



# Observations

A Monthly Publication Of The  
CHESTER COUNTY ASTRONOMICAL SOCIETY

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## First Light with 3D-Printed Hadley 114 Telescope



Read about CCAS Member Advay Kavathekar's experience building his own Newtonian telescope starting on pg. 11. Parts of Ursa Major visible in the background in his image above.  
Image details: 3-second exposure, iPhone 15.

## Membership Renewals Due

|         |                                                                                                                                           |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------|
| 09/2026 | Das<br>Matas<br>Patel<br>Peterson<br>Reilly<br>Sarkar                                                                                     |
| 10/2026 | Abbott<br>Kraynik<br>Lane<br>Lester<br>Levin<br>Na<br>Payton<br>Richardson<br>Vish, D.<br>Vish, S.<br>Wirth                               |
| 11/2026 | Baker<br>Buczynski<br>Catarinella<br>Harner<br>Holenstein<br>Kurz<br>Leiden<br>Marks<br>Prasad Packirisamy<br>Skupien<br>Suchower<br>Ward |

## September 2026 Dates

- 4th • Last Quarter Moon (3:51 a.m. EDT).
- 6th • The Moon passes 3° north of Neptune, 6 p.m. EDT.
- 10th • New Moon (11:27 p.m. EDT).
- 18th • First Quarter Moon (4:43 p.m. EDT).
- 18th • Venus is at greatest brilliancy, 9 p.m. EDT.
- 25th • Mercury passes 1.0° north of Spica, 9 p.m. EDT.
- 26th • Full Moon, the Harvest Moon (12:49 p.m. EDT).
- 30th • The Moon passes 5° north of Uranus, midnight EDT.



## CCAS Upcoming Nights Out

In addition to our monthly observing sessions at the Myrick Conservancy Center, BRC (for directions, see pg. 17), 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.

☼ Friday, September 18, 2026: CCAS Special Observing Session: International Observe the Moon with the WCU Mather Planetarium, 8 p.m. EDT to 10 p.m. EDT.

☼ Saturday, September 19, 2026 - CCAS Special Observing Session: International Observe the Moon Night, West Chester Courthouse steps, 6 p.m. EDT to 10 p.m. EDT.

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

## Summer/Autumn Society Events

### September 2026

**4th** • CCAS Monthly Observing Session, Myrick Conservancy Center, BRC. The observing session starts at sunset. (Rain date: September 5, 2026). For more information, contact our Observing Chair, [Don Miller](#).

**8th** • CCAS Monthly Meeting, in person (as well as via Zoom) at West Chester University's Merion Science Center, Room 112. Our guest speaker is Dr. Theodore Kareta, Department of Physics, Villanova University. His presentation is titled "Visitors or Neighbors?: The Origin and Properties of the Quasi-Satellites and 'Mini-Moons' of the Earth."

**9th** • Downingtown Library Solar Wednesday, 10:00 a.m. to 12:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

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

**15th** • Middletown Free Library Solar Tuesday, 2:00 p.m. to 3:30 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

**17th** • Kennett Library Solar Observing Session, 2:00 p.m. to 4:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

**18th** • CCAS Special Observing Session: International Observe the Moon with the WCU Mather Planetarium, 8 p.m. EDT to 10 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

**19th** • Downingtown Library Solar Saturday, 10:00 a.m. to 12:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

**19th** • CCAS Special Observing Session: International Observe the Moon Night, West Chester Courthouse steps, 6 p.m. EDT to 10 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

**19th** • CCAS Solar Observing Session from 10:00 a.m. to 12:30 p.m. EDT at Downingtown Library, Downingtown, PA. For more information, contact our Observing Chair, [Don Miller](#).

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

**22nd** • Middletown Free Library Solar Tuesday, 2:00 p.m. to 3:30 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

**22nd** • Equinox (northern autumn/southern spring begins), 8:00 p.m. EDT.

**23rd** • Downingtown Library Solar Wednesday, 10:00 a.m. to 12:00 p.m. EDT. For more information, contact our Observing Chair, [Don Miller](#).

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

## May 2026 Meeting Minutes by Bea Mazziotta, CCAS Secretary

- Dave Hockenberry welcomed attendees to the May 12, 2026 meeting. This final meeting of the year was held at WCU and via Zoom.
- Don Miller, Observing Chair, reviewed some May night sky observing highlights including:
  - M51 - the Whirlpool Galaxy in Canes Venatici
  - M53 - a distant globular cluster in Coma Berenices and planetary viewing opportunities
- He reminded members of the monthly Hubble Night Sky Challenge which has 8 objects to observe in May in the northern hemisphere.
  - Link for details at <https://science.nasa.gov/mission/hubble/science/explore-the-night-sky/hubbles-night-sky-challenge/>
  - He went over upcoming CCAS observing events both night sky and solar. Go to [CCAS.US](#) for details.
- Dr. Ken Koeplinger was the evening's speaker. His presentation "Stars & Stripes in the Sky; U.S. Astronomy at 250 Years" was a timely discussion of American discoveries and contributions to the science of Astronomy going back to the time of the country's founding and ending with modern day telescopes and space exploration.
  - Dr. Koeplinger, a retired research chemist, is a NASA Caltech/JPL Solar System Ambassador and adjunct Chemistry instructor.

## September 2026 CCAS Meeting Agenda by Bruce Ruggeri, CCAS Program Chair

Our next meeting will be held on September 8, 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. Theodore Kareta, Department of Physics, Villanova University. His presentation is titled "Quasi-Satellites, Mini-Moons, and Temporary Co-Orbitals."

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 coming 2026-2027 season. If you are interested in presenting, or know someone who would like to participate, please contact me at [programs@ccas.us](mailto:programs@ccas.us).

## September 2026 Guest Speaker Bio & Presentation

by Bruce Ruggeri, CCAS Program Chair

Our in-person and Zoom monthly CCAS meeting scheduled for Tuesday, September 8, 2026, will commence at 7:30 p.m. EDT. This is our first monthly meeting of the 2026-2027 season.

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 is Dr. Theodore Kareta, Department of Physics, Villanova University. His presentation is titled "Visitors or Neighbors?: The Origin and Properties of the Quasi-Satellites and 'Mini-Moons' of the Earth."

Synopsis: The Earth only has one moon, right? Right?! You might be confused if you've



*Theodore "Teddy" Kareta, Ph.D.*

been reading news articles over the past few years confidently declaring otherwise. In this talk, Dr. Theodore ("Teddy") Kareta will present and discuss the na-

ture and origins of the Earth's many closest companions: asteroids on extremely near-Earth orbits that can misleadingly get called "mini-moons."

While most of the near-Earth asteroids are thought to come from the Main Belt of asteroids between Mars and Jupiter, recent research has shown that some small fraction of the space rocks on the most Earth-like trajectories might have an origin closer to home as ejected boulders blasted off our Moon in a recent impact — but how can we tell the difference? Understanding the origins of and learning how to search for these fascinating objects won't just help us understand how much danger the Earth is in from potentially hazardous asteroids, it might also help us understand the most recent geologic history of our one (and only true permanent) Moon.

