

# The Observer

The Official Publication of the Lehigh Valley Amateur Astronomical Society

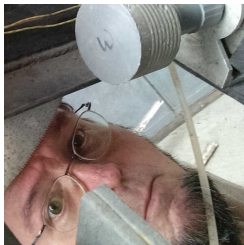
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February 2017

Volume 57 Issue 02



## ad astra\*\*\*\*\*

Ron Kunkel's talk about solar physics and solar observing at our January meeting was very enjoyable, but as I commented afterwards, I don't think it did justice to the experience of actually observing the Sun through Ron's setup. Nothing could. No matter how many splendid images you look at, it still can't quite replace the experience of seeing it through the eyepiece of a telescope, and I think this is true whether we are talking about the Sun, a planet, or a deep-sky object. Visual observing will have its place, despite the spectacular advances in imaging technology, for a long time. Hang on to those scopes and keep taking them out to observe!

Afterwards we had a lively discussion about the upcoming total solar eclipse (August 21 - make plans now, if you haven't already), including a debate on whether to try to photograph the totality. I will be concentrating on just taking it all in, and letting others do the photography, but I understand that for some people it's important to capture one's own souvenir of the moment. Just don't spend the entire duration of totality fumbling with your camera phone. Even if you are traveling to witness the event, you may not be fortunate enough to get to the centerline of the eclipse path, and so you may only have a minute, plus or minus, of time when the Sun is completely covered by the moon.

Our February speaker will be Dr. Sera Cremonini of Lehigh University, filling us in on String Theory, the topic of her research. We've all heard of this area of science, whether from reading articles and watching documentaries or from just seeing episodes of The Big Bang Theory, but if you're like me, you are probably not completely clear on what it's useful for. Amazingly, String Theory can be helpful in understanding Black Holes! I've written before about my enthusiasm when Prof. Cremonini came to Lehigh, and I'm really looking forward to hearing her talk about her research.

### Anniversary Year

This year, LVAAS will be 60 years old, and it is traditional for us to have an anniversary banquet. We have been talking about it at Board meetings, but no consensus has emerged about how "big" we should go with it. I will be taking a straw poll at the meeting, but in case you can't attend, please let me know your thoughts in an email. How much would you like to spend to attend an LVAAS banquet? Should we spend some money from the Treasury to throw a bigger party? You can express your opinion to me at [director@lvaas.org](mailto:director@lvaas.org).

## Board Announcement

At this time I am very pleased to announce that Rhonda Young has accepted an appointment as our new Director of Member Services. If you've been to a Star Party or a General Meeting in the past year, you have probably had an opportunity to meet Rhonda, a frequent volunteer. From now on she will be in charge of the Red Shift, to fulfill your wishes for snacks, beverages, and LVAAS apparel. A big Thank You to Rhonda for accepting this important role!

And don't forget, we will still have 2017 LVAAS calendars for sale at the meeting, featuring some of the great work of our own astroimagers. If you have a blank spot on your wall, please consider supporting the Society by visiting Rhonda and getting an LVAAS calendar to fill that hole.

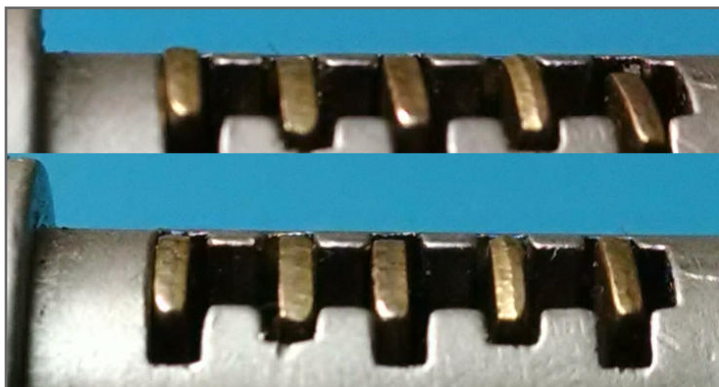
## The Drive Key Situation

A "key switch" is a lock that you put a key into, and turn to activate an electrical circuit. We have them in our cars (though in a lot of newer cars, thanks to wireless technology in our key fobs we usually don't need to use them) and we have them on our LVAAS observatory telescopes. If you were trained on an LVAAS telescope, you were probably issued a drive key to fit the key switches on our scopes.

We did not have a key switch for the 40", but thanks to some shopping on eBay, we now have one, plus a spare. Also, the key switch for the 12.5" Newtonian in the roll-off at Pulpit Rock is currently not installed, because it had become gummed up with old lubricant over the years, and stopped working. It's now cleaned up and working great and ready to be put back into service.

