THE DELAWARE VALLEY
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sharing the wonder and science of astronomy

It's Galaxy Season

May is prime galaxy season. This is because we are looking out perpendicular to the plane of our galaxy through the thinnest amount of gas and dust to obscure these island universes from our view. From Ursa Major through Canes Venatici, Leo, Coma Berenices and Virgo there are galaxies galore.

This excellent image of M81, Bode's Nebula, with its clearly seen spiral structure, and M82 , "the cigar", an irregular galaxy with its dark dust lanes, was taken by Lou Varvarezis.

Both M81 & M82 can be seen in the same low power telescopic field of view.

"But let's forget the astrophysics and simply enjoy the spectacle." Walter Scott (Scotty) Houston

PLAN ON IT!

May 5 through May 15 Dark Sky Observing. Check groups.io for updates (New Moon May 11).

May 21 (7:30 pm) **Monthly Meeting via Zoom (members) and YouTube (public).** Featured presenter: Michelle Hanlon, Co-Director of the Air and Space Law Program at the University of Mississippi School of Law (abstract on page 3). Watch for an email from Program Chair Jeremy Carlo with the meeting links.

May 22 (7:45 - 9:45 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).

June 10 Sunrise Partial Solar Eclipse for Philadelphia and Surrounding Areas

June 19 (8:00 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).

Star Party Weather Hotline: 484-367-5278 .

CONTENTS:

The Limitations of Science, or "Why Can't I believe in UFO's?"

Harold Goldner email

Arthur C. Clarke proposed 3 basic laws, the first two in his 1962 "Profiles of the Future" and the third in his 1973 revision:

1. When a distinguished but elderly scientist states that something is possible, he is almost certainly right. When he states that something is impossible, he is very probably wrong.

2. The only way of discovering the limits of the possible is to venture a little way past them into the impossible.

3. Any sufficiently advanced technology is indistinguishable from magic.

I start with these because recently on our listserve the closest thing to a fistfight broke out. We are very erudite and placid members. We don't do flame wars as much as mildly caustic retorts. The bruhaha followed the posting of a link to an interview of Avi Loeb, Ph.D., longest serving (now former) Chair of the Harvard Department of Astronomy and Frank B. Baird Jr. Professor of Science there. Dr. Loeb posits that that the best scientific approach to take to 'Oumuamua's fly-through of the solar system was that it is the product of an intelligent extraterrestrial life form.

Note that while he argues vociferously his hypothesis that 'Oumuamua is the product of an alien civilization, the main thrust of his book is to point out that from a scientific viewpoint, treating it as the product of an extraterrestrial life form can lead to advancement of science, of interplanetary archeology, as well as speeding the day when we can send probes to and receive data from other stars and star systems than our own solar system. Treating it as an errant comet, fractured piece of a planet, or asteroid, does not, for Loeb, advance any science at all --- it simply offers more of the same.

Interestingly, those of us in the Delaware Astronomy Society Book Club have just completed Loeb's book: *Extraterrestrial: The First Sign of Intelligent Life Beyond Earth.* The entertaining and enlightening book was a best-seller. His publicist has secured for him a handful of key media appearances. I heard him on Science Friday. The overwhelming response on our listserve, however, was "yeah, right." Another member with significant academic credentials suggested I review the stories of the "cold fusion" twins, Pons and Fleischmann's, whose academic careers suffered mortal wounds from their unsupportable claims.

Clarke's first and third laws, as well as history, suggest otherwise. Loeb is a distinguished scientist, and the naysayers to Loeb may be wrong. Similarly, if 'Oumuamua were the product of an intelligent extraterrestrial life form, that life form would have had centuries if not millennia of technological advances over us to reach our solar system at all, so the product of that life form may appear to be magical in a sense.

I choose to adopt Loeb's approach, notwithstanding the purely intellectual risks. I continue to think of scientific absolutes that existed for decades without question: phlogiston; luminiferous ether; crystalline spheres and epicycles.

Those signals first called "little green men" were revealed by scientists and further data analysis to be Pulsars. As much as Eddington got right, he completely blew it when it came to Chandrasekhar's discovery of black holes (in fact, he was downright rude). Galileo endured house arrest for heresy until the end of his life because the official doctrine of the Catholic Church was that the earth was the center of the universe even though most scientists of his day had already accepted the Copernican model of the solar system.

Loeb's most compelling argument is that much serious scientific study is given over to exploring unprovable theories of string theory, super symmetry, and multiple dimensions (after all, Lisa Randall has made her own living selling books like "Dark Matter and the Dinosaurs"), and yet there isn't any data to support any of these theories. Nothing observable whatsoever. On the other hand, 'Oumuamua accelerated around the sun in a manner completely inconsistent with the laws of physics, *without outgassing of any kind to propel it.*

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I'll take my lumps, on the listserve or off; because I choose to believe that science should be expansive; that we should endeavor not to get cut on Occam's Razor, and that there still is no such thing as phlogiston or luminiferous ether (frankly, and I've said this before, I'm not convinced that dark energy is a thing either). No, I am not so far gone that I believe some idiot who believes that he was beamed up to a spaceship where he was anally probed; and I continue to be skeptical of observations by pilots of weird lights and UFO's which some claim to be flying saucers.

I *am* increasingly concerned about the darker edge of the Fermi paradox, that intelligent civilizations tend to be self-destructive, especially given our own species' obsession with finding new ways to kill ourselves (and destroy our home planet), but ultimately, I believe that it is hubris to believe that we are the only intelligent life in the universe, and I use the term "intelligent" very liberally.

The guest at our most recent DVAA meeting, Dan Werthimer, himself a UC Berkeley Professor and member of the SETI team suggested, "we should be willing to consider speculative ideas." He admitted that it can be useful to contemplate "wild and crazy non-mainstream ideas."

Whether Avi Loeb is the Steve Martin-like "wild and crazy guy" of the astronomy community is a debate for another day. Meanwhile, when I gaze at the sky, whether with eyeball, binocular, or eyepiece, I still sometimes contemplate that somewhere out there is another eyeball, binocular, eyepiece, or something else mankind hasn't conceived of yet, staring back at me.