This talk will pay special attention to very recent developments in this area, specifically the February 2026 James Webb Space Telescope observations of one of these ultra-near-Earth objects, Kamo'oalewa, followed by that asteroid's visitation by the Tianwen-2 spacecraft in July 2026.

**Biosketch:** Dr. Teddy Kareta is a planetary astronomer who studies the origin of the Solar System through studying the comets, asteroids, and interstellar objects inside of it with telescopes, spacecraft, and computer models. Originally from Brookline, Massachusetts, he received his Bachelors' degrees in Astron-

## Evidence of Giant Rings in Venus's Atmosphere Uncovered in Archived Observations

by Paul Arnold, *Physics.org*

In 2010, scientists waiting to use the William Herschel Telescope in the Canary Islands captured a brief 36 minutes of images of Venus. They were waiting for the sun to set so they could look at distant stars and dust disks around young stars. Consequently, little attention was paid to the data, which was filed away in the archives.

Fast-forward more than a decade, and researchers from the Netherlands decided to look at the old observations. What they discovered, hidden in the data, was a series of faint, planetwide concentric rings in the upper atmosphere. Their findings are **published** in a paper in *The*

*Planetary Science Journal*.

The team analyzed images captured with ExPo, a highly sensitive instrument designed to measure polarized light. They compared ordinary images with polarized images taken through several visible-light filters to search for patterns that might reveal hidden atmospheric features.

They discovered a faint ring pattern in three of the observations. The rings were completely invisible in the normal images, but they showed up when the researchers isolated the polarized light.

*(Continued on page 15)*

*(Continued on page 17)*

STAR CHART FOR MID-LATITUDES OF THE NORTHERN HEMISPHERE

# What's Out Tonight?

OPTIMIZED FOR 14 HOURS  
AFTER SUNSET

Individuals may also use for group viewing

## September 2026 Sky Chart

### 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.

### FREE

Visit: [WhatIsOutTonight.com](http://WhatIsOutTonight.com)

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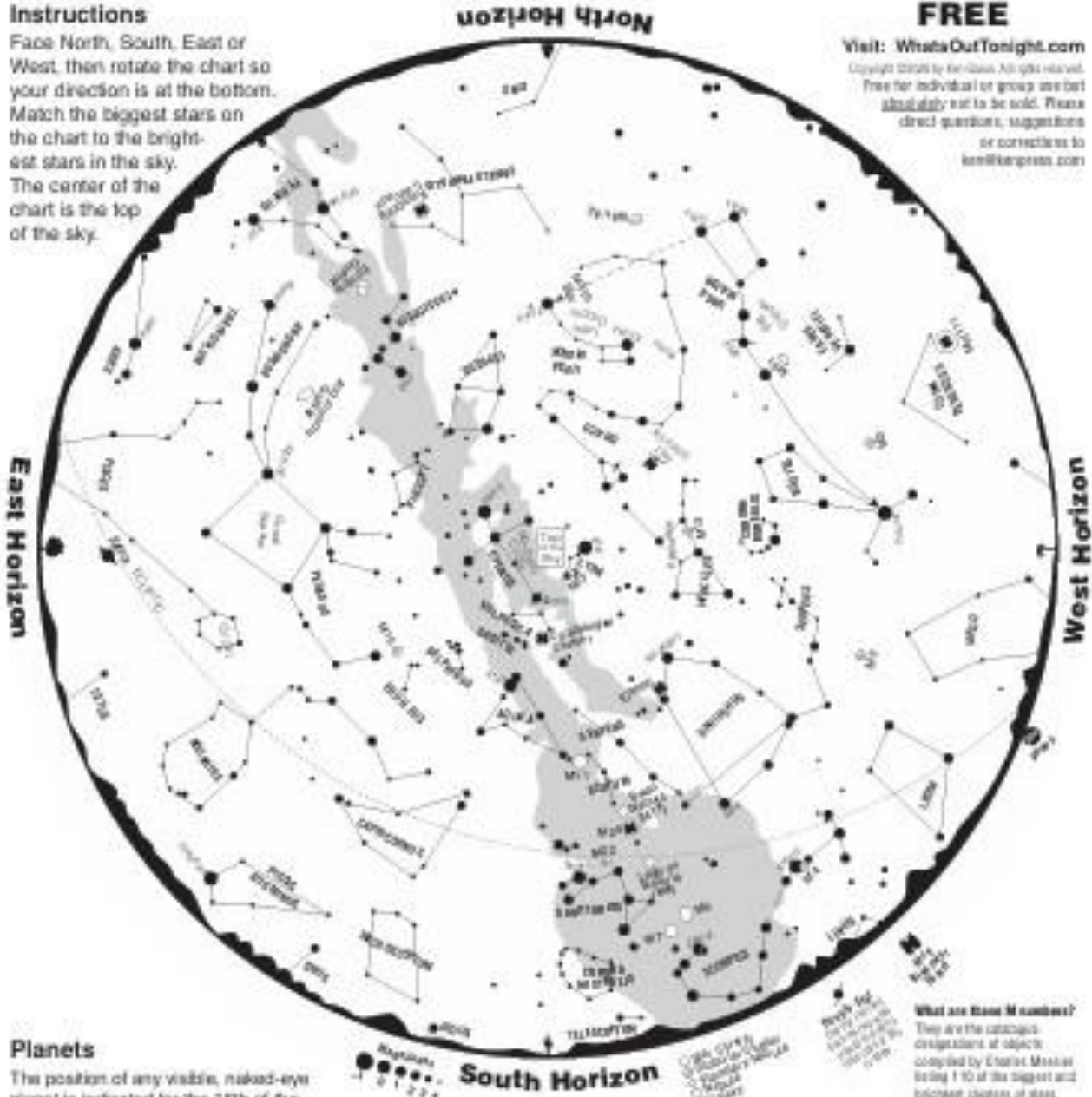
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should not be sold. Please

direct questions, suggestions

or corrections to

[kens@kessler.com](mailto:kens@kessler.com)



### Planets

The position of any visible, naked-eye planet is indicated for the 15th of the month. If the planet moves significantly during a month, other positions will be noted with dates. The ECLIPIC 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.

### September 2026 Planet Notes (15th of each month)

Venus, at magnitude -4.5, sets in the west about 1 hour after the Sun.  
Mars, at magnitude +1.2, in Gemini, rises in the east around 2 AM.  
Jupiter, at magnitude -1.8, in Cancer, rises in the east about 3 hours before the Sun.  
Saturn, at magnitude +0.4, in Cancer, rises in the east about 1 hour after sunset.