But in the process of working on these, I noticed a problem. My drive key was not quite right. Although with a bit of wiggling, it would work, it seemed like it ought to be better, and when I had the lock mechanism apart, I could see that it was not positioning the tumblers exactly right in order to allow the lock to open smoothly.

What has probably happened is that, over the years, we've made a copy of a copy of a copy, with the shape of the key deteriorating a little each time until it isn't working as well as it should anymore. My concern is that this



*The cylinder from one of our drive key switches, with the existing key inserted (top) and the new key (bottom). With the old key, you can see that the wafer in the #1 position is sticking up a bit, and the #5 wafer is lowered (which, in this type of cylinder, means that the bottom of the wafer is protruding). Both of these impede smooth operation of the lock, and both are corrected with the new key.*

could cause excessive wear on the lock mechanisms. These key switches are no longer manufactured, and it seems impossible to get parts for them.

With the help of our excellent locksmith (Keith's Lock & Door Service in Coopersburg) we have created a new master drive key, and I have tested it in the key switches in all of our observatories. In every one it works at least as well as the old one, and in most of them it works better. As you can see in the photo, the tumblers in the lock cylinder are aligned much better with the new key.

We discussed this issue at the January Board Meeting, and Assistant Director Sandy Mesics confirmed that her drive key does not work as

well as the new one in the new key switch for the 40". We need to find out what it will cost to have new drive keys made up, and decide how to cover that cost. I'm not sure exactly how this will work out, but if you are in possession of a drive key — in particular, if you have one that you use frequently — I hope you will support us in getting your key updated, in order to minimize wear on our equipment.

#### **Acknowledgement**

On behalf of LVAAS I would like to thank Mr. Charles Stetz and acknowledge his donation of an SBIG ST-4 autoguiding system, consisting of a CCDH-1 guide camera and ST-4 CPU. Our 18" Cassegrain in the Schlegel-McHugh Observatory at Pulpit Rock has a guide scope with a fairly long FL, as well as an ST-4 port, so this system seems like it would be a good match for that setup. But first, we are going to evaluate it for use with our 14" at South Mountain in support of our spectrography program.

Mr. Stetz is a member of the Lackawanna Astronomical Society (of which I am a member, and former Junior Vice-President) and he is an at-large member of the LAS Board for 2017. The donation was arranged by Steve Walters. Thank you, Charlie, for helping us with this valuable enhancement to our observatory capabilities!

#### **Renew, renew, renew**

If you haven't renewed your membership yet, time is running out to get it done without paying a penalty. Remember that in renewing your membership, you are supporting a very worthwhile 501(c)(3) educational non-profit organization, with a lot of great programs that benefit you as well as the community. Ad Astra!

— *Rich Hogg*

## Minutes for the LVAAS General Meeting of 8 January 2017

Director Rich Hogg called the meeting to order at 2:10 pm. He introduced our speaker, LVAAS life member Ron Kunkel, who he described as “the most famous amateur astronomer in the area.” Ron’s presentation was on solar observing. He discussed the properties of the Sun, the characteristics of stars, and solar observing methods, along with a review and comparison of the various solar filters, solar wedges, and solar telescopes. Following the well-received talk, there was a lively discussion about the August solar eclipse, what to expect, and how best to observe the event.

Following Ron’s presentation, there was a 15-minute break, after which Rich convened an informational session. Rich reminded those present that the Member Services board position was still open, and we are hoping for a volunteer.

Treasurer Gwyn Fowler reported on the recent audit results. There was an upward adjustment to the audited financial balance sheet for FY 2015 by a net of a \$1.60 and for FY 2016 by a net of \$52.47. The adjustment for FY 2016 also includes some income from our Vanguard investment accounts not previously entered into QuickBooks. LVAAS ended the FY 2016 budget with \$20,600.70 of revenue and \$18,205.75 of expenses. We originally proposed a deficit and we were able to change it to a surplus. So far in FY 2017 our budget revenue is \$4,949.41 and our budget expenses are \$2,807.89. LVAAS received anonymous donation of \$8,500 designated to the 40-inch Fund. This donation is not included in the budget because it is directed to a project fund. With this donation the 40-inch fund has a balance of \$16,451.64.

Membership chairperson Scott Fowler announced that membership cards are now available to those who renewed their 2017 membership. Dues are now due and should be paid before the end of February. April 1 is the cut-off date, after which members who do not renew will be delinquent.

A second reading was held for Barry Huett, who is now a full member of LVAAS. First readings were held for Andrea Sarnowski and Ted Goffinet. Scott added that Matt Binder, who has been a regular member, has now become a life member.