Don't Miss the Next Monthly Meeting: May 21, 2021

An Introduction to Space Law

Michelle Hanlon, Co-Director of the Air and Space Law Program at the University of Mississippi School of Law, Editor-in-Chief of the Journal of Space Law and Faculty Advisor for the Journal of Drone Law and Policy

Can you buy property on the Moon? Can Elon Musk declare Mars a "free" nation? Who's in charge of cleaning up our orbit? This presentation will review the international space law regime and demonstrate how the law is applied to specific space activities. It will review shortcomings in the law (and there are a lot!) and explore ways to fill the myriad gaps. From Sputnik to Space Force, we'll talk about how the law has evolved and why we need to look to the past to protect our spacefaring future.

DVAA Virtual Meeting: May 21, 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*

Welcome New DVAA Members!

Craig Attig - Rose Valley, Pa.
Thomas Hickey - Malvern Pa.
Patricia Kelly - Broomall, Pa.
Daniel Loftus - Cherry Hill, NJ
Angelo Zullitti -Upper Chichester, PA

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

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Mark Your Calendars!

Upcoming Monthly Meetings

Friday May 21, 2021: Featured Speaker: Michelle Hanlon, University of Mississippi: "An Introduction to Space Law" (see p.3). The regular monthly meeting will be livestreamed. Watch your email for sign-on directions.

Upcoming 2021 Meeting Dates: (all Friday evenings): 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 were restarted 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): **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 George Keighton for being lead editor last month.

Tom Nolasco— lead editor for this issue

Al's Observing Tips: "What! You Want Me To Observe Clusters of Galaxies?"

Al Lamperti email

As you gain observing experience and find your way through the Messier objects and other bright galaxies, you will want to venture into a veritable forest of galaxies. In fact, you were in the midst of groups of galaxies if you have observed the objects on the Messier list. For example, when you were in the Virgo cluster of galaxies, a rich area of the sky resplendent in scores of galaxies of all sizes, shapes and magnitudes, you saw M-58, 59 and 60.

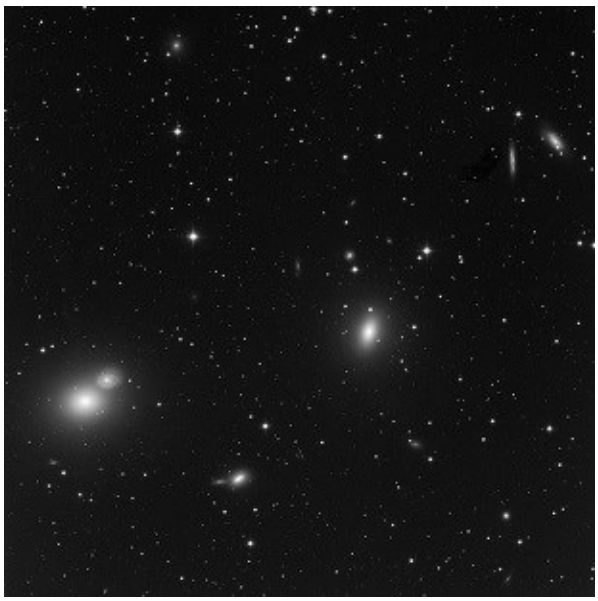
Your next step may very well be to observe large groups of galaxies from not only the Messier list but also those found in Herschel's list (see the Astronomical League's Observing Programs *"Herschel 400"* and *"Herschel II")*. Some of these galaxy groupings are in the Abell catalogue. Initially the thought might sound intimidating but careful planning ahead of time will make the observing session go more smoothly.

In the constellation Coma Berenices there is Abell 1656, a collection of galaxies, many of which have an NGC designation. The challenging part here is that the center of Abell 1656 has approximately 30 galaxies that are all within an area about one square degree! One can delve right into the cluster and observe these galaxies one by one, recording your observations as you go along. If you are observing these under high magnification to see more detail and obtain more contrast and if your telescope does not have a motor drive, the images will drift quickly across the field as you are looking at your atlas or checking your observing list. One can get lost easily and find it hard to galaxy hop.

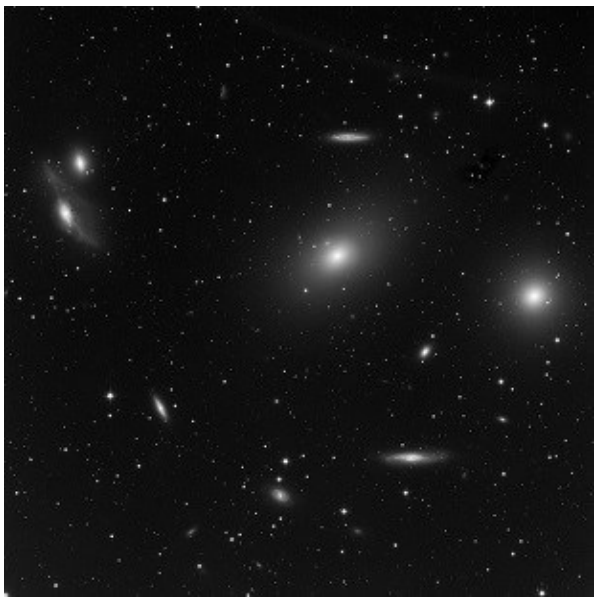
In these situations, making a rough sketch of portions of the cluster on a piece of paper will help. Each portion may have 5 or 6 galaxies grouped close together that can be observed with moderate ease. After each portion is done, you go on to the next. Having a list of each galaxy along with its size and magnitude is also helpful in differentiating one galaxy from the next, particularly if the adjacent galaxies are of dissimilar size and/or magnification.

The Astronomical League has an observing program called "*Galaxy Groups and Clusters."* In there you will find lists of relatively loose as well as compact groups of galaxies, including galaxy trios. One of these comprises the 100 compact groups of galaxies catalogued by Paul Hickson.

You will find that observing these groupings may give you that extra-added challenge you were looking for. In the process you gain a deeper appreciation for the vastness and organization of the universe.