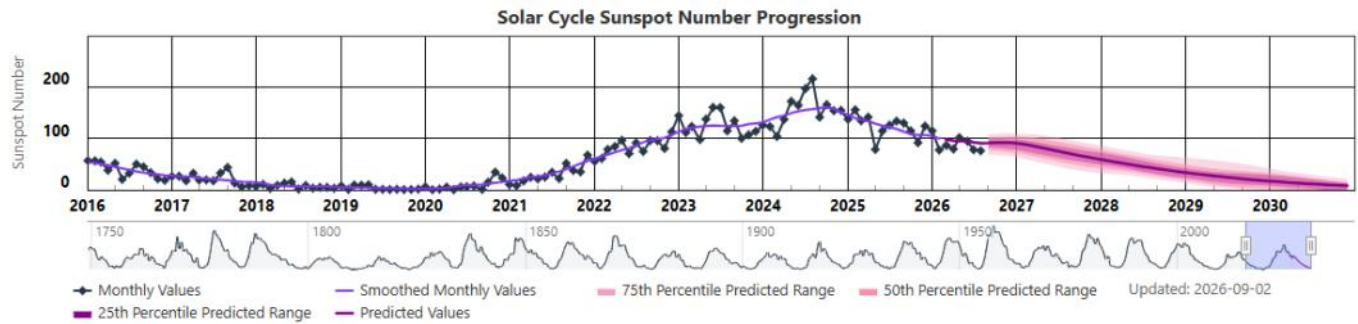
Distances planets are from the Earth on the 15th of this month:  
Venus: 42,803,080 miles. Mars: 105,903,080 miles.  
Jupiter: 588,808,080 miles. Saturn: 786,808,080 miles.

### What are those M numbers?

They are the catalogue designations of objects compiled by Charles Messier listing 110 of the biggest and brightest clusters of stars, nebulae and galaxies.

## September 2026 Observing Highlights

by Dave Hockenberry, CCAS President



### Key Events for this month:

For yet another month, some of the best observing will be available in the predawn 1-2 hours before sunrise.

Thursday, September 3rd - the moon, at about 60% illumination, brushes close to the Pleiades open star cluster in Taurus. Use a small, low focal length telescope or better yet binoculars to view! The moon doesn't occult the cluster in our area, but it will be a visual treat. If you miss this one, look again on September 30th for a repeat performance.

Tuesday, September 8th: a thin crescent moon will be about 3.5 degrees above Jupiter in the predawn skies. For those with Go-To rigs that can track, later that day the moon will occult Jupiter during the day. For our location Jupiter will disappear behind the moon at about 4:00 in the afternoon and reappears at just past 5:00 p.m. EDT.

Saturday, September 26th: Getting out in the early

evening brings a close approach on the moon to Saturn. As the evening progresses Saturn will be within  $6^\circ$  of the full moon. This will be a fun opportunity to swing your telescope just between the two but take time to appreciate this with naked eye observing as well.

**Discussion:** We are approaching Fall, so days are getting noticeably shorter and nights longer. Sunset occurs at 7:30 p.m. EDT at the beginning of the month and at 6:45 p.m. EDT by the end of the month. In practical terms that means it will be dark by 8:30 p.m. EDT and 7:45 p.m. EDT respectively. With comfortable temperatures and better seeing by the end of September this is a great time of year to get outside, especially late September and into October for the best seeing conditions of the year.

**THE SUN** – Although winding down from Solar Max 2 years ago, we are still seeing plenty of sunspots and prominences during our solar events.

*(Continued on page 7)*

### Sunrise/Sunset & Moon Phases for September 2026

| Date       | Civil Twilight Begins | Sunrise       | Sunset        | Civil Twilight Ends | Length of Day |
|------------|-----------------------|---------------|---------------|---------------------|---------------|
| 09/01/2026 | 6:02 a.m. EDT         | 6:30 a.m. EDT | 7:33 p.m. EDT | 8:01 p.m. EDT       | 13h 02m 21s   |
| 09/15/2026 | 6:16 a.m. EDT         | 6:43 a.m. EDT | 7:10 p.m. EDT | 7:38 p.m. EDT       | 12h 27m 27s   |
| 09/30/2026 | 6:30 a.m. EDT         | 6:57 a.m. EDT | 6:46 p.m. EDT | 7:13 p.m. EDT       | 11h 48m 25s   |

### Moon Phases

|               |            |               |           |            |                |
|---------------|------------|---------------|-----------|------------|----------------|
| Last Quarter  | 09/04/2026 | 3:51 a.m. EDT | New Moon  | 09/10/2026 | 11:27 p.m. EDT |
| First Quarter | 09/18/2026 | 4:43 p.m. EDT | Full Moon | 09/26/2026 | 12:49 p.m. EDT |

## Through the Eyepiece: Messier 21, an Open Cluster in Sagittarius

by Don Knabb, CCAS Treasurer & ALCOR

Back in the 18th century, famed French astronomer Charles Messier noted the presence of several “nebulous objects” in the night sky. Having originally mistaken them for comets, he began compiling a list of these objects so that other astronomers wouldn’t make the same mistake. This list is now called The Messier Catalog, and it contains many of the deep space objects that amateur astronomers seek with their binoculars and telescopes.

The summer southern sky around Sagittarius and Scorpius is full of amazing objects from Messier’s catalog. One of the less flashy and often overlooked objects is Messier 21.

Messier 21 or M 21, also designated NGC 6531 or Webb's Cross, is an open cluster of stars in the north-east of the constellation Sagittarius, close to the Messier objects M20 and M8.

This cluster is relatively young and tightly packed. A few blue giant stars have been identified in the cluster, but Messier 21 is composed mainly of small dim stars.

Messier 21 is only 4.6 million years old, which makes it relatively young for an open star cluster. It is only 10 percent of the age of Messier 45, the famous Pleiades cluster in Taurus, and 1 percent the age of the Sun.

Messier 21 lies just beyond naked eye visibility but can easily be found even in the smallest binoculars. It is located 2.5 degrees northwest of Messier 8 (the Lagoon Nebula) and only 0.75

(Continued on page 10)



Image credit: Don Knabb, Seestar S50

## Observing (Cont'd)



Top to bottom: M57 Ring Nebula; M27 Dumbbell Nebula;  
M56 Courtesy of NASA/ESA

(Continued from page 5)

And with the sun arcing lower in the sky, we don't need quite as much sunblock to use our solar scopes. For the latest solar activity report check out this web site link:

<https://earthsky.org/sun/sun-news-activity-solar-flare-cme-aurora-updates/>

MOON: The full moon in September is called the Harvest Moon.

- First Quarter – September 18th
- Full Moon – September 26th
- Last Quarter – September 4th
- New Moon – September 11th

### PLANETS:

- Mercury – Is hidden in the Sun's glare all month.
- Venus – Is Visible at dusk in the first half of the month, slowly diving into the sun.
- Mars – Rises early in the early morning at shortly before 3:30 a.m. EDT September 1 and rises earlier later in the month. At magnitude 1.2 it is much dimmer and smaller than it will be next February when it gets to magnitude -1.2!
- Jupiter – Rises just before dawn and will be visible in dawn skies for the rest of the month.
- Saturn – Is visible all night during September, and with the rings opening up it becomes more spectacular with each passing week.
- Uranus – Rises at 11:13 p.m. EDT and transits at 6:35 a.m. EDT in the morning.
- Neptune – Rises at 8:29 p.m. EDT and transits the meridian at 2:36 a.m. EDT in the morning.