Tom Duff reported that Megameet will be held from May 26-28 at Pulpit Rock, a change from fall to spring.

Frank Lyter gave an update on the 40-inch project. The mirror is waiting for the coring to be completed, and then will need to be coated before final figuring of the secondary mirror can take place. We are looking toward completion in late 2017, but there is a lot of infrastructure work to be done to the observatory and to the telescope itself.

Carol Kiely announced that there is no star party in January or February. The next star party will be on Saturday, March 4. On Friday, March 3, the Lunatics and Stargazers will meet at South Mountain.

Rich Hogg informed the group that the next general meeting will feature Sera Cremonini from Lehigh University. We are not sure of her topic, but it might involve string theory or cosmology.

The meeting was adjourned at 4:20 p.m.

Respectfully submitted,

Sandy Mesics, Assistant Director

**General Meeting: Open to the Public  
Sunday, February 12, 2017 at 2 p.m.**

**Muhlenberg College, Trumbower Rm. 130  
(Lithgow Science Auditorium)**

**Black Holes, Strings and Holography**

**Sera Cremonini, PhD,  
Assistant Professor of Physics, Lehigh University**



The recent announcement of the direct detection of gravitational waves provides yet another remarkable confirmation of Einstein's vision of the universe, in which space and time are interwoven and dynamic. Despite its stark successes, the theory of general relativity is incomplete, in that it fails to describe regions of space-time with very large curvature, and for which quantum mechanical effects cannot be ignored. These include the interior of black holes and the very early universe. String theory, our leading candidate for a quantum theory of gravity, offers a concrete framework to probe the microscopic properties of black holes and the short-distance behavior of space-time. It has also led to remarkable new insights into the connection between gravity and the quantum mechanical world. This lecture will discuss various aspects of string theory and what it has taught us about the nature of gravity.

*A native of Cremona, Italy, Sera moved to the US after high-school. She earned her undergraduate degree in Physics and Mathematics from The City College of New York (CUNY), her Masters from Columbia University, and her PhD from Brown University. Before joining Lehigh University in 2015 as an Assistant Professor in Physics, she held a position with The Michigan Society of Fellows, University of Michigan, Ann Arbor, and a joint position between Cambridge University and Texas A&M University.*

***The 2017 LVAAS Calendar will be available for purchase at this event.***

# Reminders!

- If you haven't already done so, it's time to **renew your LVAAS membership.**

First, download the renewal form from this link:

[http://lvaas.org/filemgmt\\_data/files/LVAAS2017MembershipRenewalForm.pdf](http://lvaas.org/filemgmt_data/files/LVAAS2017MembershipRenewalForm.pdf)

Then, please send it, along with your check to the address on the form



- **The LVAAS 2017 calendar** is available for purchase at general membership meetings including those held at Muhlenberg College over the winter months. Proceeds benefit the LVAAS Greater Lehigh Valley educational outreach program.



*Thank you for your generous support of LVAAS!*

# Schlegel Observatory Report

by Rich Hogg

*February, 2017*

This month I'm going to talk about the optical configuration of the 40" telescope. There is a problem with the design that we have known about for a while — in fact, since before I joined LVAAS — but work on it was put on hold until figuring of the primary mirror was completed. Our optician, Mike Lockwood of Lockwood Custom Optics, was made aware of the issue and promised to do what he could to improve it. Well, he wasn't able to do as much as we hoped, so it was time to take stock of the situation.

The design of the telescope is a Cassegrain system. To be specific, it is a "classical" Cassegrain, with the primary mirror having the shape of a paraboloid. When we turned the mirror over to Mike, our agreement was that he would work with the preliminary grinding and figuring that was already done, correcting any problems with it and bringing it to a finished state. A complete do-over was beyond the scope of the project.

A Cassegrain system is a two-mirror system. If it is aimed directly at a star, the light from that star is captured by the primary mirror and reflected into a converging cone, whose apex would be the focal point of the mirror. The height of the cone above the center of the reflecting surface is the focal length (FL) of the primary.

But that is not allowed to happen in the finished telescope. The light never reaches the focus; instead, it is captured by the secondary and redirected back through the central aperture in the primary.

Of course, we usually want to see more than one star. We would like our telescope to take in some circular patch of the sky - a very narrow cone of light from neighboring stars, or the surface of some celestial object, with an angle that constitutes the field of view of the telescope. The focused cone of light reflecting from the primary is widened by this angle, which would result in the creation of an image at the prime focus, if the secondary mirror did not intervene.