Brightest two galaxies are M60 & M59 located in Virgo. Photo by Dick Steinberg



Brightest two galaxies are M84 & M86 located in Virgo. Photo by Dick Steinberg

The April Monthly Meeting

Jeremy P. Carlo email

The April 2021 DVAA meeting was opened by President Harold Goldner. Harold reminded the audience of several upcoming events, including an outreach event on April 27, and a possible partnership with a 50+ community looking to participate in astronomy events. Harold also gave an update on the Delaware Astronomical Society's book club, which is currently reading Prof. Avi Loeb's book on the possibility of extraterrestrial life. While there will be no official Main Sequence Star Parties, our sister club CCAS (Chester County Astronomical Society) has invited us to "tag along" to their outing to Cherry Springs August 10-13 (rain date Sep. 7-10).

Up next were committee reports. Welcoming Chair Brian Lee welcomed 3 new members, and Treasurer Lou Berman reminded us that it's a great time to renew your dues if you haven't already; it's easier than ever through the website. VP and Outreach Chair Jan Rush told us about yet another outreach event on April 27, this at the Anderson Farm Park in Upper Providence.

Astrophotography Chair Lou Varvarezis then introduced Darlene Scott of the Norristown Rotary Club to give a brief presentation. Darlene is working on an educational program for underserved youth, in partnership with Albright College in Reading, and with the SETI Institute. This program will be part of the STEM Youth Explorer Academy to take place in Summer 2022. While this program is still in the early planning stages, Darlene is interested in getting DVAA members to help out with the program, and will be in contact as plans come together.

DVAA Observing Chair Andrew Hitchner then gave his observing report for April, and discussed the (apparent) brightness of stars and the magnitude system. As amateur astronomers, the magnitude system is one of the first things we learn about. It's a number which tells us how bright a star is to the human eye. Lower numbers are brighter. The brightest star, Sirius, is magnitude -1.5, while Vega (which was for many years the standard calibration star) shines near magnitude 0, and the dimmest stars visible to the naked eye from a dark sky site are about magnitude 6. The magnitude system is a logarithmic scale; a difference of one magnitude corresponds to a factor of about 2.5 in brightness, while a difference of 5 magnitudes corresponds to a factor of 100 in brightness.

But in reality, things are a lot more complicated than this. Many (in fact, virtually all, if you measure carefully enough) stars exhibit some variation in brightness. The apparent brightness also depends on the "pass band" used – exactly how sensitive your detector is to red light and blue light, and at exactly what wavelengths you cut off your detection window. To this end, the European Space Agency has launched the GAIA mission, which aims to produce the most precise 3-D map of the galaxy ever by studying about 1% of the galaxy's ~100 billion stars, observing each one 70 times over a period of years. GAIA will measure the star's brightness to unprecedented accuracy, as well as its position, which enables determination of its distance (because of parallax), as well as its motion through the galaxy (known as proper motion) and its spectrum (which can tell us about a star's composition and age, among other things). GAIA was launched in December 2013 and is still collecting data, and its early data release has already revolutionized our understanding of the galaxy, and will continue to do so as more data is published.

DVAA Programs Chair Jeremy Carlo then introduced the evening's featured speaker, Dan Werthimer of the University of California – Berkeley and SETI (the Search for Extraterrestrial Intelligence). Dan has been a scientist at SETI since 1979 and has been a major player in a number of programs including SERENDIP, CASPER, and perhaps most familiar to us, the screensaver program SETI@home, which enables you to use your own computer, in its downtime, to analyze data collected from radio telescopes for signs of signals from intelligent civilizations. Dan's topic was "Are We Alone?: The Search for Extraterrestrial Intelligence."

Dan started with a little about his background. He first got interested in astronomy via an astronomy club in the San Francisco Bay area, and worked with none other than the famous John Dobson. And Dan introduced the topic by pointing out the Drake Equation, developed by Frank Drake in 1961 as a tool to estimate the probability of making contact with an extraterrestrial civilization.

The Drake equation has a number of terms. Each is a number, and when those numbers are multiplied out the answer is the number of communicative extraterrestrial civilizations in the galaxy. The early numbers are astronomical – the rate of star formation, the fraction of stars with planets, the fraction of planets which are habitable. There has actually been a lot of progress in the last few decades in nailing these numbers down. Then it becomes more speculative: what fraction of habitable planets develop life? What fraction of planets with life develop intelligent life? What fraction of intelligent species develop the capability for interstellar communication? And then it gets *really* speculative: How long do those intelligent, communicative, civilizations last before dying out?

As far as the astronomy terms and the first of those biology terms go, things are looking optimistic. We have discovered thousands of extrasolar planets. At least some of those appear to be in the "Goldilocks zone" of habitability (in which liquid water, believed to be vital to complex chemistry) can exist. In our own solar system, we also know of bodies (particularly Enceladus and Europa) which are well outside the habitable zone, but nonetheless have huge subsurface water oceans thanks to tidal heating. The Miller-Urey experiment demonstrated the formation of complex organic molecules under conditions believed to be relatively common in young earthlike planets. And life appears to have emerged fairly quickly on Earth, in geological terms. This all sounds rather optimistic, although our understanding of those remaining terms is comparatively rudimentary. It took some 4 billion years for intelligent life to emerge on earth. Is this fast? Is this slow? Is this typical? Is this highly unusual? We really don't know.

With the stage set, Dan discussed the history of search-

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es for extraterrestrial intelligence. The crucial point here is the fact that, according to all we know about physics, interstellar space travel is extremely difficult. Thus the most likely way an extraterrestrial civilization would make contact with outsiders is via sending out signals at the speed of light. Although this can still take many years given the enormous distance between stars, it's a lot faster (and cheaper, and perhaps less dangerous) than actually trying to travel those vast distances. (At least, that is, according to our best current understanding.)

