THE DELAWARE VALLEY
amateur ASTRONOMER
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sharing the wonder and science of astronomy

The Unicorn's Wreath

The Rosette Nebula (NGC 2237) in Monoceros is a challenge visually due to its low surface brightness but a fabulous imaging target.

Mark Firary took this great image from the New Jersey Pine Barrens on January 23rd of this year during a 71% waxing gibbous moon.

Mark used a ZWO ASI 294MC Pro Camera mounted to an Orion ED80 refractor (600mm focal length) with a 0.85x reducer on an Orion EQ-G mount. The image consist of 30x300sec subs thru an Optolong L-Enhance Narrowband Filter.

Calibration, Stacking and Channel Extraction were performed in AstroPixelProcessor and Post-Processing was implemented using PixInsight.

PLAN ON IT!

March 6-7 and 13-14 Dark Sky Observing. Check groups.io for updates (New Moon March 13).

March 20 (6:45 - 8:45 pm) **Public Star Party** at Valley Forge National Historical Park model airplane field. Free and open to the public in a new distanced format (must pre-register for this event).

March 26 (7:30 pm) **Monthly Meeting via Zoom (members) and YouTube (public).** Featured presenter: Dr. Stephanie LaMassa, Space Telescope Science Institute (STSI). Watch for an email from Program Chair Jeremy Carlo with the meeting links.

April 17 (7:15 - 9:15 pm) **Public Star Party** at Valley Forge National Historical Park model airplane field. Free and open to the public in a new distanced format (must pre-register for this event).

April 23 (7:30 pm) **Monthly Meeting via Zoom (members) and YouTube (public).** Dr. Dan Werthimer from UC Berkeley on the Search for Extraterrestrial Intelligence.

Star Party Weather Hotline: 484-367-5278 .

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From Time to Time

Harold Goldner email

Last month I was enjoying a glorious sunset, my usual scotch on the rocks in my hand. I then looked skyward for the conjunction of Mars and the nearly first quarter Moon. Certainly, it was not as spectacular as the "Great Conjunction" of this past December, but it was still the kind of thing that made me think, focus, and see the solar system in three dimensions.

I also realized that it was but last year when I awoke just before dawn and saw the Moon occult Mars at this very same spot. It was a vastly different time, when talk of a possible pandemic was in its infancy, and life continued apace as though nothing was awry. The coincidence struck me that it was as if the Moon and Mars had performed for me one of those stock sequences you see in some movies where the pages of the calendar fall away to denote the passage of time.

I considered how I can mark different times in my life to different astronomical events, too. The recollection of those events brings back a remembrance of everything going on in my life at the time. Proust had to bite into a madeleine dipped in tea for his remembrance of things past. I think about the sky.

There was the night last July at Cherry Springs during which I viewed all of the planets (and one "dwarf planet," formerly a planet). Then I remember that summer's tensions and great void of unknowns about the pandemic and wondering if there would ever be a cure or a vaccine.

We went to Nashville to watch the "Great American Eclipse" back in 2017, only nine days after my father passed away. Those experiences are forever fused together in my memory.

I once brought my then 12-year-old daughter to see Mars close up from Colonial Observatory when this organization called Delaware Valley Amateur Astronomers, of which I had never heard at the time, sponsored a viewing event during opposition. Then I remember the struggles of having young teenage children and what we went through as parents of teens, and marvel how now they are all independent adults, some with children of their own.

One cold November night years earlier I was re-arranging blankets for my wife and children when the sky lit up behind me. Their faces, briefly illuminated by the flash of a bright Leonid meteor, showed wide amazement. As I think of that moment, I remember what it was like when my children were under one roof and not spread out over the country.

On a warm summer evening we watched an ISS fly-over on a family vacation with my children, my siblings, and their children. I contemplate how far-flung and distant my siblings are now and my children's cousins are literally coast to coast. I struggle to remember the last time all of my siblings and I were in one place at the same time.

My wife and I watched a total lunar eclipse with my oldest child one summer, and I recall what a challenge it was switching from a young married couple to parents. That in turn reminds me of watching Comet Halley in early 1986 while we waited for the birth of that very child, contemplating an unknown at least as vast as the path of the comet itself.

Every time I see Jupiter's Galilean moons and Saturn's rings with my own eyes, I once again become that small child whose father first showed me those sights through our own refracting telescope in our backyard nearly sixty years ago.

Before there were cell phones and GPS; before atomic clocks and Seiko watches; before Seth Thomas Regulator wall clocks and giant clock towers like Big Ben; before the pyramids at Tulum or Giza; before the giant stones were dragged to their positions at Stonehenge; and for probably thousands if not tens of thousands of years our species kept track of the passage of time and tracked the events of history by studying what was in the sky.

I suppose it should not be such a surprise that we still do it now.

Welcome New DVAA Members!

Razvan Ionescu of Newtown, Pennsylvania

We welcome all new members to enjoy the most our club has to offer by participating in DVAA activities. You are encouraged to ask questions and pursue your interests in astronomy through the club.

We suggest that new members attend our observing events and special interest group meetings, or volunteer to help with an outreach event or committee. Participation can advance your skills and enjoyment of the hobby and help you get to know your fellow members. New members are entitled to all benefits of membership.