SELECTED NIGHT SKY OBJECTS: High in the south at nightfall catch the Ring Nebula M57 and the "Double Double" star Epsilon Lyrae in Lyra the Harp. While you are in Lyra check out the globular cluster M56. At Magnitude 7.1 it punches above it's weight in medium aperture telescopes. Then just a short hop East in Vulpecula get a glance at the Dumbbell Nebula M27. The Ring Nebula is what the Dumbbell nebula would look like if we could see it from the top.

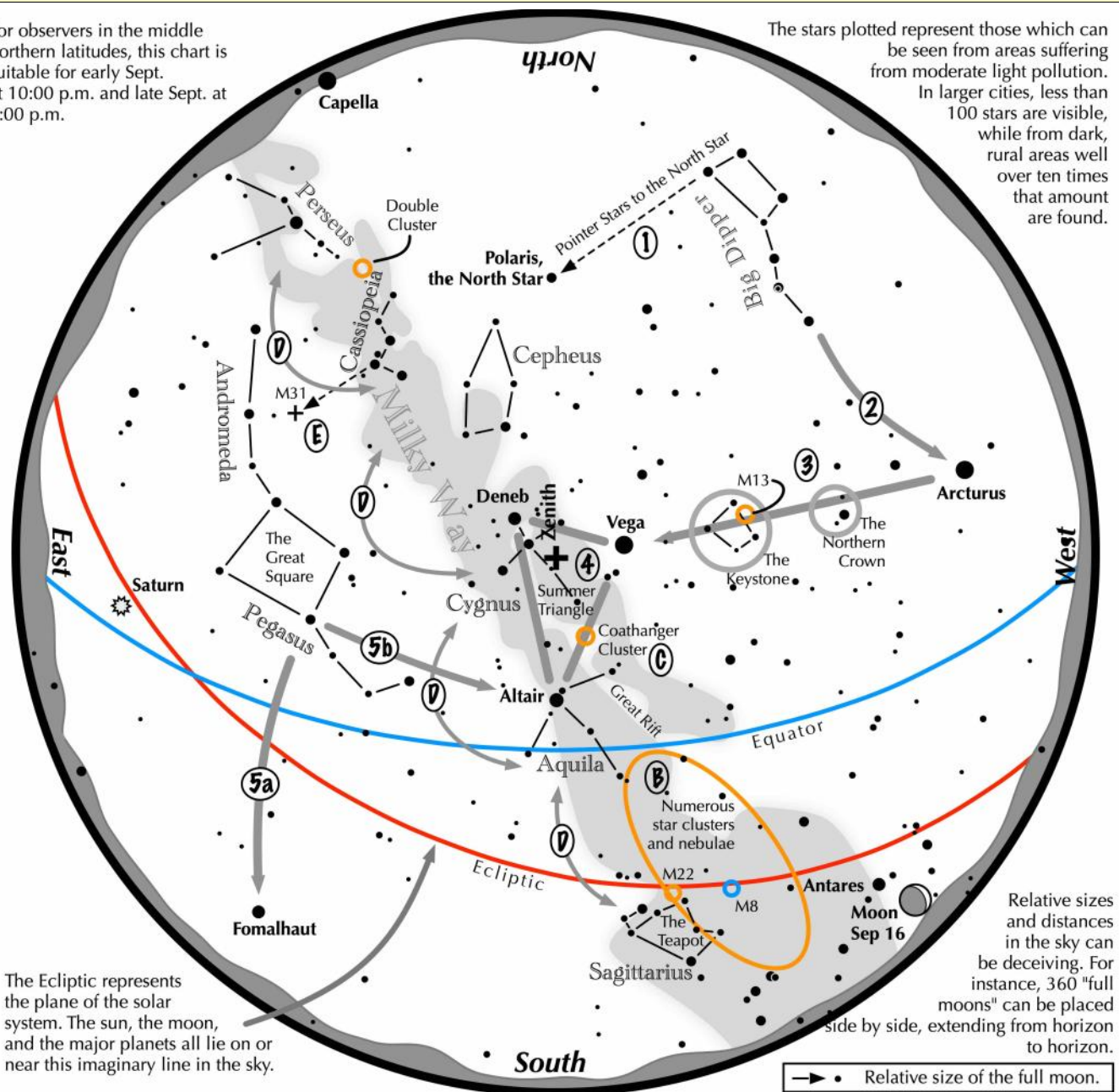
(Continued on page 18)

## Navigating the mid-September Night Sky

courtesy of the Astronomical League

For observers in the middle northern latitudes, this chart is suitable for early Sept. at 10:00 p.m. and late Sept. at 9:00 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.

Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

→ • Relative size of the full moon.

### Navigating the mid September 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 September evening sky.
- 3 Nearly overhead shines a star of similar brightness as Arcturus, 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 The stars of the summer triangle, Vega, Altair, and Deneb, shine overhead.
- 5 The westernmost two stars of the Great Square, which lies high in the east, point south to Fomalhaut. The southernmost two stars point west to Altair.