What defines the field of view is the region of the sky for which all of the light is captured by the secondary. Outside this region, some of the light from the primary misses the secondary, causing a

darkening of the final image, an effect known as "vignetting." What we need to evaluate is the "fully illuminated field of view (FOV)."

So what determines the FOV? Given that the design of the primary - its diameter and FL - is fixed, the characteristics of secondary mirror take control: its diameter, and its distance from the primary.

So here's the problem: the 40" was designed with a 10" secondary, and a partially-figured secondary already exists, which is currently in Mike Lockwood's shop. Also, the telescope's structure was built to place the secondary 108.25" from the primary, which isn't quite far enough.

Knowing we had a potential problem here, we asked Mike Lockwood to try to decrease the FL of the primary a bit in his work on the mirror. He succeeded to a very limited extent: he reports that the finished mirror will have an FL of 146.3". If you do the math, you find that this design has no fully-illuminated field at all. Even if the instrument is aimed directly at a single star, not all of the light from the primary will fall on the secondary.

Pete Brooks and I did some measurements a few years ago, and we came to the conclusion that the spacing could be increased to about 110.7". This helps, giving us an FOV of 0.06 degrees, which would be a little over 1/2" in the image plane. That means, if you put a good-quality 2" eyepiece on the instrument, you would see a circle a bit over 1/4 the diameter of the field which is fully illuminated, with vignetting beginning outside that circle.

Now I need to tell you that it is not as bad as it sounds. Why? Because although some of the light from the primary is slipping past the edge of the secondary, the reality is it's not that much. At the edge of a 2" field, less than 2% of the light that should be getting there is being lost. This would not be noticeable in visual observation and barely detectable in imaging, if at all, and it could be compensated for by using flat frames.

### ***Remedies***

So it amounts to a problem that does not need fixing. If it did, what could you do? Well, more careful measurements and a possible redesign of the secondary mirror cell and spider might allow us to increase the spacing by a few more inches, which is all it would take to get a full-illuminated 2" field. We may look at this if we get an opportunity. It all depends on the progress in getting ready to figure the secondary as it relates to our ability to work in the observatory (and we will need to get the slew motors running again in order to take the measurements).

Another option that was discussed in past years was increasing the size of the secondary. A bigger 12" secondary could be moved closer to the primary and still catch more of the light, and it would have the additional effect of reducing the system's effective FL, changing it from f/13.2 to closer to f/11. But this would be an expensive change, requiring a new spider and secondary mirror cell, as well as a new mirror blank which would be more expensive to figure. 12-inch mirror blanks seem to be priced starting at

around \$500 and going up to more than \$1500 for a lightweight blank, which is what we might need. Even though the secondary moves closer to the primary, the reduced moment arm is not enough to compensate for the increased weight of a mirror of the same type. And adding weight to the front of the instrument would require adding even more weight to the back to maintain balance.

Bottom line, unless someone has a lightweight 12" mirror blank lying around that they want to donate, we will plan to stick with the 10" secondary, and set the spacing as high as we think we can to get the least vignetting, which won't matter that much anyway.

### ***Back Focus***

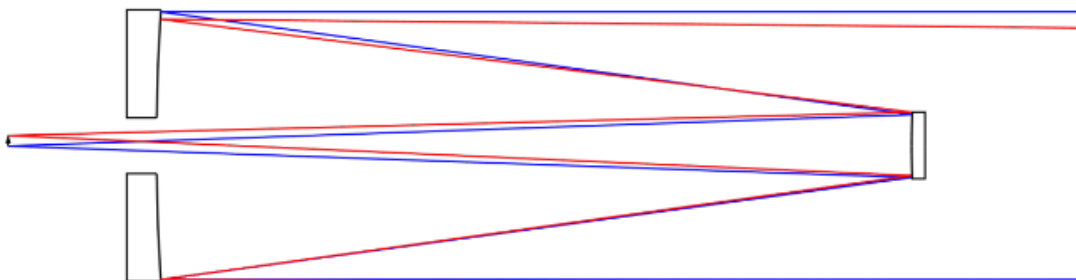
The other key design parameter is "back focus", or the distance from the primary mirror surface to the actual focal plane. The current mechanical design wants to make this about 12", about 6" of which is accounted for by the mirror itself and the back plate of the mirror cell. This puts the focal plane about 6" behind the mirror cell.

However, there is 28" of clearance from the mirror cell to the bottom of the fork, so there is room to increase it. I calculated that even if the back focus were increased by 5.5", there is still room for my head, a Tele Vue Ethos 21mm eyepiece, and a 2" pillow (because that fork is welded steel and it's pretty hard). So just in case I wanted to lie there propped up in the fork, observing Polaris through the 40" without the benefit of a diagonal, I would still fit. This is not an activity that I am planning on anytime soon, but it's a benchmark that should leave plenty of room for an astrocamera or other instrumentation.