Brian Lee
Welcoming Committee Chair
welcoming@dvaa.org

DVAA Board & Committee Chairs

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Welcoming	Brian Lee	welcoming@dvaa.org
Women of DVAA	Jan Rush	women@dvaa.org

Mark Your Calendars!

Upcoming Monthly Meetings

Friday Mar. 26, 2021: Featured Speaker: Dr. Stephanie LaMassa, Space Telescope Science Institute: "Black Holes - How do we see that which gives off no light?" (see p. 11). The regular monthly meeting will be livestreamed. Watch your email for sign-on directions.

Upcoming 2021 Meeting Dates: (all Friday evenings): Mar. 26, Apr. 23, May 21, June 25, July 23, Aug. 20, Sept. 17, Oct. 15, Nov. 19, and Dec. 17.

2021 Public Star Party Dates

DVAA public star parties at Valley Forge National Historical Park will be restarting in March staying with the revised format incorporating Covid-related safety precautions. They will be held at Valley Forge National Historical Park on the Model Airplane Field. (Google Maps). ***Weather Hotline: 484-367-5278 .***

Public Star Party dates for 2021 (all Saturday evenings): **Mar. 20** (6:45), **Apr. 17** (7:15), **May. 22** (7:45), **Jun. 19** (8:00), **Jul. 17** (8:00), **Aug 14** (7:30), **Sep. 18** (6:30), **Oct. 16** (5:50), **Nov. 13** (4:15).

Note: Consistent with recommendations from Governor Wolf and the Centers for Disease Control, some live DVAA public events have been cancelled or postponed. Monthly meetings are being held via Zoom and livestreamed via YouTube. Check the website (www.dvaa.org) for updates.

Follow the DVAA on Facebook!

DVAA Facebook group
DVAA Photo Enthusiasts

Newsletter Editorial Committee: Jeremy Carlo, George Keighton, Tom Nolasco, Dana Priesing, Jan Rush and Barclay Thorn.

If you would be interested in joining us on the Newsletter Committee, just drop us a line at newsletter@dvaa.org — we'd love to have you on board, regardless of your experience level!

Thanks to Dana Priesing for being lead editor last month.

Tom Nolasco— lead editor for this issue

Al's Observing Tips: Moonlight Washes Out the Sky & I Can't Observe

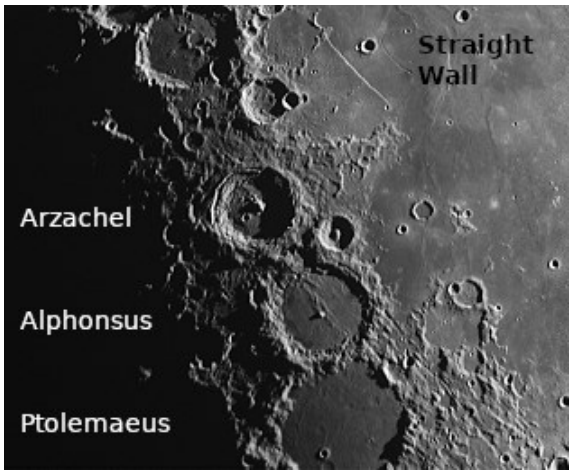
Al Lamperti email

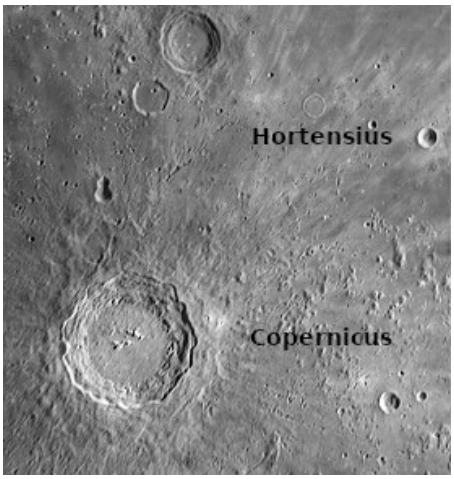
That was my complaint for a long time until I discovered the Astronomical League's "Lunar", "Lunar II" and "Lunar Evolution" programs. The former served as a gentle introduction to what my wife calls a "hunk of rock." Though work-related activities used to keep me from observing the Moon more often, the Moon is really a fascinating territory to explore. Like any other exploration, a map or atlas is beneficial. The "*Atlas of the Moon*" by Antonin Rukl or "*21st Century Atlas of the Moon*" by Charles Wood both provide excellent information and detail of the many features that can be seen.

The Moon displays itself well in almost any telescope. You will find yourself going through at least two phases of lunar observation: an exploration phase and a wonderment phase. The Astronomical League's program will familiarize you with many of the basics such as finding and exploring the various Maria or "seas", craters, flooded plains, named mountains and valleys and ejecta debris. The best detail can usually be seen along the terminator where the sun is rising or setting on the moon. It is here that the shadows are the longest and the outlines and details of lunar structures are the most pronounced. A waxing moon will reveal more and more detail to you as the terminator marches across the moonscape. If you happen to miss a day or two, you do not necessarily have to wait until the following month to catch some of those elusive features. If you are ambitious or a night person, you can catch the terminator as it progresses across the waning moon during the last 2 weeks of the lunar month.