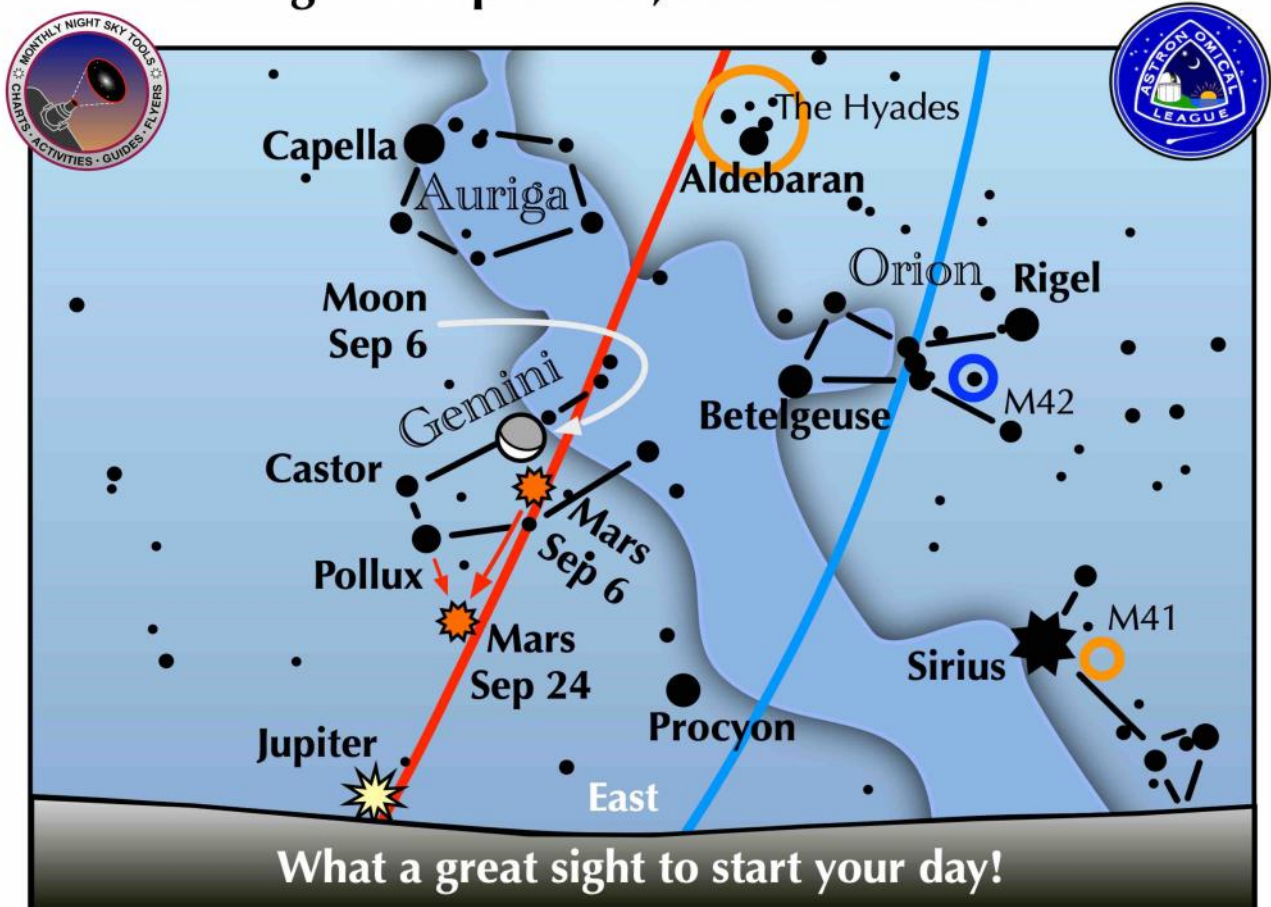
#### Binocular Highlights

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

Astronomical League [www.astroleague.org/outreach](http://www.astroleague.org/outreach); duplication is allowed and encouraged for all free distribution.



**If you can catch only one celestial event in the morning this September, see one of these two.**



**September 6:**

**Celestial Parallelogram of Castor, Pollux, Mars, and the Moon**

**September 24:**

**Mars aligns with Castor and Pollux forming the Triplets of Gemini**

**Look in the east 90 minutes before sunrise on Sep. 6.**

- The twin stars of Gemini – Castor and Pollux – along with Mars and the crescent moon, full with earthshine, form an attractive parallelogram.
- Jupiter peeks above the eastern horizon.

**Again, look in the east 90 minutes before sunrise on Sep. 24.**

- Mars aligns with Castor and Pollux, forming the Triplets of Gemini. Its brightness equals that of Pollux.

## Eyepiece (Cont'd)



*Sky map created with Stellarium, the free planetarium software*

*(Continued from page 6)*

degrees to the northeast of Messier 20 (the Trifid Nebula).

The cluster contains about 35 stars with a visual magnitude between 8 and 12. Many of these stars can easily be seen in a small telescope. A telescope 6-inch or larger will show more stars tightly packed within an area 13 arc minutes in apparent size.

Messier 21 is beginning to sink lower into the sky as September nights progress, so seek out this open cluster just after darkness falls early in the month.

Charles Messier discovered this object on June 5th, 1764. As he wrote in his notes on the occasion: "In the same night I have determined the position of two clusters of stars which are close to each other, a bit above the Ecliptic, between the bow of Sagittarius and the right foot of Ophiuchus: the known star closest to these two clusters is the 11th of the constellation Sagittarius, of seventh magnitude, after the catalog of Flamsteed: the stars of these clusters are, from the eighth to the ninth magnitude, environed with nebulosities."

While Messier separated the

two star clusters, he assumed the nebulosity of M20 was also involved with M21. In this circumstance, we cannot fault him. After all, his job was to locate comets, and the purpose of his catalog was to identify those objects that were not.

An open cluster is a group of up to a few thousand stars that were formed from the same giant molecular cloud and are roughly the same age. More than 1,100 open clusters have been discovered within the Milky Way galaxy, and many more are thought to exist. They are loosely bound to each other

*(Continued on page 15)*

## Building a Low-Cost, Beginner-Friendly 3D-Printed Telescope

by CCAS Member Advay Kavathekar

Have you ever thought you could view the stars with something you made? I actually have had the joy of doing so. After gaining interest in observational astronomy, I had my sights set on getting a good beginner Dobsonian reflector, preferably a cheap, lightweight, and portable setup, which would allow me to haul it out to my porch every day, or take it on longer trips to darker skies than we have here. I did some internet searches and found some beginner tabletop [Dobsonians](#) with either 114mm or 150mm mirrors for over \$300. This did not fit my budget for a good scope, so I searched for more affordable options, preferably under \$150, without sacrificing mirror size or ease of use. I eventually stumbled across the option of making my own telescope optical tube assembly, using 3d printing technology. I have a simple [Crealitty](#) Ender 5 S-1 3d printer and would love to make another interesting DIY project like 3d printing my own telescope.

The design I ended up finding is called the Hadley 114 telescope, hosted on [printables.com](#), a website that allows users to upload their 3d models and other users to download them for no cost. The listing on Printables had already gained some fame among the astronomy community, but I had yet to know this at the time, and I found the community's support incredibly helpful. This telescope was based around an open truss design, using aluminum rods, #10 screws, and 3d printed lower, upper, and middle truss assemblies to hold the 114mm aperture primary mirror. The focal length of the



*The complete Hadley 114 telescope, with the three major parts, UTA, MTA, and LTA, as well as the 2x4 base.*

mirror is 900mm, making it quite slow at f/7.9, which is not optimal for astrophotography, but perfectly good for a beginner visual setup. Its mount was a basic plywood Dobsonian mount that was made from  $\frac{3}{4}$  inch ply-

wood, wood screws, and 3d printed altitude and azimuth bearings.

While conducting my final research before beginning con-

*(Continued on page 12)*

### 3D-Printed Telescope (Cont'd)

*(Continued from page 11)*

struction of the telescope, I found many remixes of the telescope; a remix on Printables is a model that adds onto or modifies another, acknowledging the fact that it was based on another creator's model. One such remix, I found, would be incredibly helpful for me: the non-rotating focuser. You see, the original Hadley telescope model featured a rotating focuser that used an extremely simple screw to adjust the distance the eyepiece sat at to gain focus, but this caused the entire eyepiece to rotate when the focus was adjusted. If I ever planned on attaching a camera or my mobile phone to this telescope to do some imaging, it would not be optimal. This non-rotating focuser instead utilized a moving threaded ring and a stationary threaded ring that pushes out the eyepiece collet in a straight line, eliminating the rotation of the basic focuser.