Why increase the back focus at all? Mostly to allow using a diagonal, or a multi-port instrument selector, comfortably. With an optical path extending only 6" from the backplate, using a diagonal would require your head to be jammed against the instrument.

To be honest, I'm not too worried about this. The reason is that you can move the focal plane by moving the secondary, and there is an amplifying effect: moving the secondary in this design by 0.1" moves the focal plane in the opposite direction by about 1.4". So, with just over an inch of adjustability in the position of the secondary, we can move the focal plane through the entire range that would potentially be useful. And it has only a very minor effect on the optical performance.

The converse is that, once the secondary is ground for a certain spacing, you can't move it very much. So it is important to choose a suitable spacing before figuring begins on the secondary.



## ***The Plan of Record***

To summarize where we are, here is the current plan for the optical design of the telescope, in detail.

Primary aperture: 39.8" (40" less a 0.1" chip bevel)

Primary FL: 146.3"

Primary conic constant: -1.0 (paraboloid)

Secondary diameter: 9.8" (10" less a 0.1" chip bevel)

Secondary radius of curvature: 98.6"

Secondary conic constant: -3.09 (determined by optimizing using OSLO\_EDU software)

Spacing: 110.7"

Back focus: 17.4" (from primary reflecting surface)

System effective focal length: 526.4"

System f/ratio: 13.23

Fully illuminated field: 0.548" (at image plane), 0.06° on the sky

Working field: 2" (at image plane), 0.22° on the sky

Light loss due to vignetting at edge of working field: 1.8%

## ***Current Status and Activities***

Mike Lockwood reports that our mirror is still at John Pratte's shop, and that coring has not commenced. One of the problems is that to do this work, they will need to flip the mirror over a couple of times, and this is not something to be taken lightly for a valuable 550-pound piece of precision optical glass. You don't just bring home a few guys from the pub to manhandle it.

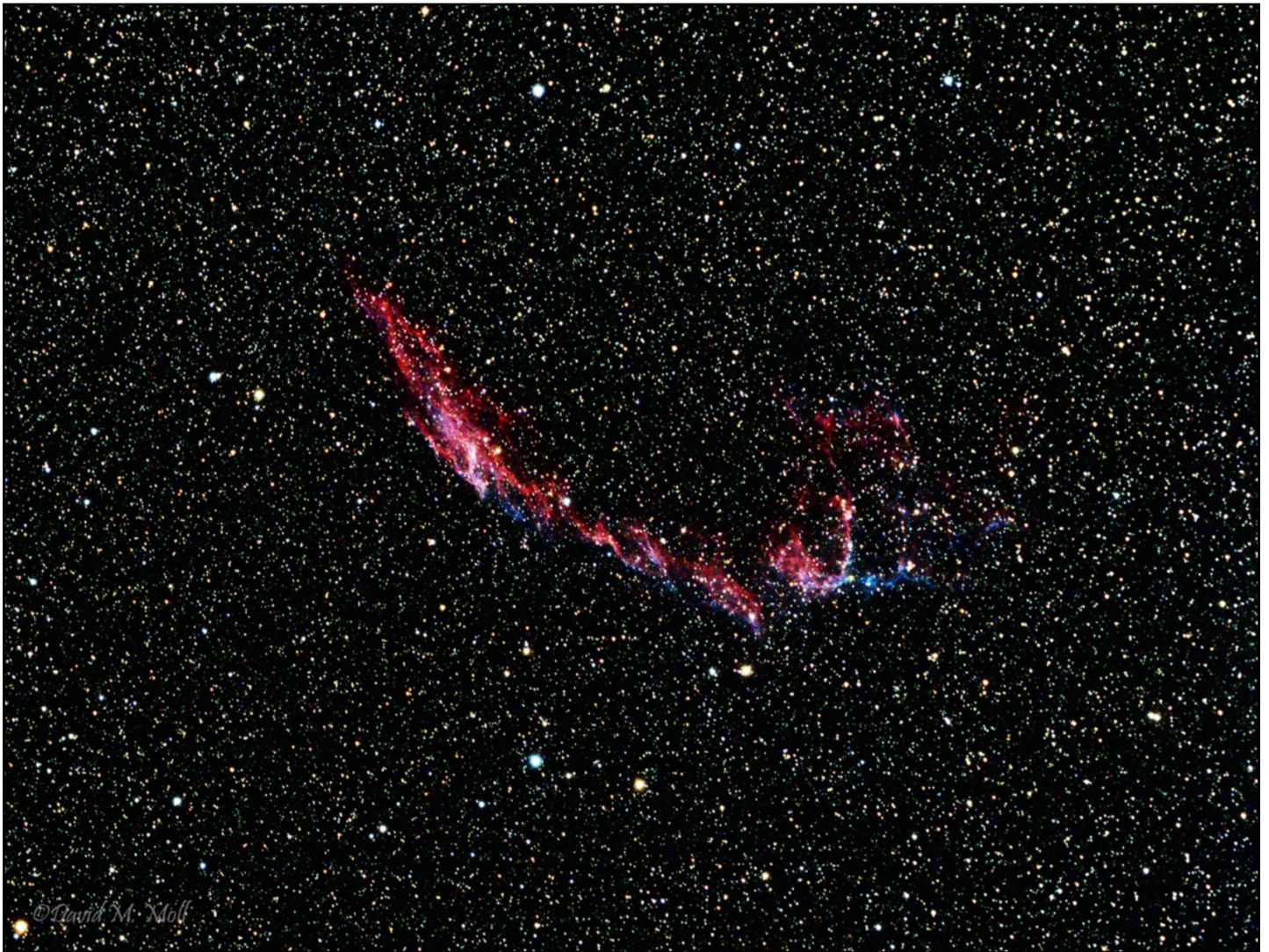
In addition, our current preferred candidate for applying the coating will require us to use commercial shipping, and it has been our feeling that a new crate would need to be constructed in order to ship it. But this creates an opportunity for some synergy: the crate can be designed to allow for safely flipping the mirror, thus solving two problems. So that is the plan at this time.