Continued lunar observing will bring you to what I call the wonderment phase. For example, look at these craters in your telescope: Ptolemaeus, Alphonsus and Arzachel. Why are there central peaks in the middle of two of them? Why does Arzachel display terraced walls? Of the three, which do you think is the oldest? the youngest? Look at the floor of Alphonsus and note the slight darkening of the lunar soil at the "4 and 9 o'clock" positions. These are dark halo craters. What caused them to be dark? Did stress fractures cause the Alpine Valley and the Straight Wall to form? Did lava flows cause the formation of Schroter's Valley? Why do some craters, like Copernicus, have polygonal outlines rather than perfectly round ones? The floor of the crater Petavius is convex rather than flat or concave and there is a rille, a crack-like structure, in its floor. What was causing the uprising from beneath the floor? Is there a selenological explanation for the lunar domes seen near the crater Hortensius? Were these "moon burps" that never quite made it to the surface? Perhaps the small calderas or summit craters on the peaks of the domes indicate some volcanic activity in the lunar past.

Judging from what we can see now, the Moon had a very active and turbulent history. Lava flowed through cracks caused by impacts and solidified on the surface. More impacts resulted in the craterlets seen on the floors of larger craters. Impacts, ejecta material, movements of the lunar crust and bombardment by cosmic radiation all contributed to the features we observe in our neighbor.





Lunar Images by Tom Nolasco

The February Monthly Meeting

Jeremy P. Carlo email

The February 2021 DVAA meeting was presided over by Secretary Mike Tucker. Mike started by introducing himself to the fifty-ish attendees, and gave a sneak peek at the upcoming newsletter. Mike announced that our socially distanced star parties at Valley Forge would resume in March.

Moving on to committee reports, Outreach Chair Jan Rush announced that outreach events are scheduled for June, and to stay tuned for more information. Welcoming Chair Brian Lee welcomed four new members, and Treasurer Lou Berman said that renewals are going well and we currently have 182 people in our membership list! Astrophotography Chair Lou Varvarezis said that weather has been challenging lately, although he's looking forward to having some upcoming sessions focusing on imaging galaxies, with the spring "galaxy season" coming up.

Mike then gave a short presentation on "Martian bandwidth" – how do we communicate with satellites on and around Mars? The Deep Space Network, an array of large, high-gain radio dishes spread around earth, maintains contact with a constellation of five satellites currently orbiting Mars, with a latency period of 1,400,000 milliseconds and upload/download speeds of up to 2 Mbps. That's pretty slow compared to modern broadband, but a lot faster than the 56k modems most of us were using 20-ish years ago! (In contrast, the Voyager spacecraft, currently exploring the depths of the outer solar system, communicate with Earth at a rate of about 160 bits per second at a frequency of 8.4 GHz, with a latency period of about a day! Mike showed some images of the recent landing of the Perseverance Rover, and talked about how the lander was able to maintain nearly-continuous communication with Earth via its UHF and X-band (~7 GHz) transmitters.

Next, DVAA Observing Chair Andrew Hitchner presented his report for February. He started by presenting an Astronomical League observing award to Al Lamperti, for the "Alternate Constellation" program, which requires observing and sketching 48 constellations as denoted by other cultures and civilizations. (Al is only the seventh person to complete this program – congratulations, Al!) Andrew announced that a beginner astronomy class will be hosted by the Chester County Astronomical Society and will be free to DVAA members; there will be six sessions beginning March 1 covering a variety of topics including the sun, moon, and planets, as well as information about observing and astronomical equipment.

Andrew then gave a brief overview of the Bortle Scale, which is used by amateur astronomers to rate the darkness of an observing site. This scale ranges from 1, which is an ideal pristine dark-sky site, to 9, for an inner-city urban sky. Most of our "dark sky" sites are around 3 to 5 on this scale (to get to a "1" site requires being many hours from any human habitation at all, and there is nothing like that on the Eastern seaboard). The Bortle scale also relates to sky brightness, which is rated in magnitudes per square arcsecond; the higher this number, the darker the sky. This can be measured in real time using devices such as the Unihedron Sky Quality Meter (SQM). You can also estimate sky darkness by star counting, and comparing what is visible to the naked eye with a star chart or software. A number of projects attempt to keep track of sky brightness from a variety of sites over time, including the "Globe at Night" citizen science project. For more information about light pollution and dark skies, Andrew referred us to the International Dark Sky Association (IDA), to the more local Pennsylvania Outdoor Lighting Council, and to our own DVAA Light Pollution Chair and guru, Barry Johnson.

With committee reports completed, Programs Chair Jeremy Carlo gave an overview of upcoming programs, and then introduced the evening's invited speaker, Dr. Joleen Carlberg of the Space Telescope Science Institute, whose topic was "A Window into the Ultraviolet Universe with Hubble."

Joleen started her presentation by discussing the importance of ultraviolet radiation. Visible light represents a small segment of the so-called electromagnetic spectrum, which ranges from radio waves at the long-wavelength, low-energy end, to x-rays and gamma rays at the high-energy, short-wavelength end. Visible light falls somewhere in the middle. Just "below" visible light is infrared, about which we heard in last month's talk. Just above it is ultraviolet, or "UV." UV is most familiar to us as the high-energy component of sunlight which is responsible for sunburns and skin cancer, but is also useful in germicidal applications (such as sterilization of equipment to prevent the spread of COVID).