In the 1800's (prior to the discovery of radio waves), scientists proposed making large geometric patterns or rings of fire on the earth, which sufficiently advanced civilizations could see with their telescopes. Since then, most interest has focused on using much longer-wavelength radio waves, although a program called Optical SETI has also searched for ultra-bright laser pulses which an extraterrestrial civilization could send out. In the 1970's and since, we have sent several spacecraft (including Pioneer 10 and 11, Voyager 1 and 2, and most recently, New Horizons) on trajectories which will lead them into interstellar space. Each carries a plaque or other artifact intended for some civilization which may someday encounter them, although that is extremely unlikely to happen for a very long time, if ever. Electromagnetic radiation is just that much faster. Interestingly, back in the early 20th century, Marconi and others discovered radio signals of unknown origin. These turned out to be distant thunderstorms. Oh well…

Radio SETI started in earnest in the 1960's with the pioneering work of Frank Drake at Cornell and others, and evolved into the current SETI program. The Arecibo telescope was used to send a signal out to the globular cluster M13. However, it'll be 50,000 years before we would receive a reply, even if somebody there did copy the message and chose to write back.

However, most SETI searches have been passive in nature: for the most part, we've just been listening. Listening really carefully, using some very large radio telescopes. Dan noted that the original SETI project used an 85' telescope in northern California, which unfortunately collapsed. They then moved to a 300' telescope in West Virginia… which also collapsed. Most recently they used the 1000' telescope at Arecibo, which functioned for many decades… until it too collapsed last year! Some of the optical searches used a telescope at Lick Observatory which came close to buying the farm in wildfires a few years ago. With this streak of bad luck, the Weekly World News (which has been disseminating "fake news" before we knew fake news was a thing) opined that these telescopes were zapped by aliens. (Or maybe it was the government…)

Well, what are they looking for? Basically, a signal which "looks" to be interstellar in nature based on its time dependence, motion across the sky, and changing Doppler shifting. But, more importantly, a complex signal which cannot be explained by some natural phenomenon. Perhaps a sequence of prime numbers or some other complicated mathematical pattern.

Needless to say, all this searching requires vast amounts of computer power. That's where SETI@home comes in, putting millions of home computers to work in their spare CPU cycles. While the program is currently in hibernation due to the loss of Arecibo, some 8 million participants have given 3 million years' worth of computer time, performing 3 x 10^{23} operations (that is, half of Avogadro's number!) over its lifetime to date.

The upshot (spoiler alert!) is that no unambiguous signal has been detected to date. Still no confirmation of "ET." However, the search goes on, and will be going in some new directions. PanoSETI (panoramic SETI) will use an array of telescopes to survey numerous stars at once, taking a "shotgun approach" to improve the odds. Plans are underway to use the new FAST telescope in China, which at 500 meters is nearly twice as large as Arecibo. Optical searches, looking for rapid laser flashes, are also ongoing.

Dan then discussed some more speculative ideas. One idea is to use the sun as a massive gravitational lens, producing a telescope the size of the sun. An instrument of this size would have a theoretical resolving power of about 10 meters on the surface of an extrasolar planet, although the detector would have to be positioned about a hundred times further out than Pluto! A program called Breakthrough Starshot would send a tiny spacecraft (weighing a total of 1 gram) to our nearest neighbor, Proxima Centauri, at about 25% of the speed of light. This trip would take about 20 years, although the necessary technology is many decades in the future.

Closer to home, however, SETI has had a number of spinoffs. It's a great opportunity for education and outreach. It's a great project for "citizen science," including projects like SETI@home. It is also one of the best examples of a "high risk, high reward" research project – one in which success is so difficult, but would be so profound.

Dan concluded with some discussion of what a definitive result – one way or the other – would mean for us. If we're not alone, it means we have fellow travelers in the cosmos. What can we teach them? What can they teach us? Is their biology like ours, or not? And if we're alone after all, then there's no help coming from elsewhere, and there may not be a "Planet B" for us to go to. We had better take care of each other, since we're all we have in the vast emptiness of the Universe. It also seems like a tremendous waste of space.

Dan closed with several SETI Haikus:

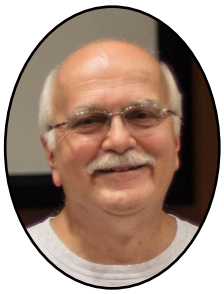
Searching for life
Answers are revealed
About ourselves. (Paula Cook)

One million earthlings
Bounded by optimism
Leave their PC's on. (Dan Seidner)

Dan's talk was followed by an extremely lively Q&A which touched on a great number of topics! I can't summarize it all here, so I suggest you check out the meeting recording on YouTube.

Many thanks to Dan Werthimer for an engaging and accessible talk on the search for extraterrestrial civilizations!

Live Stacking: Seeing the Unseen



Tom Nolasco email

Many people have strong feelings on what I'll call "computer assisted observing." They feel the only true observing is if the photons from an eyepiece are directly smacking into their retinas. It is summed up in a quote I came across by Ben Funk:

"I would rather freeze and fight off mosquitoes than play astronomy on a computer."

I get it, and under a dark sky I completely agree with that sentiment. Who doesn't savor the actual photons that have traveled great distances, perhaps millions of light years or more, before being directed into your eye? Just imagining that is mind boggling and enhances the observing experience.

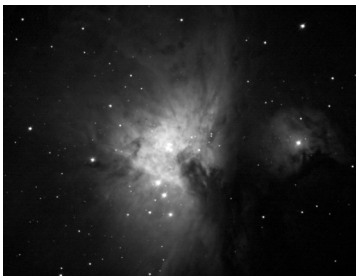
However, my backyard is nothing like a dark sky site. Trying to separate those distant photons from the background noise of light pollution can be very frustrating. You see, like many of you, I live under very bright skies, brighter than the airplane field in Valley Forge National Park, where we have our monthly public star parties. So recently I have taken my first steps into computer assisted astronomy and would like to counter Ben's sentiment above with one of my own in regards to observing deep sky objects from a less than dark site:

"I would rather see something on a computer screen than nothing through my eyepiece."

The seed for my adventure was planted several years ago at a DVAA meeting where John Bajtelsmit gave an excellent presentation on video astronomy. John spoke about what he could "see" in his backyard with a MallinCam video camera attached to a small telescope. I stored that information away in the back of my brain thinking that might be an interesting idea to try sometime.

With the Perfect Storm of the pandemic, stimulus checks and light polluted skies that sometime was now. I had learned of a freeware software application called SharpCap that performed Live Stacking of images from a standard astronomy camera. Live Stacking is the displaying of short exposure images in real time, on your laptop, with each image being stacked or added to the previous short exposure building an ever clearer and brighter view of the object you are observing.