In addition to working on the optical design, I am also still working on the power distribution. At this time the connection to 110V is ready to be installed. It consists of a standard power cord with a 3-prong plug, a 15 amp circuit breaker, a drive key switch, and an emergency stop button, plus 3 indicator lamps, one for each of 3 power circuits: one always on, one for electronics (controlled by the key switch), and one for motors (controlled by the key switch plus the emergency stop button).

If you have any questions, comments, or suggestions about this project, email [theotherplanb@gmail.com](mailto:theotherplanb@gmail.com).

# The Network Nebula, NGC 6992, in Cygnus

By Dave Moll



The Network Nebula (Eastern side of the Veil Nebula), NGC 6992, in Cygnus. Imaged from Neffs, PA, Monday, Oct. 24, 2016. Single frame, 10 minute exposure, UNGUIDED. Astro-Tech AT65EDQ Quad Apo scope, SBIG STF-8300C CCD camera, iOptron CEM-60 mount. Nebulosity 4 capture/preprocess, Photoshop CC final process. Noisy but cool!  
D. M. Moll photo.

# Ron's Ramblings

*Ron's Ramblings is a monthly series of articles describing some recent or otherwise important event in astronomy. The ramblings will attempt to describe both the astronomical event and its significance. Obviously, the description will be that of a rambling amateur astronomer.*



## Tweaking the Standard Model

The Standard Model (SM) of particle physics exquisitely describes all of the known particles and their interactions, and in spite of extensive searches no significant deviations from the SM have yet been detected. But despite its supreme success, the SM has some known shortcomings when it comes to a complete description of Nature. Notable are: its failure to predict a dark matter particle, its failure to explain the predominance of matter over anti-matter, an inaccurate description of neutrino masses and their oscillations, and its inability to explain the lack of strong CP violations. Another problem, this one in the field of cosmological physics, is the inability to explain the origin of the primordial inflation.

Now a rather simple tweak to the SM -- the addition of three heavy neutrinos, a tri-color fermion, and a field that includes two particles, the axion and the inflaton -- solves all five of these major seemingly disparate problems of particle physics and cosmology in a remarkably simple way.

The tweak to the SM is called SMASH, which stands for Standard Model Axion Seesaw Higgs. This theory was formulated by Guillermo Ballesteros of the University of Paris-Saclay in France along with three other colleagues. Because it only adds six particles, SMASH is a minimal extension of the SM. Other theories, such as supersymmetry for instance, add hundreds of particles to the SM to explain just some of these problems. Incidentally, none of these supersymmetric particles have ever been detected by particle accelerators despite efforts to detect them. SMASH only adds six particles and solves these five intertwined problems in a relatively simple way.

SMASH is appropriately several prior theories simultaneously “smashed” together into one encompassing theory that solves numerous seemingly intertwined problems in particle physics and cosmology. The 1980 KSVZ model previously introduced the axion as a dark matter particle. A theory in 2005 by Shaposhnikov added three heavy neutrinos to the SM's existing three light neutrinos. That 2005 theory successfully described the low mass and oscillation properties of neutrinos.