Astronomically speaking, ultraviolet radiation carries a wealth of information, although accessing it

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has posed a challenge. While the longer wavelength end of the UV spectrum can get through the earth's atmosphere (causing skin cancer and the like), the shorter-wavelength end is (thankfully) absorbed. Thus to get a full picture of the ultraviolet universe, one must use space-based observatories. Historically, there have been several observatories capable of observing in the UV, the only one currently operating is the famous Hubble Space Telescope, which is better known for its visible light work but also carries some ultraviolet instruments. The upcoming James Webb Space Telescope, for a variety of reasons, will primarily be an infrared observatory with some visible capabilities, which means that even after JWST launches later this year (fingers crossed!) HST will still be the only game in town.

Joleen then talked a little about how ultraviolet instruments work. Her work primarily focuses on so-called MAMA's, or Multi-Anode Microchannel Arrays. These are arrays of tiny pores, which collect ultraviolet photons, each of which generates a cascade of electrons which are then detected. In principle this is somewhat similar to how a CCD works, although these devices can be run in "event" mode which tags each photon's arrival time (to within about 0.1 milliseconds), giving much more detailed information about time dependence than can be gotten through a conventional image (in which the detector is left "open" for a specified time and then the number of photons arriving over that interval is summed up). However, MAMA's can also be run in this sort of "conventional imaging" mode as well.

Joleen also talked about the challenges of scheduling observations for an observatory which hurtles around the earth every 90 minutes or so. The earth blocks out nearly half of the sky at all times, and which half is blocked goes completely around with every orbit. The scope must also be carefully aimed to ensure that its instruments aren't damaged by being pointed at very bright objects, so mission planners must carefully map out what objects to observe at what time.

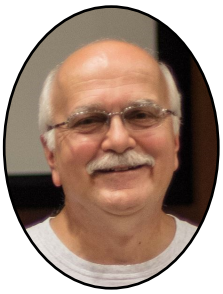
So why do we care about ultraviolet? Joleen discussed a number of specific science projects tackled with UV observations. With ultraviolet, HST can observe auroras on Jupiter, caused by high-energy charged particles in Jupiter's magnetosphere crashing into its poles. Transits of exoplanets across their parent stars can be observed, and UV is particularly sensitive to detecting the atmospheres or other tenuous materials surrounding those planets, by carefully mapping out which components of the star's light are dimmed out as the planet's silhouette passes across the star. Ultraviolet observations played an important role in investigations of the recent dimming of Betelgeuse, suggesting that clouds of UV-absorbing material were ejected, and contributed to the star's temporary dimming.

Ultraviolet observations are also crucial to understanding the properties of extremely "metal-poor" stars which formed in the universe's early days. A little terminology is in order here. Astronomers consider all elements heavier than helium to be "metals" (much to the consternation of your chemistry teacher). In the early universe, the only elements present were hydrogen and helium (#1 and #2 in the periodic table, respectively). All heavier elements were produced by fusion reactions inside stars, or in the hectic reactions which take place when stars die (such as supernovas and neutron star mergers). Thus stars which have very low "metal" content are among the oldest in the Universe, and thus provide a window back to that early epoch some 13 billion years ago. (Interestingly, as we learned in last month's presentation, infrared is also crucial to understanding the early universe, as we survey light from the most distant galaxies which has been strongly redshifted by the cosmic expansion, to the point that even visible and ultraviolet light coming from those galaxies has been shifted down to the infrared portion of the spectrum!)

Joleen finished her talk with some hints about the future. Unfortunately, JWST's ultraviolet capabilities will be nonexistent, and HST will remain our only window to large swaths of the UV spectrum (although some limited work can be done from the ground, particularly mountaintop observatories). However, plans are afoot to succeed Hubble with a larger UV-capable instrument, under the LUVOIR (Large UV – Optical – InfraRed) Surveyor program. This mission is still in the planning stages, but preliminary ideas include a telescope in the range of 8 meters to 15 meters in diameter (compared to HST's 2.4 meters, and JWST's 6.5 meters). This would likely involve a segmented mirror, much like JWST; the increased aperture would provide both improved light-gathering ability, and improved angular resolution. In any event, it's still a long ways off, so let's hope HST keeps gathering photons – ultraviolet and otherwise – for quite a while!

Many thanks to Joleen Carlberg for an exciting presentation on the world of ultraviolet astronomy!

A Vesta (fus) for the Rest of Us



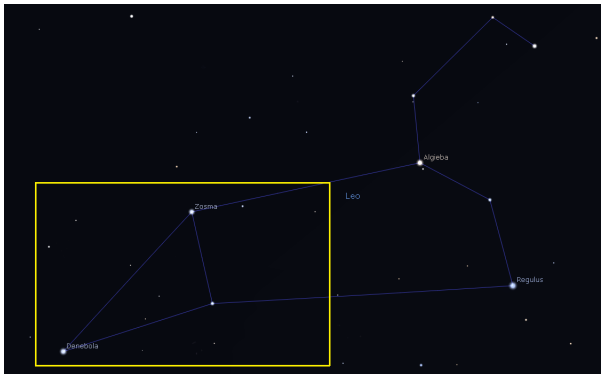
Tom Nolasco email

Tracking down an asteroid from your backyard can be a real challenge unless you have a telescope on a "go-to" mount. It can be tough to star hop in bright suburban skies where you can't see the pilot star you are trying to hop from. Star hopping is like rock climbing, you need a good hand hold (or star hold) to begin. You have to be positive that your pilot star is truly what you think it is or you will hop yourself into total confusion.