To begin the build, I printed out each of the individual telescope pieces. 3D printers, like mine, currently only print certain types of plastics, such as Polylactic Acid (PLA), Polyethylene Terephthalate Glycol (PETG), or Polycarbonate (PC). I wanted my telescope to be extremely stiff to prevent losing collimation, but also durable so it would survive my early attempts at locating targets. The plastic that I selected was PETG, which is known for its strength and ability to be printed easily.

Since the telescope featured a fully open truss design, it did not require the 3d printer plastic



*The 3D-printed non-rotating 1.25" focuser with the Hubble-style 4-vane spider and three-screw adjustment mechanism.*

to make a whole 900mm tube, but rather just the top, middle, and bottom sections, which each have their own distinct functions. The top section, called the Upper Truss Assembly (UTA), was printed first. The UTA houses the most important optical pieces of the telescope, because it holds the secondary mirror in place at the proper re-

quired 900mm focal length from the primary, and also holds the entire focuser and eyepiece.

Next, I printed the Middle Truss Assembly (MTA), which is what supports the entire telescope, by balancing the weight evenly on both sides, to allow for incredibly smooth altitude adjustments. The MTA holds

*(Continued on page 13)*

## Eyepiece (Cont'd)



Original 2x4 base design with 3D-printed Dobsonian bearings.

*(Continued from page 12)*

the altitude bearings, which are semi-circle-like pieces that actually make contact with the bearing holder on the Dobsonian mount. Next, the Lower Truss Assembly (LTA) was printed, which is the piece that holds the primary mirror cell, as well as the primary mirror itself. The mirror is attached to the primary mirror cell using silicone, which

serves as a soft mount and safely allows the mirror to expand or contract thermally without bending the mirror at all, and keeping collimated. This cell was then mounted to the LTA using some screws, springs, and knobs to allow for extremely accurate collimation of the primary.

For the rest of the optics, I later printed out the spider, of

which I selected the Hubble Space Telescope version—as a small tribute to the famous telescope—which gives the stars classic four-vented diffraction spikes. Then, the secondary mirror holder was printed, and the small secondary mirror that came with the primary was [siliconed](#) onto it. Then, this holder assembly was screwed onto the spider with three screws, for collimation. Next, the focuser setup with its eyepiece collet was assembled quickly and screwed onto the frame using the standard #10 screws. Finally, the LTA, MTA, smaller additional pieces, and the UTA were slid onto the three ½ inch x 3-foot solid aluminum rod. This total assembly only weighs around 12 pounds, without the wooden mount.

The simple Dobsonian mount I made utilized another remix of the Hadley telescope on [printables.com](#), but using my own simple twist. The original used long pieces of plywood, but I did not have access to a table saw or jigsaw, which usually make cutting plywood very easy. Due to this paucity of adequate woodworking equipment, I used simple, cheap 2x4 beams and my miter saw instead. To complete the Dobsonian mount, the azimuth bearing was 3d printed and attached to the bottom of the 2x4 frame and a small precut plywood base. As seen in the photos, it does not look the best, but it is an incredibly stable and easy-to-use mount when balanced correctly.

My final review of this telescope, as an incredibly fulfilling

*(Continued on page 14)*

### 3D-Printed Telescope (Cont'd)

*(Continued from page 13)*

and worthwhile DIY project, and as a beginner telescope are phenomenal! The complete build process cost me \$120, with most of the cost coming from the \$35 mirror set and the \$25 25mm Plossl eyepiece. It took me about one week to get all of the pieces printed out and assembled completely. For testing, with an additional 9mm Ultra-Wide-Angle eyepiece, I was able to see the moons of Jupiter quite clearly, and Venus' phases as well (photo provided). I simply aimed the finderscope towards Jupiter in the Western sky, and I could see four moons and small amounts of red banding. I would highly recommend this project for anyone wanting a cheap, beginner-friendly build and telescope with access to a 3d printer (the local library system has one available for use).

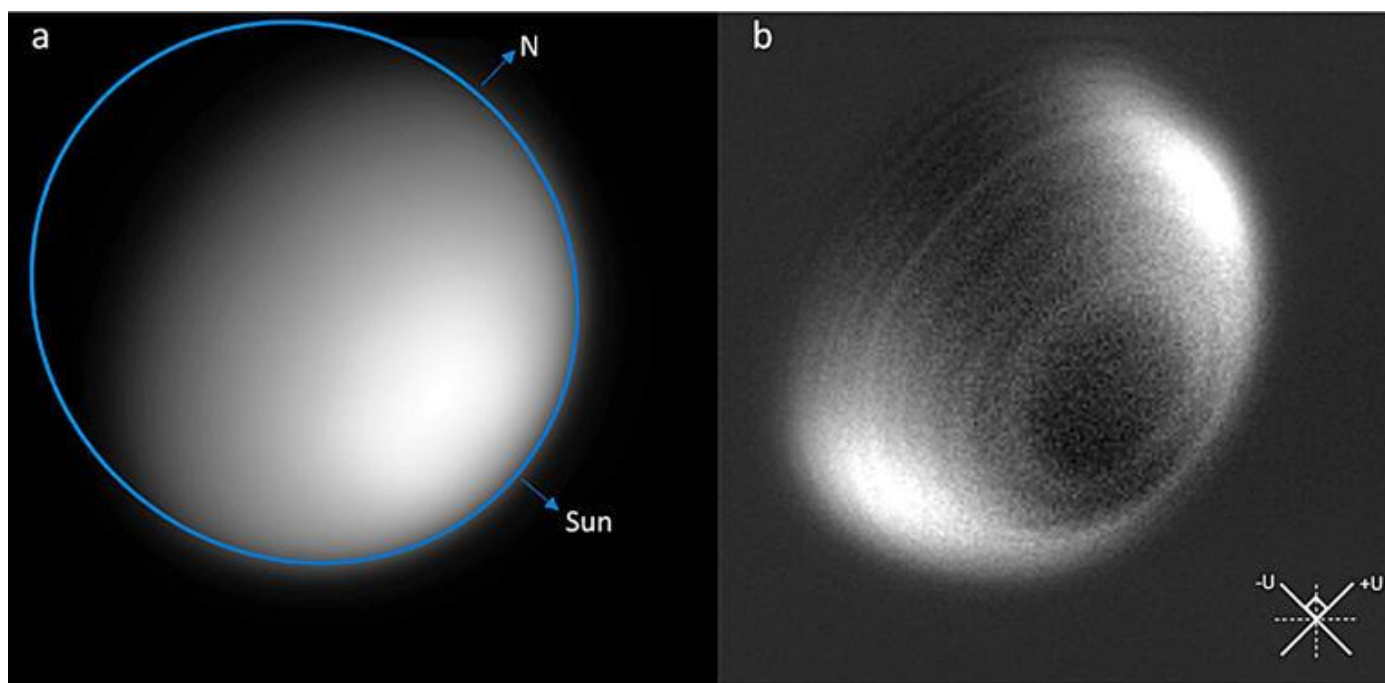
To close things off, I would like to thank all of the open-source creators that made these 3d models and assembly instructions available to the public for free. I would also like to mention that I have posted a full, detailed build guide of this telescope, and it is available for viewing on YouTube, as I was unable to find a good enough, properly detailed build guide in video format. This video includes all of the required links to the Bill of Materials all in one simple place. The link to this video is here: <https://youtu.be/QtocrxxSAAY?si=LS-weXIVKZMgBKnv>

Thank you for reading. Clear Skies.