Now in SMASH, the simultaneous addition of the two field particles, axion and inflaton, along with the three heavy neutrinos, solves the strong CP violation problem and in so doing also explains the reason for the preponderance of matter over anti-matter, e.g. the baryogenesis problem. The axion becomes the dark matter particle. Additionally, the two field particles acting in concert with the SM's Higgs particle produces primordial inflation. In short, the addition of only six particles simultaneously solves five problems.

And interestingly SMASH makes some testable predictions. For instance, the hypothesized dark matter particle, the axion, should be ten billion times lighter than the electron. It should be detectable within the decade by experiments such as CULTASK currently running in South Korea, or by the proposed ORPHEUS experiment in the United States and the planned MADMAX experiment in Germany. Additionally SMASH should be decisively probed by the next generation of cosmic microwave experiments.

**Reference:**

Unifying inflation with the axion, dark matter, baryogenesis, and the seesaw mechanism. (2016, October 27). Retrieved from <https://arxiv.org/pdf/1608.05414v1.pdf>

The end of my ramblings until next month.  
- Ron Kunkel



by **Gary A. Becker**



## Sunglasses at Night

On Friday, February 10, we will witness a very strange lunar eclipse. Eclipses come in two basic “flavors.” Solar eclipses occur when the moon hides the sun. They are daytime events and require safe filtration while any part of the sun is visible. The next total solar eclipse for us is only months away, August 21 of this year, when the moon’s shadow sweeps across the country from coastal Oregon to South Carolina on the East Coast. For Pennsylvania and New Jersey about 80 percent of the sun will be covered by the moon, an event that will require special filters to see throughout the entire eclipse. More about this later.

On February 10 we get to witness the second broad category of eclipses, a lunar eclipse-- the Earth’s shadow blocking the moon-- but this one will be decidedly different. If you could see the dark shadow of Earth projected into black space, you would observe a circular region where most of the sun’s light was completely blocked-- called the umbra-- and a ring or washer-shaped area surrounding the umbra where the intensity of sunlight gradually diminishes towards the umbra, a result of Earth blocking more and more of the sun’s light. This secondary shadow of Earth is called the penumbra.

During this lunar eclipse, visible in the east, the moon only enters the penumbra of Earth, but the position of the moon at its maximum depth, 99 percent at 7:44 p.m., EST, is so close to the umbra that Luna will appear decidedly darkened (dusky) in this region. A very small portion of the moon, about one percent, opposite to this location will be exposed to full sunlight. The moon will look as if it is gradually losing light from one side to the other. If the moon is made into a clock, at maximum eclipse, Luna should be brightest at the 3:30 position and darkest at the 9:30 position.

If you want to heighten the effect of the diminution of light, try wearing sunglasses to observe the moon. Remember the Cory Hart song lyrics, “I wear my sunglasses at night.” Well, here is your perfect opportunity to go Hollywood during the February 10 penumbral lunar eclipse. Clear skies to all!

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Moravian College Astronomy - [astronomy.org](http://astronomy.org)



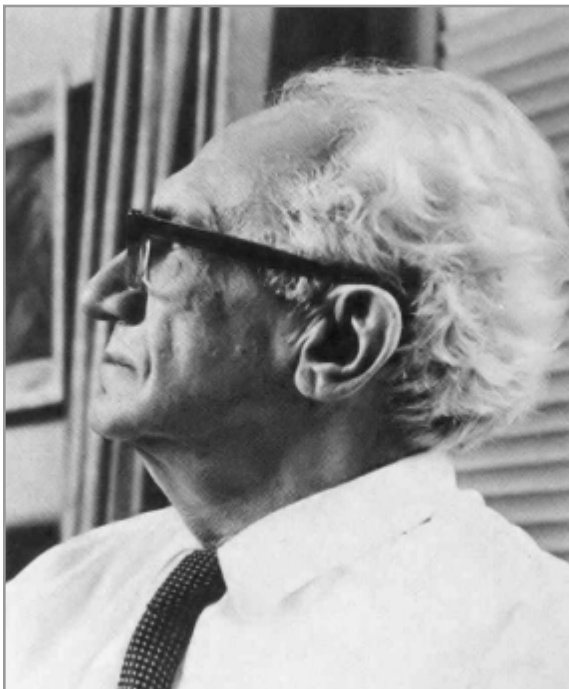
*From the LVAAS Archives:*

## **February, 1967: Planetary Billiards, Night Lights in Space, and Hours of Board Meetings** **by Sandy Mesics**

In 1967, Board of Governors meetings were held the Monday immediately following the monthly general meetings at the LVAAS Headquarters. They were scheduled to begin at 8 p.m., though sometimes were not called to order until as late as 8:50 p.m. Generally there was a refreshment break midway through the meetings. The length of the meetings varied from 2 hours, 1 minute to a whopping 4 hours and 15 minutes. It took the Board a total of 34 hours and 1 minute to conduct LVAAS business in 1967.