Well you don't have to worry about that this month because you're in luck. Vesta, which is the brightest asteroid, will be well placed high in the sky by 9:30 at night and near an easy to identify stellar landmark that doesn't have a multitude of 5th and 6th magnitude stars in the immediate area for the asteroid to hide among. For this pass of Vesta you do not need a go-to mount or a dark sky site.

Vesta reaches opposition on March 4th and is closest to Earth on March 9th being roughly 127 million miles away.

The asteroid Vesta makes a nice apparition this year peaking at magnitude 5.8 in March in the hind section of the easily recognizable constellation of Leo. (box highlights area of interest)



The Leo star field was captured from Stellarium, the free planetarium software available for download at www.stellarium.org.

The dominant portion of this area of Leo resembles a right triangle consisting of the bright stars Denebola at magnitude 2.1, Zosma at magnitude 2.6 and Chertan at magnitude 3.3, and is very easy to find looking eastward from the reverse question mark defining the head of Leo. From February through June, Vesta makes a wonderful arc around the star Chertan, the star at the base of the right triangle. But wait it gets better, not only is it easy to find your "pilot" star Chertan, the stars in and around the right angle triangle only contain 3 or 4 others stars that are in the 6th magnitude range with all others being a magnitude or more fainter.

Vesta should be easy to pick out through a small finder scope or binoculars from your own backyard and at a really dark site you may be able to see it with your naked eye.

As a bonus, on the night of June 9th & 10th, Vesta will be about a degree from the galaxies M65 and M66, however by then it will have faded quite a bit to magnitude 8. From a darker site, Vesta will make a nice addition to the LEO triplet consisting of M65, M66 and NGC3628.

One of the cool things to observe with an asteroid is watching its location change from night to night in relation to the background stars. I would suggest making a quick sketch of the area each night to create your own record of the asteroid's pass. This will also give you positive feedback that indeed the "star" you think is Vesta really is.

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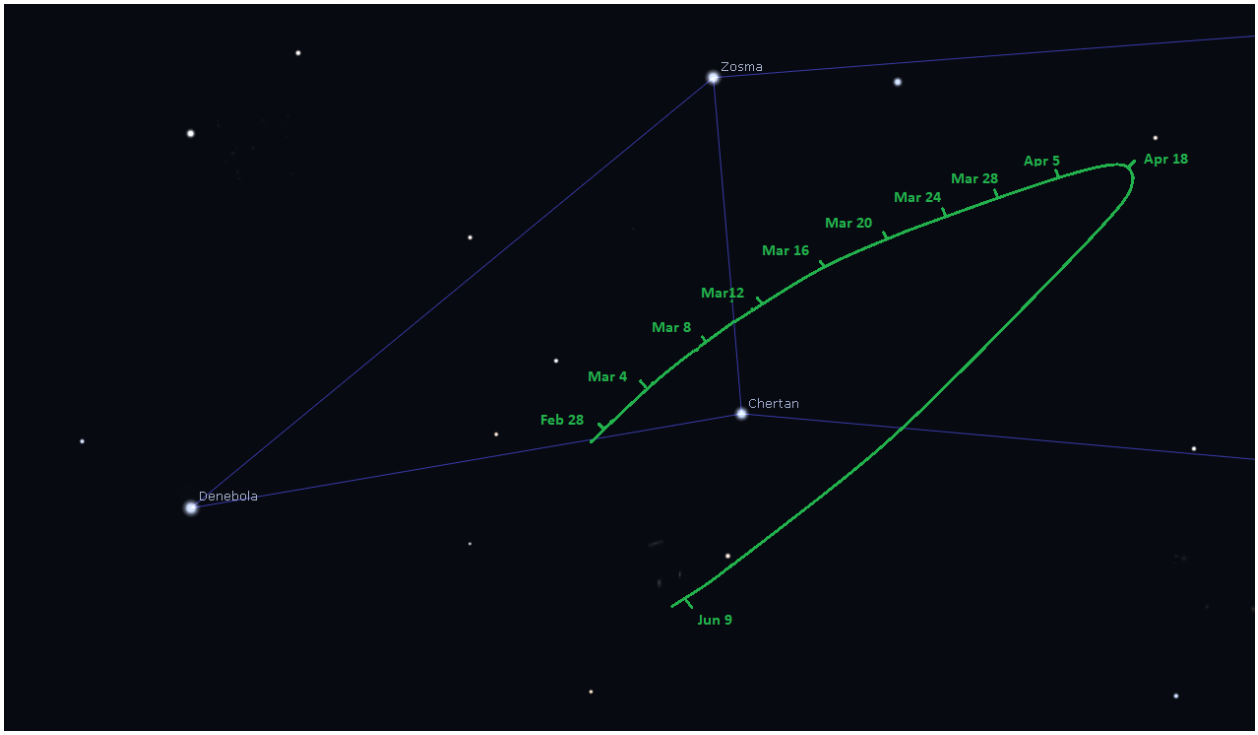
Below is a closeup of the area of interest where I drew in the path of Vesta.