Armed with SharpCap, my aging solar system imaging camera and my 6 inch F/9 telescope mounted onto an old equatorial mount, I gave it a go. While far from the ideal setup, it was good enough to see if Live Stacking was worth pursuing. For my first attempt I wanted to try an easy target, the Orion Nebula. I knew if I couldn't get a good view of that then I would have little to no hope of "seeing" other deep sky objects. Below is what I saw on my laptop screen the night of January 20th 2021. This quick 72 second exposure (36 images of 2 seconds each) was my first attempt.



I was thrilled at the prospect that Live Stacking might actually work under sky conditions as bad as mine. I had proof of concept. I knew however, for the Live Stacking to truly work, the mount must track accurately over several minutes to allow SharpCap to consistently find the alignment stars in each image. So I got serious by putting my government stimulus check to work purchasing my first high quality goto equatorial mount, new astro camera and premium version of SharpCap. I was all in. Hey, that stimulus money wasn't going to spend itself.

My deep sky setup now consists of my existing 8 inch F/4 reflector mounted onto my new iOptron CEM mount. I use a ZWO ASI174 monochrome camera driven by the SharpCap software to perform the Live Stacking of images on my laptop. For me, the monochrome image gives a closer feel of what I would see through an eyepiece.

It's been truly amazing. I can "see" way more on my laptop, using my 8 inch F/4 in my backyard, than I can see visually through an eyepiece at Cherry Springs Sate Park through my 14 inch F/4.5.

SharpCap is the secret sauce in this. You can perform histogram stretching, image sharpening and zooming all in real time as the images are stacking. At any point during the Live Stacking you can save a raw file of the data you've collected up to that point and/or save a copy of the image as currently displayed on your laptop with the tweaks

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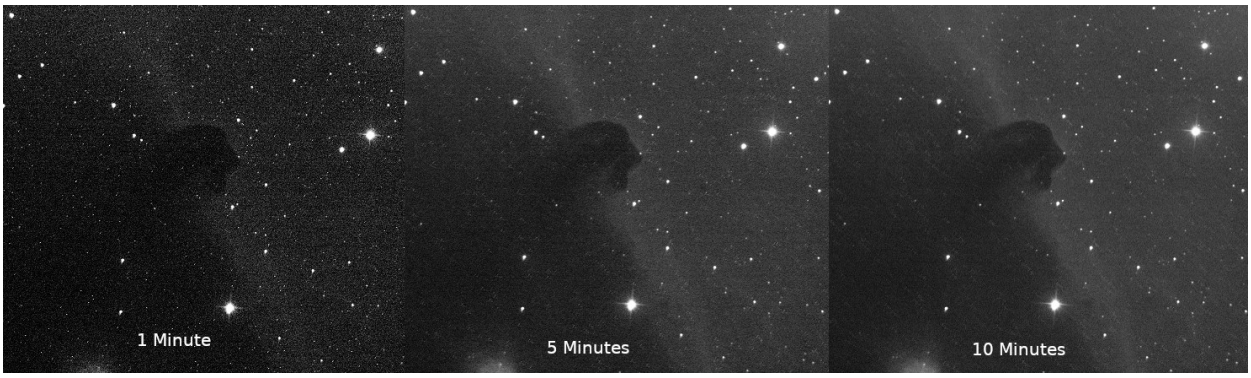
to the display that you've made. This occurs without stopping the Live Stack operation. So you have a souvenir of your observation, how cool is that?

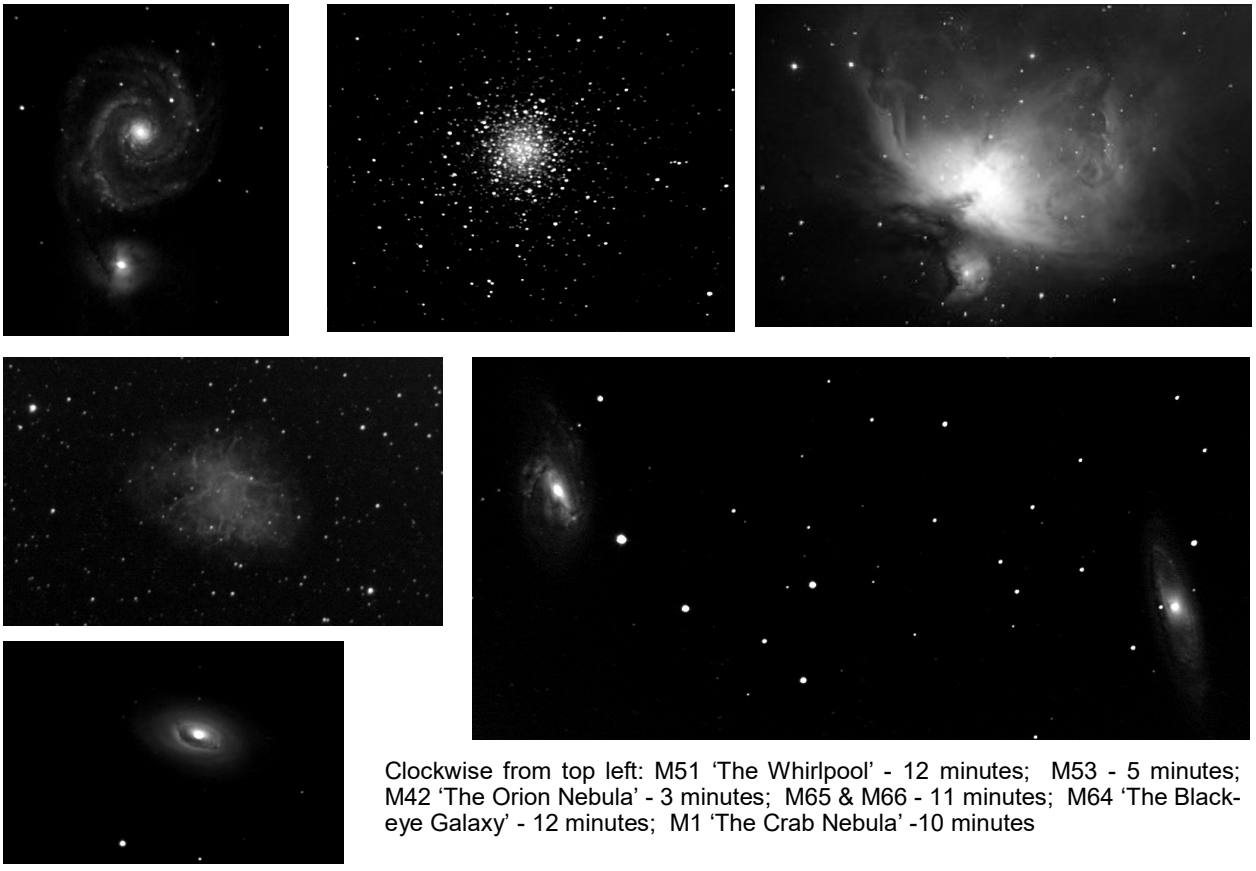
Let me show you what I see on my laptop during the stacking process. Here's any example with an image saved after 1, 5 and 10 minutes total exposure. I decided to push my luck and try, a very difficult object, Barnard 33, the Horse Head nebula, as my first test with the new mount and camera. Here are the results taken on March 13, 2021 under average transparency skies.