*Image of Jupiter with the Hadley. Four of its Galilean Moons are visible (left to right): Callisto, Ganymede, Io (very small mark on the right side of Jupiter), and Europa. Taken with a 9mm Sibony eyepiece and an iPhone 15.*

## Atmospheric Rings (Cont'd)



Venus as observed in total flux  $F$  (left) and polarized flux  $U$  (right) through the  $H\alpha$  continuum filter (see Table 1). Due to Venus's orientation, the planetary scattering plane makes an angle of about  $45^\circ$  with ExPo's optical plane (the two orthogonal directions along which ExPo measured  $U$  are indicated below the image). The spatial resolution is approximately 775 km at the subobserver point on Venus's disk. Credit: *The Planetary Science Journal* (2026). DOI: [10.3847/psj/ae7e6f](https://doi.org/10.3847/psj/ae7e6f)

(Continued from page 3)

But what were the rings doing, and why were they there? To get some answers, the research team

### Eyepiece (Cont'd)

(Continued from page 10)

by mutual gravitational attraction and become disrupted by close encounters with other clusters and clouds of gas as they orbit the galactic center. Open clusters generally survive for a few hundred million years. In contrast, the more massive globular clusters of stars exert a stronger gravitational attraction on their members and can survive for many billions of years.

Information sources:

[https://en.wikipedia.org/wiki/Messier\\_21](https://en.wikipedia.org/wiki/Messier_21)

<https://www.universetoday.com/31935/messier-21/>

<https://www.messier-objects.com/messier-21/>

ran several computer simulations that modeled how sunlight scatters through the gas layer above Venus's clouds. These virtual models allowed the scientists to test how different atmospheric conditions alter light. The calculations showed that small changes in gas density of 5% to 10% would create ring patterns matching those seen in the data.

"Our simulations also show that such density variations would not show up in total flux observations," wrote the study team in their paper.

Based on these results, the authors suggest that these density variations are massive atmospheric waves. Specifically, they could be giant, planetwide gravity waves, a type of wave that creates ripple-like patterns in gas layers, much like ripples on

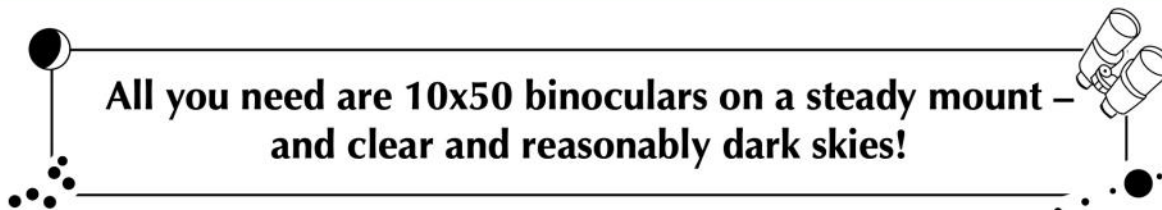
the surface of water.

Although the rings are a direct observation, the atmospheric waves are inferred from the data, so the team stresses that their work is a candidate detection rather than confirmation of a new Venusian phenomenon. And since the ExPo instrument has been dismantled, the archived data remains the only dataset available. As the researchers write: "We are therefore careful in claiming the detection of a new atmospheric phenomenon on Venus."

More information: Gourav Mahapatra et al, Planet-wide, Concentric Density Waves in Venus's Upper Atmosphere Revealed through Polarimetry?, *The Planetary Science Journal* (2026). DOI: [10.3847/psj/ae7e6f](https://doi.org/10.3847/psj/ae7e6f)



## Galileo Observing Program Activity



**All you need are 10x50 binoculars on a steady mount –  
and clear and reasonably dark skies!**

### Observe (and draw) ...

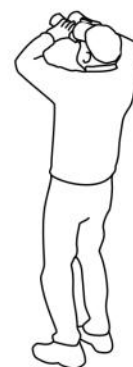
- ★ the Pleiades star cluster visible from late fall through early spring,
- ★ the changing phases of Venus,
- ★ craters and surface markings on the moon,
- ★ the Beehive star cluster (M44) in winter through mid spring,
- ★ sunspots (*must use proper full-aperture solar filters*),
- ★ the changing positions of Jupiter's Galilean moons,
- ★ Jupiter's Galilean moons in eclipse,
- ★ a comet and track its path across the heavens,
- ★ the stars of the Orion's Head Nebula (Lambda Orionis),
- ★ the non-starlike quality of Saturn,
- ★ and identify Neptune,

### Optional ...

- ★ aurora,
- ★ supernova.

for all the details of this wonderful program, please visit:

**<https://www.astroleague.org/galileo-observing-program/>**



## Speaker Bio (Cont'd)

(Continued from page 3)

omy and Physics from the University of Massachusetts Amherst in 2017 and subsequently received his doctorate in Planetary Science from the University of Arizona in 2021. He has played critical roles in NASA's Double Asteroid Redirection Test ("DART") and OSIRIS-REx missions to the near-Earth asteroids as well as the European Space Agency's Rosetta mission to Comet 67P/C-G and is one of the science advisors to the NASA Jet Propulsion Laboratory's spacecraft mission design school.

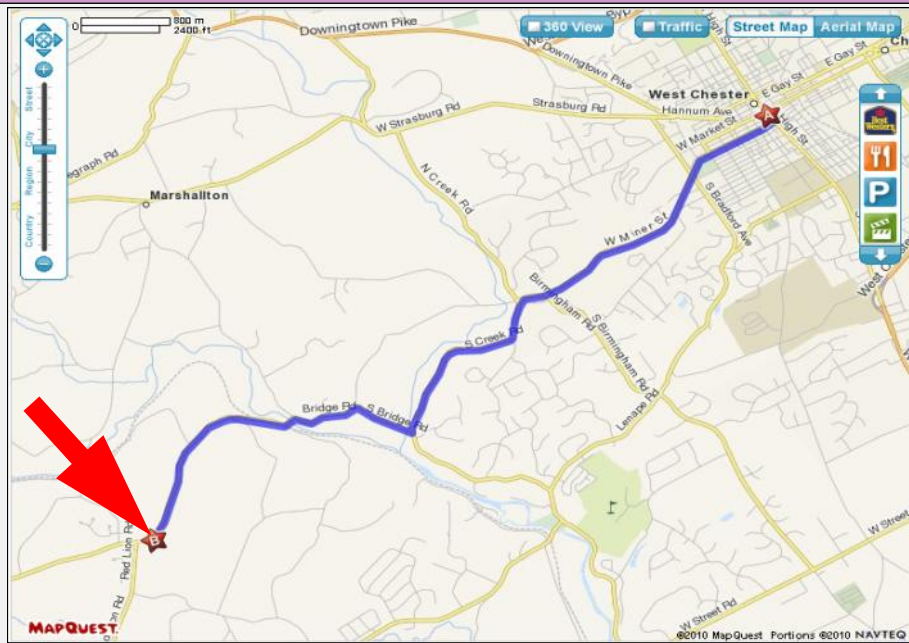
Since 2025, he has been an Assistant Professor of Astrophysics and Planetary Science at Villanova University.