Star chart shows stars down to magnitude 6.



Note: This star field was captured from Stellarium, the free planetarium software available for download at www.stellarium.org.

Here is a little background information on Vesta. German astronomer Heinrich Wilhelm Matthias Olbers discovered Vesta on March 29th, 1807. It was the fourth asteroid to be discovered, thus its formal designation is 4 Vesta. It is the second largest and the brightest of the main belt asteroids orbiting the Sun between Mars and Jupiter every 3.6 Earth years. Vesta is oblong in shape, being approximately 341 by 287 miles. During the approximately 17 months between oppositions, its brightness can range between magnitude 5.1 and 8.7. The maximum brightness of Vesta at opposition varies with each apparition.

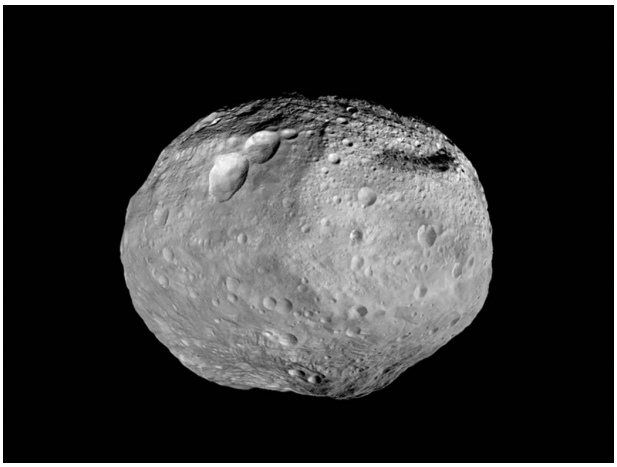


Image of Vesta taken from the Dawn spacecraft. NASA/JPL-Caltech/UCAL/ *MPS/DLR/IDA*

Dawn studied Vesta from July 2011 to September 2012.

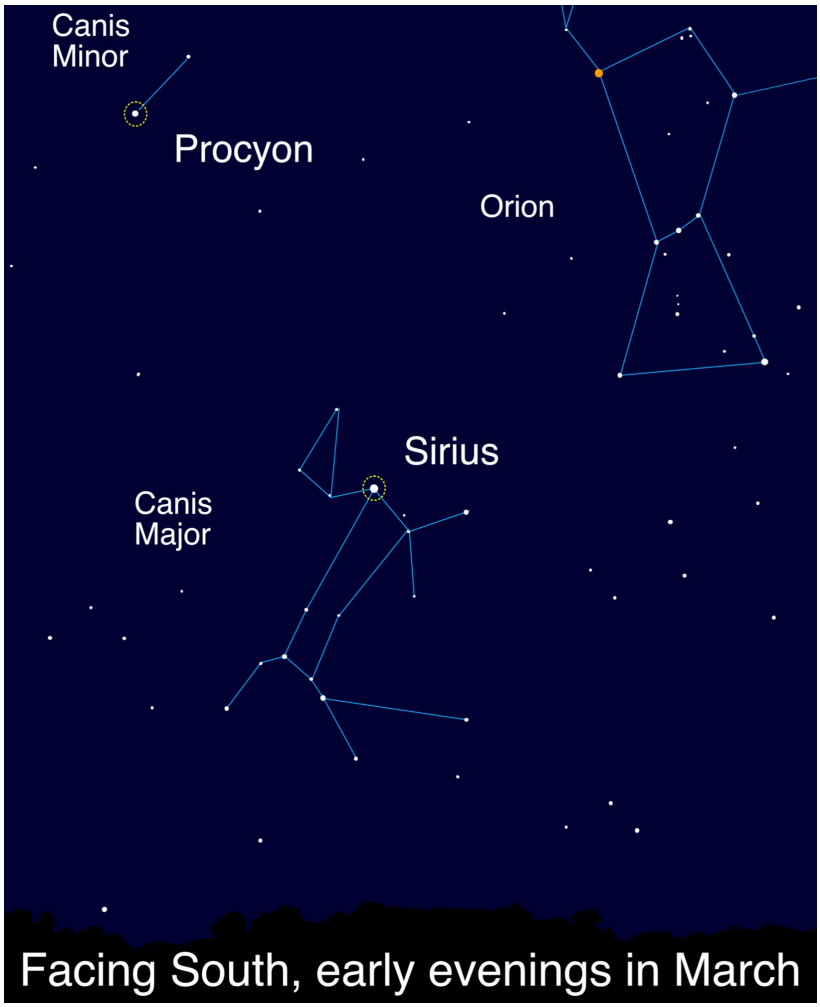
Taking the Dog Stars for a Springtime Walk: Sirius and Procyon!

David Prosper

Article Courtesy of the NASA Night Sky Network.

March skies feature many dazzling stars and constellations, glimmering high in the night, but two of the brightest stars are the focus of our attention this month: Sirius and Procyon, the dog stars!

Sirius is the brightest star in the nighttime sky, in large part because it is one of the closest stars to our solar system at 8.6 light years away. Compared to our Sun, Sirius possesses twice the mass and is much younger. Sirius is estimated to be several hundred *million* years old, just a fraction of the Sun's 4.6 *billion* years. Near Sirius - around the width of a hand with fingers splayed out, held away at arm's length - you'll find Procyon, the 8th brightest star in the night sky. Procyon is another one of our Sun's closest neighbors, though a little farther away than Sirius, 11.5 light years away. While less massive than Sirius, it is much older and unusually luminous for a star of its type, leading astronomers to suspect that it may "soon" – at some point millions of years from now – swell into a giant star as it nears the end of its stellar life.



