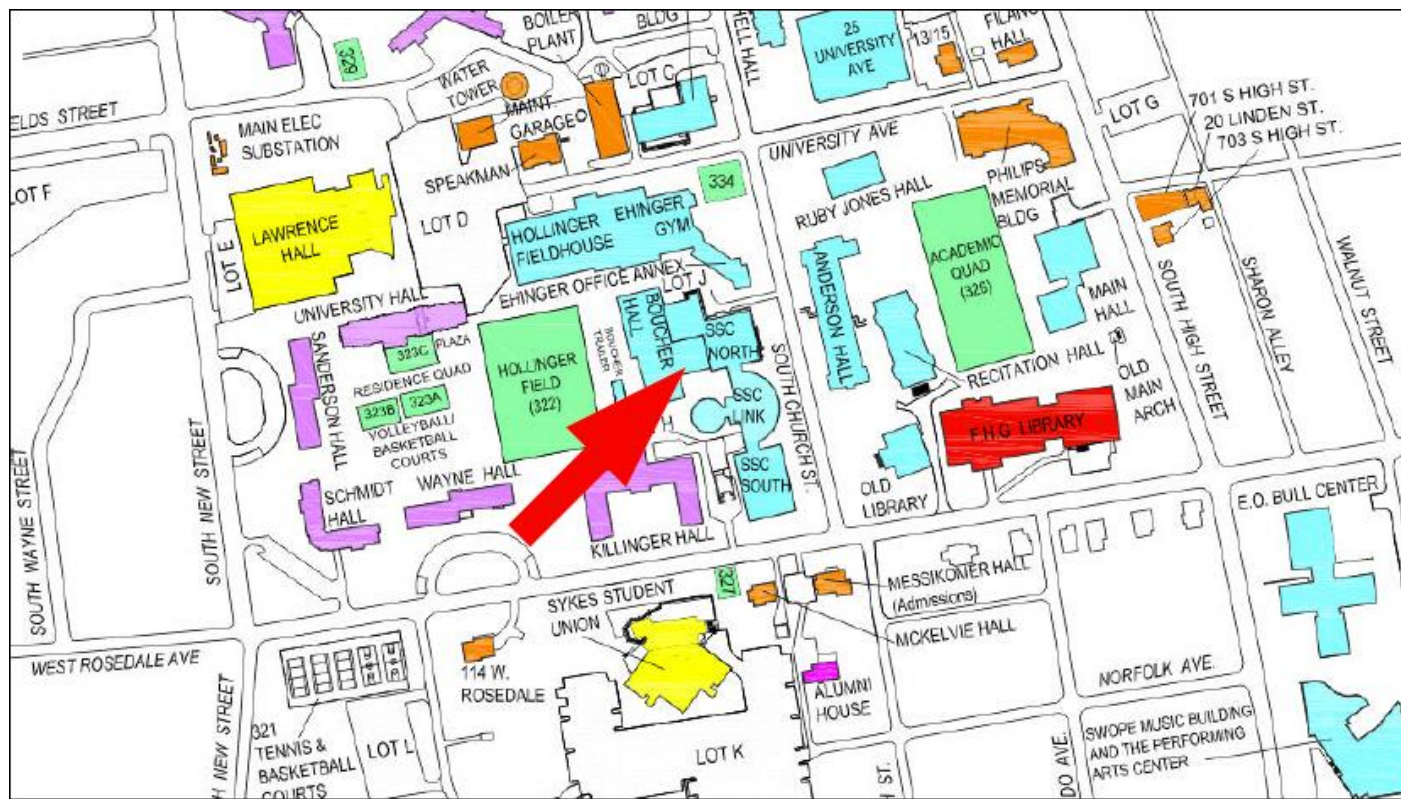
It's been a privilege to serve in these dual roles for over 20 years. I'll always be grateful for this experience. I've made so many friends and learned so much from so many of you. Members past and present, some still with us, others no longer present—each of you shared your knowledge, experience, and most importantly, your friendship, with me.

But now, it's time for someone else to take over. Technology in web hosting and desktop publishing has progressed over the past two decades. I'm excited to see what comes next for the public face of the Chester County Astronomical Society! I know the new solutions will be great!

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).