I was stunned at the result. What you will notice, as more images are added to the stack, the image gets cleaner as the noise is reduced. Typically, I stack relatively short exposures in the 10 to 15 second range.

Sharpcap also has the capability to apply dark and flat frames to each image being stacked in real time, although I haven't experimented with that feature yet.

Below are examples of images captured directly as displayed on my laptop in real-time with no additional post processing.



Clockwise from top left: M51 'The Whirlpool' - 12 minutes; M53 - 5 minutes; M42 'The Orion Nebula' - 3 minutes; M65 & M66 - 11 minutes; M64 'The Black-eye Galaxy' - 12 minutes; M1 'The Crab Nebula' -10 minutes

Virgo's Galactic Harvest

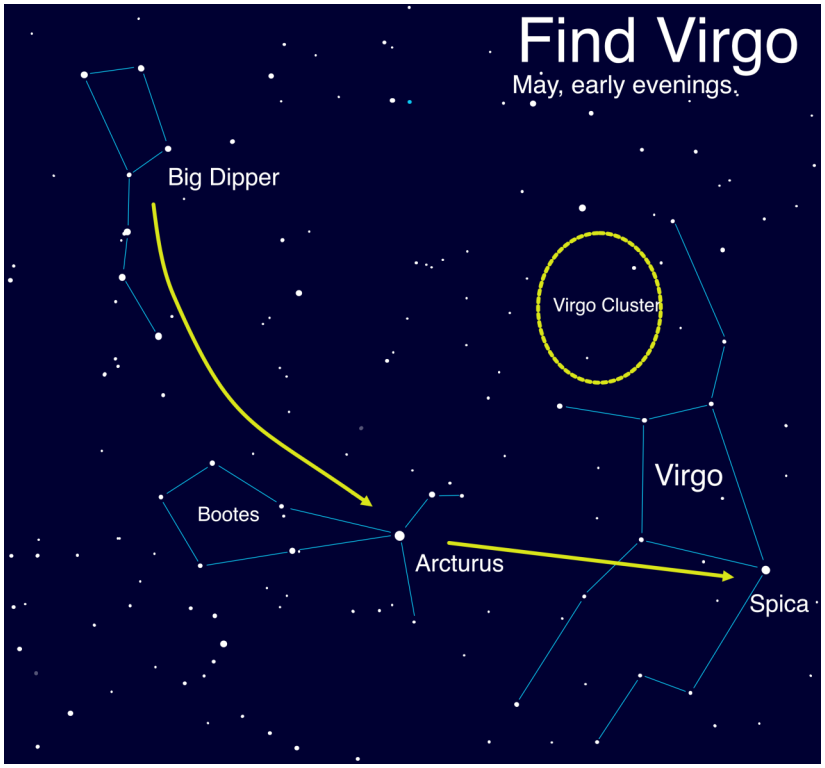
David Prosper

May is a good month for fans of galaxies, since the constellation Virgo is up after sunset and for most of the night, following Leo across the night sky. Featured in some ancient societies as a goddess of agriculture and fertility, Virgo offers a bounty of galaxies as its celestial harvest for curious stargazers and professional astronomers alike.

Virgo is the second-largest constellation and largest in the Zodiac, and easily spotted once you know how to spot Spica, its brightest star. How can you find it? Look to the North and start with the Big Dipper! Follow the general curve of the Dipper's handle away from its "ladle" and towards the bright orange-red star Arcturus, in Boötes – and from there continue straight until you meet the next bright star, Spica! This particular star-hopping trick is summed up by the famous phrase, "arc to Arcturus, and spike to Spica."

This large constellation is home to the Virgo Cluster, a massive group of galaxies. While the individual stars in Virgo are a part of our own galaxy, known as the Milky Way, the Virgo Cluster's members exist far beyond our own galaxy's borders. Teeming with around 2,000 known members, this massive group of galaxies are all gravitationally bound to each other, and are themselves members of the even larger Virgo Supercluster of galaxies, a sort of "super-group" made up of groups of galaxies. Our own Milky Way is a member of the "Local Group" of galaxies, which in turn is *also* a member of the Virgo Supercluster! In a sense, when we gaze upon the galaxies of the Virgo Cluster, we are looking at some of our most distant cosmic neighbors. At an average distance of over 65 million light years away, the light from these galaxies first started towards our planet when the dinosaurs were enjoying their last moments as Earth's dominant land animals! Dark clear skies and a telescope with a mirror of six inches or more will reveal many of the cluster's brightest and largest members, and it lends itself well to stunning astrophotos.

Virgo is naturally host to numerous studies of galaxies and cosmological research, which have revealed much about the structure of our universe and the evolution of stars and galaxies. The "Universe of Galaxies" activity can help you visualize the scale of the universe, starting with our home in the Milky Way Galaxy before heading out to the Local Group, Virgo Cluster and well beyond! You can find it at bit.ly/universeofgalaxies. You can further explore the science of galaxies across the Universe, along with the latest discoveries and mission news, at nasa.gov.