Sirius and Procyon are nicknamed the "Dog Stars," an apt name as they are the brightest stars in their respective constellations – Canis Major and Canis Minor – whose names translate to "Big Dog" and "Little Dog." Not everyone sees them as canine companions. As two of the brightest stars in the sky, they feature prominently in the sky stories of cultures around the world. Sirius also captures the imaginations of people today: when rising or setting near the horizon, its brilliance mixes with our atmosphere's turbulence, causing the star's light to shimmer with wildly flickering color. This vivid, eerie sight was an indication to ancient peoples of changes in the seasons, and even triggers UFO reports in the modern era!

Sirius and Procyon, the loyal hunting dogs of nearby Orion the Hunter! What other stories can you imagine for these stars? Learn about "Legends in the Sky" and create your own with this activity: https://bit.ly/legendsinthesky *Image created with assistance from Stellarium.*

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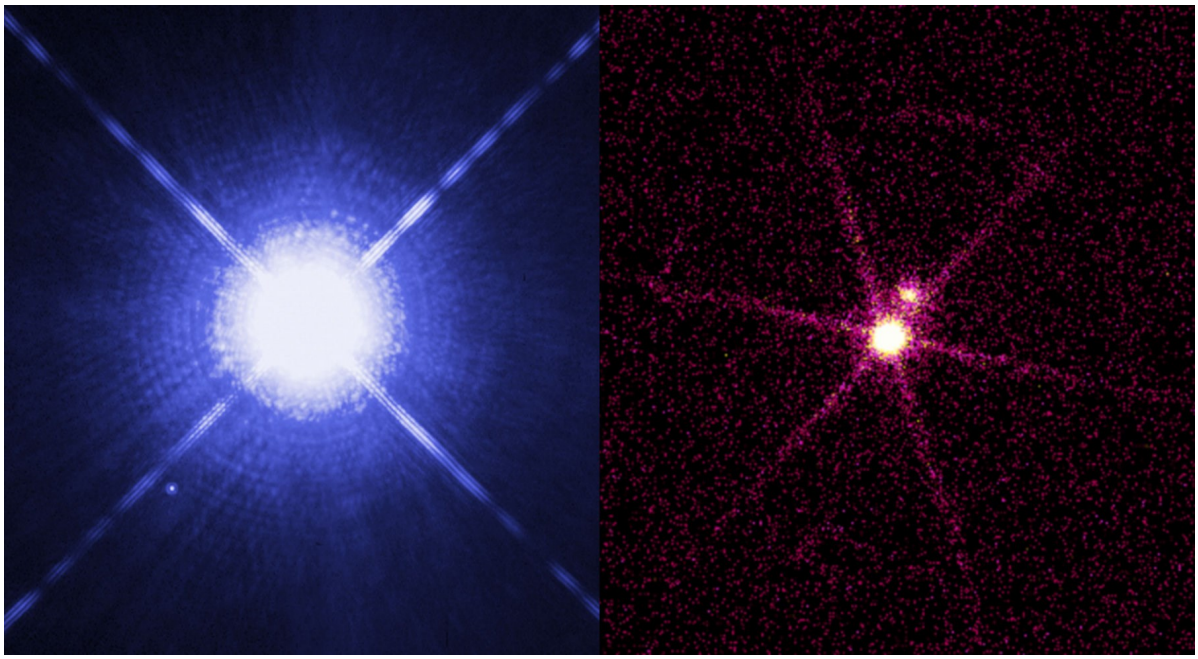
Both of these bright stars have unseen companions: tiny, dense white dwarf stars, the remnants of supermassive companion stars. Interestingly, both of these dim companions were inferred from careful studies of their parent stars' movements in the 1800s, before they were ever directly observed! They are a challenging observation, even with a large telescope, since their parent stars are so very bright that their light overwhelms the much dimmer light of their tiny companions. The white dwarf stars, just like their parent stars, have differences: Sirius B is younger, brighter, and more energetic than Procyon B. Careful observations of these nearby systems over hundreds of years have helped advance the fields of: astrometry, the precise measurement of stars; stellar evolution; and astroseismology, the study of the internal structure of stars via their oscillations. Discover more about our stellar neighborhood at nasa.gov!