Speaker Bio (Cont'd)

(Continued from page 13)

Moon and Mars. He ultimately served three years as the Astrogeology Science Center Director before moving to APL in 2010. He was a Participating Scientist (PS) on the Mars Polar Lander and Mars Exploration Rover (MER) missions.

He is currently a PS on the Mars Science Laboratory Curiosity rover mission, a Co-Investigator on the SuperCam and Mastcam-Z instruments on the Mars2020 Perseverance rover mission, and Co-Investigator on the Dragonfly mission to Titan.

Website: <https://civspace.jhuapl.edu/people/jeffrey-johnson>

CCAS Membership Information and Society Financials

Treasurer's Report by Don Knabb

Sept. 2026 Financial Summary

Beginning Balance	\$1454
Deposits	\$470
Disbursements	-\$0
Ending Balance	\$1924

New Member Welcome!

Welcome to new CCAS members Frank & Christine Moscardiello, from West Chester, PA, and Donald Mathisen, also from West Chester, 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 \$35.00 for one year. Send to:

International Dark-Sky Association
5049 E Broadway Blvd, #105
Tucson, AZ 85711

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.lymebasics.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 Phoenix, Arizona.

Phone: 520-280-3846

<http://www.starrynightlights.com>



LIGHTHOUSE
OUTDOOR LIGHTING

Lighthouse Outdoor Lighting is a dedicated lifetime corporate member of the [International Dark-Sky Association](http://www.darksky.org). 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.

211 North Walnut St.
1st Floor
West Chester, PA 19380

Phone: 484-291-1084 or 800-737-4068

<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.



High Point Scientific is a retailer of telescopes, binoculars, eyepieces and telescope accessories from Meade, Celestron, Televue, Orion, StellarMate, Takahashi, and many more. They also have an extensive blog of advice and education for amateur astronomers.

High Point Scientific

442 Route 206

Montague NJ, 07827

Phone: 800-266-9590

<https://www.highpointscientific.com/>



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: 267-297-0423

Fax: 215-965-1524

Hours:

Monday thru Friday: 9AM 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 484-888-1831.

Contributing to Observations

Contributions of articles and images 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 to:

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

The deadline for submissions to the monthly newsletter is the 26th of each month. Articles and images should be original or the author/artist must be given credit. Articles should be in MS Word format with 12 point Times New Roman Font with single row spacing and one-inch margins on all four sides. Images should be in JPG or PNG file format. The submission window opens on the 20th of each month.

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 (484) 883-5033 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 & Treasurer: Don Knabb
484-888-1831

Observing: Don Miller
610-247-8712

Secretary: Beatrice Mazziotta
610-933-2128

Program: Bruce Ruggeri
610-256-4929

Education: Don Knabb
610-436-5702
Dennis O'Leary
610-701-8042

Webmaster & Newsletter: John Hepler
484-883-0533

CCAS Membership Information

The 2023 membership rates are as follows:

REGULAR MEMBER.....\$30/year
SENIOR MEMBER.....\$15/year
STUDENT MEMBER.....\$ 5/year
JUNIOR MEMBER.....\$ 5/year
FAMILY MEMBER.....\$40/year

Membership Renewals

Check the Membership Renewals on the front of each issue of *Observations* to see if it is time to renew. If you need to renew, you can mail your check, made out to "Chester County Astronomical Society," to:

Don Knabb
988 Meadowview Lane
West Chester PA 19382-2178

Phone: 484-888-1831
e-mail: treasurer@ccas.us

Sky & Telescope Magazine

The club membership subscription cost for *Sky and Telescope* magazine has increased to **\$45.75**. This is still a good saving from the regular rate of **\$57.75**.

There is no need to go through the CCAS treasurer for subscriptions or renewals. Just go to the Sky and Telescope website and select "Magazine", then under the FAQs you can subscribe at the club rate.

<https://skyandtelescope.org/subscribe/>

If you have **any** questions call Don Knabb at 484-888-1831.

Astronomy Magazine Group Rates

Subscriptions to this excellent periodical are available through the CCAS at a reduced price of **\$34.00** which is much less than the individual subscription price of **\$42.95** (or \$60.00 for two years).

There is no need to go through the CCAS treasurer for subscriptions or renewals. Just call customer service at 877-246-4835 and request the club rate for your new subscription or renewal.