Find Virgo by "arcing to Arcturus, then spiking on to Spica." Please note that in this illustration, the location of the Virgo Cluster is approximate - the borders are not exact.

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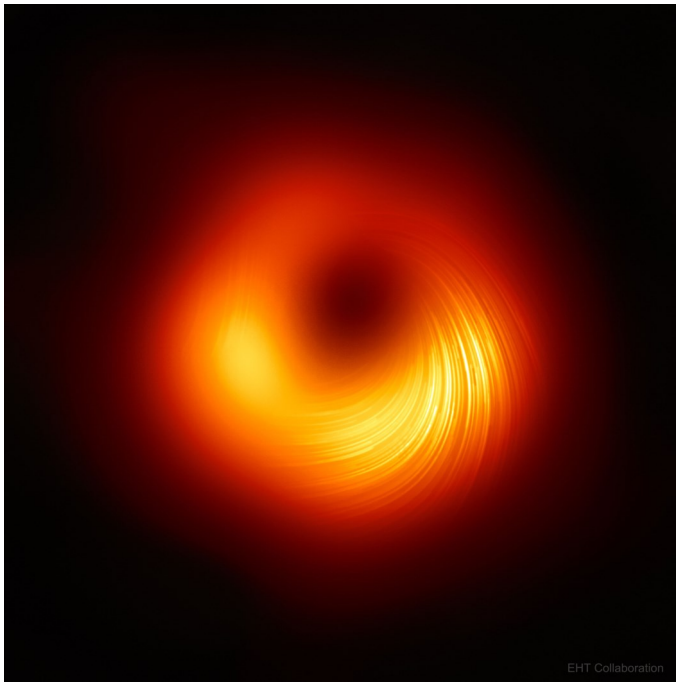


The first image of a black hole's event horizon was taken in the center of one of the most prominent galaxies in Virgo, M87! This follow up image, created by further study of the EHT data, reveals polarization in the radiation around the black hole. Mapping the polarization unveils new insights into how matter flows around and into the black hole - and even hints at how some matter escapes! More details: apod.nasa.gov/apod/ap210331.html

Credit: Event Horizon Telescope Collaboration

Ashen Glow

The mystery of Ashen Glow, the dim glow on the darkened portion of a crescent moon, was solved by Leonardo da Vinci in the 16th century. He explained the phenomenon after realizing that both the Earth and moon reflect sunlight and that light is reflected from the Earth to the moon then back to the Earth. More commonly known today as earthshine it is most visible when the lunar phase is a crescent.

The best to dates to view this beautiful sight in May are May 7th- 9th in the early morning and May 13th -15th in the early evening.

The crescent moon pictured here with Mars and Venus on February 20, 2015. Photo by Tom Nolasco.

Five Must-See Galaxies in May

Frank Colosimo captured these five outstanding images from his observatory at Blue Mountain Vista.

NGC 4631 The 'Whale' Galaxy & *NGC 4627, the 'Pup'*. NGC 4631 is a huge 9th magnitude edge-on spiral galaxy in Canes Venatici. Its 15x3 arc-minute tapered oval shape resembles a whale and is one of the largest edge-on galaxies.

NGC 4490 The 'Cocoon' Galaxy is a 10th magnitude barred spiral. This 6x3 arc-minute galaxy is interacting with the smaller nearby galaxy NGC 4485. They are around 45 million light years away from us in the constellation Canes Venatici.

NGC 4565 The 'Needle' Galaxy is a 10th magnitude edge-on spiral galaxy in Coma Berenices. It is a long thin object being 16x2 arc-minutes with an easy to see central bulge. With averted vision, and a bit of concentration, the dust lane is visible. This was reported as John Dobson's favorite object in the sky and Frank dedicated this image to his memory.

M104 The 'Sombrero' Galaxy is an 8th magnitude, 7x4 arc-minute, edge-on spiral galaxy in Virgo. It has the trademark dark rim of dust, with a large pronounced bulge in the center. You will need a 6 inch or larger telescope for the dust lane to be seen.

M64 The 'Black Eye' Galaxy is a 9th magnitude spiral galaxy in Coma Berenices. The 9x5 arc-minute galaxy has a prominent dust lane, that may be glimpsed in 4 inch telescope but is more easily seen in a 6 inch or larger telescope, that gives it its namesake..

"Time spent with 2-billion-year-old photons is potent stuff." – Peter Lord

Upcoming Solar System Highlights

May is a Great Time to See Mercury

Mercury has its best viewing opportunity of 2021 in May as it climbs in the western sky after sunset. Greatest elongation will be on the 17th when Mercury is 11 degrees above the western horizon 45 minutes after sunset. If you have never seen Mercury, this could be your chance.

May 3rd - Mercury approaches within 2 degrees of the Pleiades low in the western sky. This will be a tricky one and definitely a binocular event. About 45 minutes after sunset scan the sky at the same location as where the Sun has set. The Pleiades will be to the upper-right of Mercury.

May 13th - Mercury can be found about 3 degrees to the lower right of the 4% illuminated 1 1/2 day old moon. Both will fit nicely in a binocular view and the moon will help you locate Mercury.

May 28th - This is the main event for Mercury. Mercury, now moving back towards the Sun, passes by Venus, which is moving away from the Sun. Mercury is less than 1/2 degree from the Evening Star on the 28th however has faded from its May 3rd brilliance of –0.9 to magnitude 2.3, roughly 300 times fainter than Venus. Telescopically both planets will be approximately the same 10" of arc in diameter with Mercury displaying a thin crescent and Venus being nearly full.

June 10th - Sunrise Partial Solar Eclipse

Wake up, rise and shine. The last solar eclipse visible from the continental United States was the coast-to-coast total eclipse of August 21, 2017. While not as spectacular as that, the Philadelphia area and the Jersey shore are positioned for a unique astronomical event, a sunrise of a partially eclipsed Sun. On the morning of June 10th the Sun will rise with approximately 70% of its disk obscured by the moon.