## Classic La Para by Nicholas La Para



I'VE BEEN COLLECTING PHOTONS ALL NIGHT  
IN MY LIGHT BUCKET.

## 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.

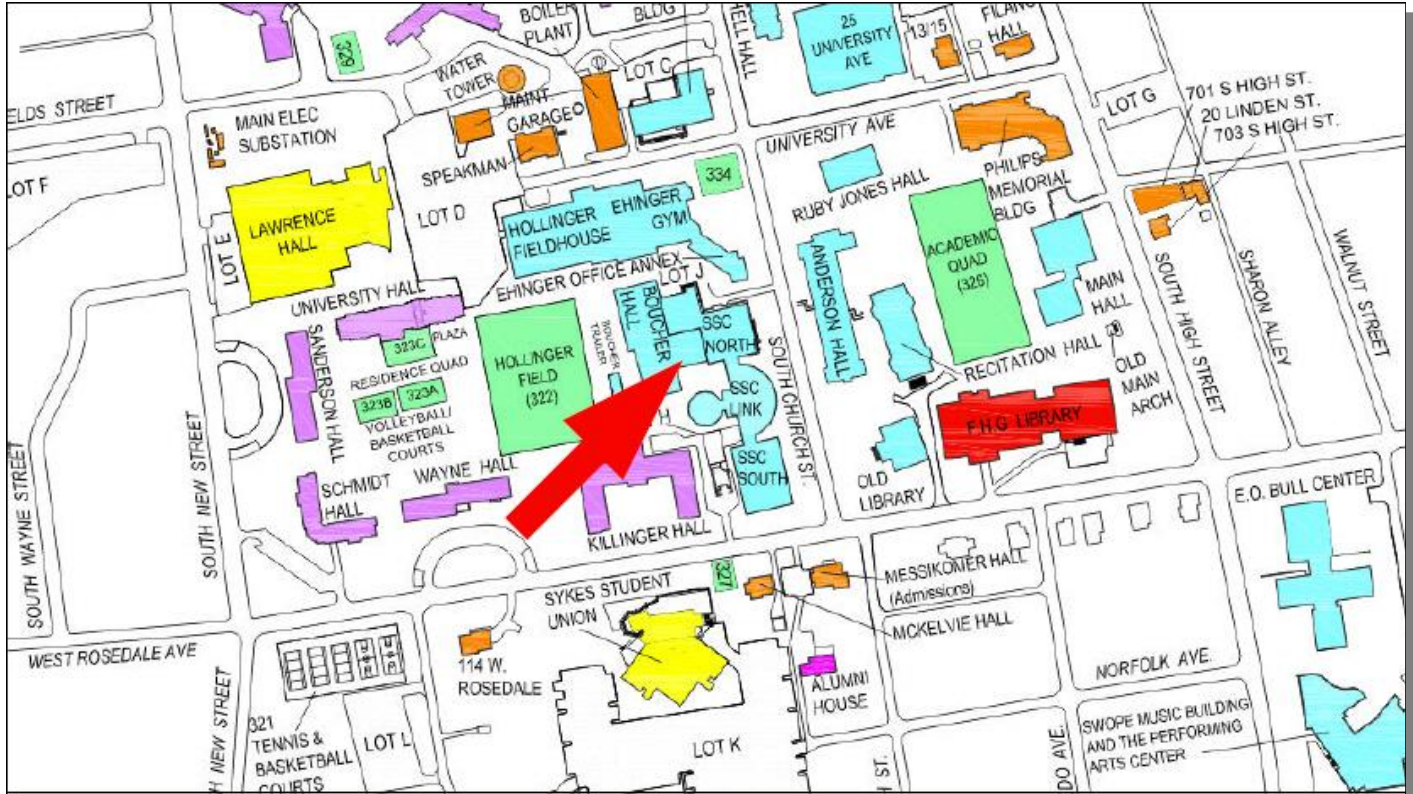
To get to the Myrick Conservation Center from West Chester, go south on High Street in West Chester past the Courthouse. At the next traffic light, turn right on Miner Street, which is also PA Rt. 842. Follow Rt. 842 for about 6 miles. To get to the observing site at the BRC property, turn left off Route 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).

## CCAS Directions

**West Chester University Campus**

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



## Observing (Cont'd)

(Continued from page 7)

For those waking up early in the morning, look for the “Red Triangle” in East/Southeast skies at around 4 AM consisting of Aldebaran (the red “eye” star of Taurus), Betelgeuse (the right shoulder star of Orion), and Mars at the feet of Gemini. The red color of all three is quite apparent, and a real treat for those early risers wanting a naked eye treat before dawn!

### CCAS Membership Information and Society Financials

## Treasurer's Report

*by Don Knabb*

### July 2026 Financial Summary

|                   |             |
|-------------------|-------------|
| Beginning Balance | \$1409      |
| Deposits          | \$45        |
| Disbursements     | <u>-\$0</u> |
| Ending Balance    | \$1454      |

**New Member Welcome!**

Welcome to new CCAS members  
John Palladino 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](mailto:ida@darksky.org)

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

<http://www.darksky.org>

## Dark-Sky Website for PA



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

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/>



**Spectrum Scientifics**  
Quality Science Products for All Ages

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

4403 Main Street  
Philadelphia, PA 19127

Phone: 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](mailto: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](mailto:newsletter@ccas.us).

### CCAS Website

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

<http://www.ccas.us>

Dr. Hepler welcomes any additions to the site by Society members. The contributions can be of any astronomy subject or object, or can be related to space exploration. The only requirement is that it is your own work—no copyrighted material! Give your contributions to Dr. Hepler at (484) 883-5033 or e-mail to [webmaster@ccas.us](mailto:webmaster@ccas.us)

### CCAS Purpose

The Chester County Astronomical Society was formed in September 1993, with the cooperation of West Chester University, as a non-profit organization dedicated to the education and enjoyment of astronomy for the general public. The Society holds meetings (with speakers) and observing sessions once a month. Anyone who is interested in astronomy or would like to learn about astronomy is welcome to attend meetings and become a member of the Society. The Society also provides telescopes and expertise for "nights out" for school, scout, and other civic groups.

### CCAS Executive Committee

For further information on membership or society activities you may call:

**President:** Dave Hockenberry  
610-558-4248

**Vice President:** Pete Kellerman  
610-873-0162

**ALCor & 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](mailto: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.