Sirius A and B imaged by two different space telescopes, revealing dramatically different views! Hubble's image *(left)* shows Sirius A shining brightly in visible light, with diminutive Sirius B a tiny dot. However, in Chandra's image *(right)* tiny Sirius B is dramatically brighter in X-rays! The "Universe in a Different Light" activity highlights more surprising views of some familiar objects: http://bit.ly/different-light-nsn *NASA, ESA, H. Bond (STScI), and M. Barstow (University of Leicester) (left); NASA/SAO/CXC (right)*

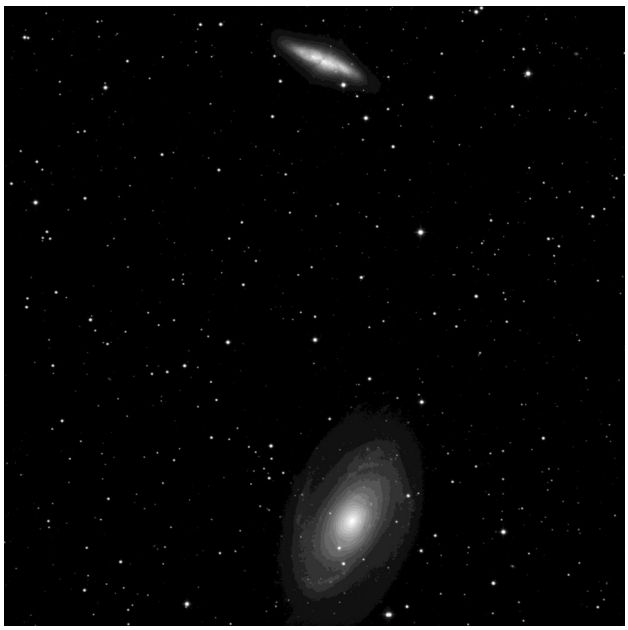
March Twofers

Take this opportunity to check-out these well placed March object pairs in the same telescopic field of view.

Clockwise from upper left we have two open star clusters, 6th magnitude M35 at a distance of 3870 light-years & 8th magnitude NGC2158 to the Southwest which is 9,000 light-years farther.

Next we have two galaxies. 8th magnitude M81 (Bode's Galaxy) & 9th magnitude M82 (Cigar Galaxy). Both galaxies are part of the M81 Galaxy Group at a distance of 12 million light-years.

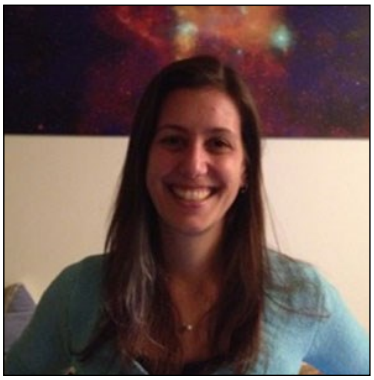
Finally we have 6th magnitude open cluster M46 at a distance of ~5000 light-years & the 10th magnitude planetary nebula NGC2438 at a distance of 1,370 light-years.



These excellent images were taken by Richard Steinberg from Blue Mountain Vista Observatory

Don't Miss the Next Monthly Meeting: March 26, 2021

Black Holes - How do we see that which gives off no light?



Dr. Stephanie LaMassa , JWST NIRISS Branch Manager , Space Telescope Science Institute

Black holes are the most enigmatic objects in the Universe, objects so dense that not even light can escape from them. A natural consequence of Einstein's theory of general relativity, observational evidence of black holes has become abundant over the past several decades, demonstrating that they are more than theoretical curiosities. Though black holes give off no light, we can infer their presence based on the effect they have on their surroundings. In this talk, I will highlight the clues we use to discover black holes within our Galaxy to the edges of the Universe, and how recent ground-breaking observations from the Event Horizon Telescope and gravitational waves have pushed the boundaries of our knowledge about black holes. Still, questions abound which the next generation of ground and space based telescopes will help answer.

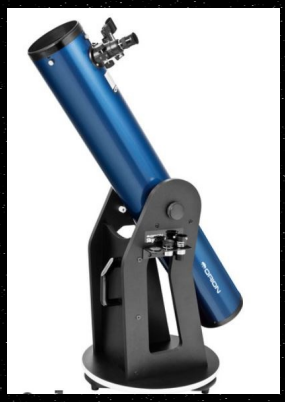
DVAA Virtual Meeting: March 26, 2021, 7:30 PM (sign-on starts at 7:00pm).

- *DVAA Members via Zoom (check your email for the link)*
- *Members of the public can watch the livestream on YouTube*

DVAA Telescope Rentals

Celestron NexStar 5SE

6" Orion Dobsonian



DayStar 60 mm Solar Telescope

6" Orion StarBlast Dob

All scopes include tripod/base, eyepieces, manuals, power, etc. Rental is $10/month with $20 deposit. More info at www.dvaa.org under the OBSERVING tab. To rent one of these scopes, contact Joe Lamb at rentals@dvaa.org.

The Delaware Valley Amateur Astronomers

Since 1976, the **DVAA**, a non-profit corporation, has **shared the wonder and science of astronomy** with thousands of amateur astronomers and the public in the Philadelphia area. Each month we host dark-sky and local star parties, telescope workshops, science & astronomy lectures, educational outreach sessions, and more. To learn more or to join DVAA, please visit **www.dvaa.org**.

Check the schedule for our **free monthly meetings open to the public**, usually held on Friday via Zoom.

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JOIN the DVAA TODAY!

Dues are $40 per year for an individual, $60 for a Family Membership, or $10 for a Junior or Student Membership. **Membership benefits** include our monthly newsletter, membership in the Astronomical League (including its publications), access to our dark-sky observing sites, and inexpensive rentals of fine telescopes. You can join or renew online at www.dvaa.org. If paying by mail, include a note stating what you are paying and membership category desired. Make checks payable to "DVAA" and send to our treasurer: Louis Berman, 477 Turner Avenue, Drexel Hill, PA 19026, or for more information contact treasurer@dvaa.org.