Depending on your location, sunrise on the 10th will occur between 5:28 AM and 5:32 AM with maximum eclipse occurring only 3 to 4 ½ minutes later. The partial eclipse ends about one hour after sunrise. Finding an unobstructed view toward the northeast will be a must!

The eclipse presents a great photo op as well. With the Sun so low on the horizon dramatic landscapes can be captured with the partially eclipsed Sun. There is also the possibility of unusual twilight effects due to the Sun having a significant portion of its visible surface covered at sunrise.

But don't forget, Protect Your Eyes! Find those solar eclipse glasses you used in 2017 when the last solar eclipse touched the US. Carefully inspect them for any pinholes and if found discard them. Be careful, do not stare at the sun even if the light of the sun is diminished by thin clouds or haze near the horizon. Infrared rays from the Sun can still penetrate them. Damage can occur without any sensation of pain so err on the side of caution.

So set your alarms and be sure not to miss this. The early bird sees the eclipse.

Note: The eclipse simulation was captured from Stellarium, the free planetarium software available for download at www.stellarium.org.

On April 7th 2021, from his deck in Penn Valley, Dick Steinberg captured this beautiful image of planetary nebula NGC 2392, also known as the "Eskimo Nebula," in Gemini.

Dick used an Orion SSPro camera for this 8 minute exposure through his C11 at f/7.

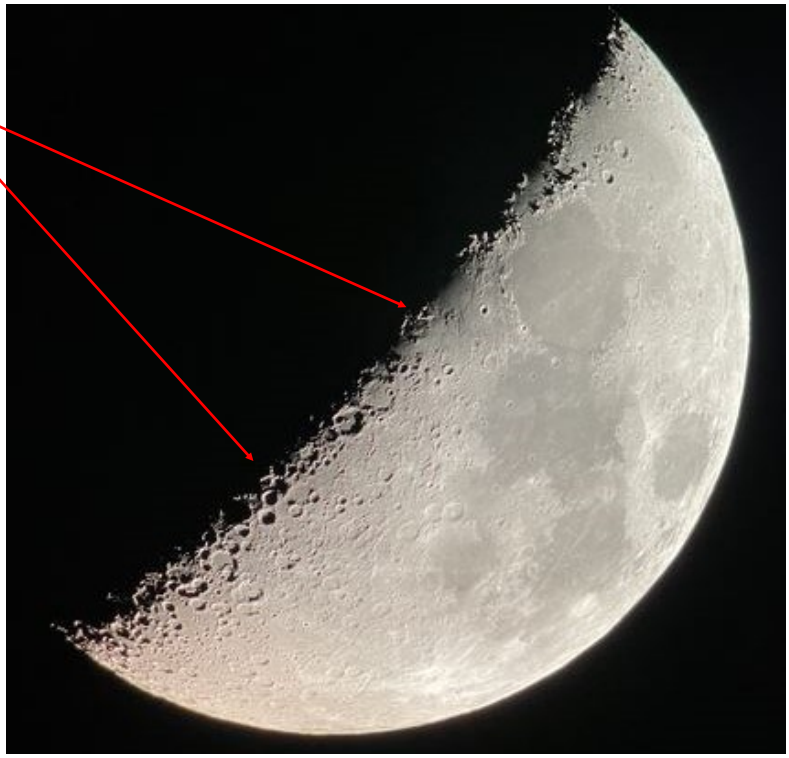
Lunar V
Lunar X

A nice capture of the Lunar X & Lunar V by Stan Williams on the Spring Equinox 2021.

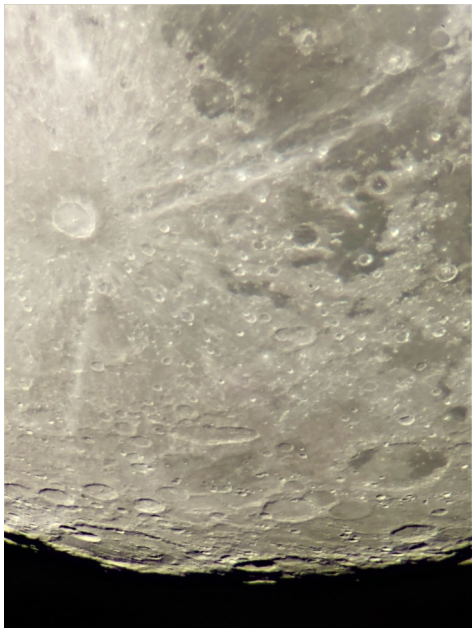
Stan used a Televue 85 telescope with a 6mm Ethos eyepiece, Baader Contrast Booster Filter, TeleVue FoneMate and an iPhone 12 Pro.

The Lunar X is caused by the strong contrast between light and dark creating the appearance of a letter 'X' on the rim of the Blanchinus, La Caille and Purbach craters. Its appearance is brief, lasting only a few hours before the first quarter moon.

North of the X, the Lunar V is also visible, formed by Ukert crater and several other small craters.



On April 25th, while visiting Powder Mill Park in Wynnewood, Mitch Berger captured this interesting cloud that immediately reminded him of the interacting galaxies M51 & its companion NGC 5195 in Canes Venatici. This was the first galaxy to be classified as a spiral long after being discovered by Messier in October, 1773. The image of M51, on the right, was taken by Lou Varvarezis.



Despite only so-so seeing and breezy conditions, Bart Fried captured these impressive close-up images of the eastern limb of the lunar surface on April 25th, only one day before full moon.

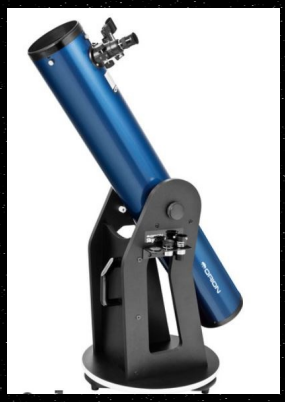
With his Google Pixel 4A phone camera held in a Nexyz phone holder, Bart used his 1903 antique 4.5" f/15 Brashear refractor to project the image from a 9.5 mm eyepiece into the camera. All focusing was done first by eye, and then the phone took over. Amazing what can be done with simple gear and excellent optics!

"The true value of a telescope is how many people have viewed the heavens through it" – John Dobson

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**.

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