In February 1967, LVAAS had a budget balance of \$1898.45, equivalent to \$13,645 in today's dollars. Not bad for a 10-year old society that had 81 members: 54 regular members, and 27 associate members (under age 21). No doubt because LVAAS was becoming financially stable, this was the first time the Treasurer was bonded, initially for \$2,000.

### **Immanuel Velikovsky Comes to Philadelphia**



Source: *Pensée* Vol.2. No.2, Immanuel Velikovsky Reconsidered (page 5) May 1972

At the February 1967 LVAAS general meeting, there was discussion about Dr. Immanuel Velikovsky's upcoming talk at the Rittenhouse Astronomical Society in Philadelphia.

Velikovsky was a controversial character in the scientific community. He was born in Russia, trained to become a medical doctor, and then began practicing as a psychiatrist. He came to the US in 1939, initially planning to spend a sabbatical year researching for his book *Oedipus and Akhenaton*. The book explored the possibility that Pharaoh Akhenaton was actually the character Oedipus. With the outbreak of World War II, he remained in the US, eventually settling in first in New York, then in Princeton.

During the war years, his work detoured toward "catastrophism." Based on ancient manuscripts that discussed major catastrophies, Velikovsky concluded that the planet Venus is a former comet which was ejected from Jupiter and subsequently, 3,500 years ago, made two catastrophic close passes by Earth, 52 years apart,

and later interacted with Mars, which then had a series of near collisions with Earth which ended in 687 B.C., before settling into its current orbit. Velikovsky used this to explain the biblical plagues of Egypt, the biblical reference to the "sun standing still" for a day (Joshua 10:12 & 13, explained by changes in Earth's rotation), and the sinking of Atlantis.

After being rejected by eight publishers, Macmillan published this theory in a 1950 book entitled *Worlds in Collision*. The book would turn out to be Velikovsky's most criticized and controversial work. Astronomer Harlow Shapley was so opposed to the publication of this book as pseudoscience, he threatened to organize a textbook boycott of Macmillan, which was a major academic publisher at the time. Within a couple of months, Macmillan transferred the book to Doubleday. Nevertheless, the book was an instant *New York Times* bestseller, topping the charts for eleven weeks while being in the top ten for twenty-seven straight weeks.

The astronomy community agreed that the celestial mechanics proposed in the book were physically impossible, requiring planetary orbits that do not conform to the laws of conservation of energy and conservation of angular momentum. Eventually, Velikovsky's ideas were almost entirely rejected by mainstream academia and his work is generally regarded as erroneous in all its detailed conclusions. Also, his unorthodox methodology (for example, using comparative mythology to derive scenarios in celestial mechanics) was viewed as an unacceptable way to arrive at conclusions.

Not surprisingly, for most of the 1950s and early 1960s, Velikovsky was *persona non-grata* on college and campuses. Nevertheless, he persevered, and by the late 1960s and early 1970s, perhaps with the advent of the counterculture, he began to receive more requests to speak. He lectured, frequently to record crowds, at universities across North America.

All this brings us to the discussion at the February 1967 LVAAS meeting. The Franklin Institute in Philadelphia had given the Rittenhouse Astronomical Society the use of its meeting rooms to since 1929. However, when the RAS invited Velikovsky to speak on April 7, 1967, the Institute refused to let the group use its rooms for this event. Instead, the talk was moved to the Free Library of Philadelphia, and his talk drew an audience of 450 people. His topic was "My Star Witnesses." There is no record of who, if anyone, from the LVAAS attended. Incidentally, Velikovsky spoke at Moravian College in 1971 as well.

In 1974, the American Association for the Advancement of Science felt obliged to address Velikovsky's controversial theories, as they had previously done in relation to UFOs. The AAA devoted a session to him featuring (among others) Velikovsky himself and Carl Sagan. Sagan gave a critique of Velikovsky's ideas but he did not remain to debate him in person. This fact was used by Velikovsky's followers to attempt to discredit Sagan's critique. Sagan retaliated by further attacking Velikovsky's ideas in his PBS television series *Cosmos*.

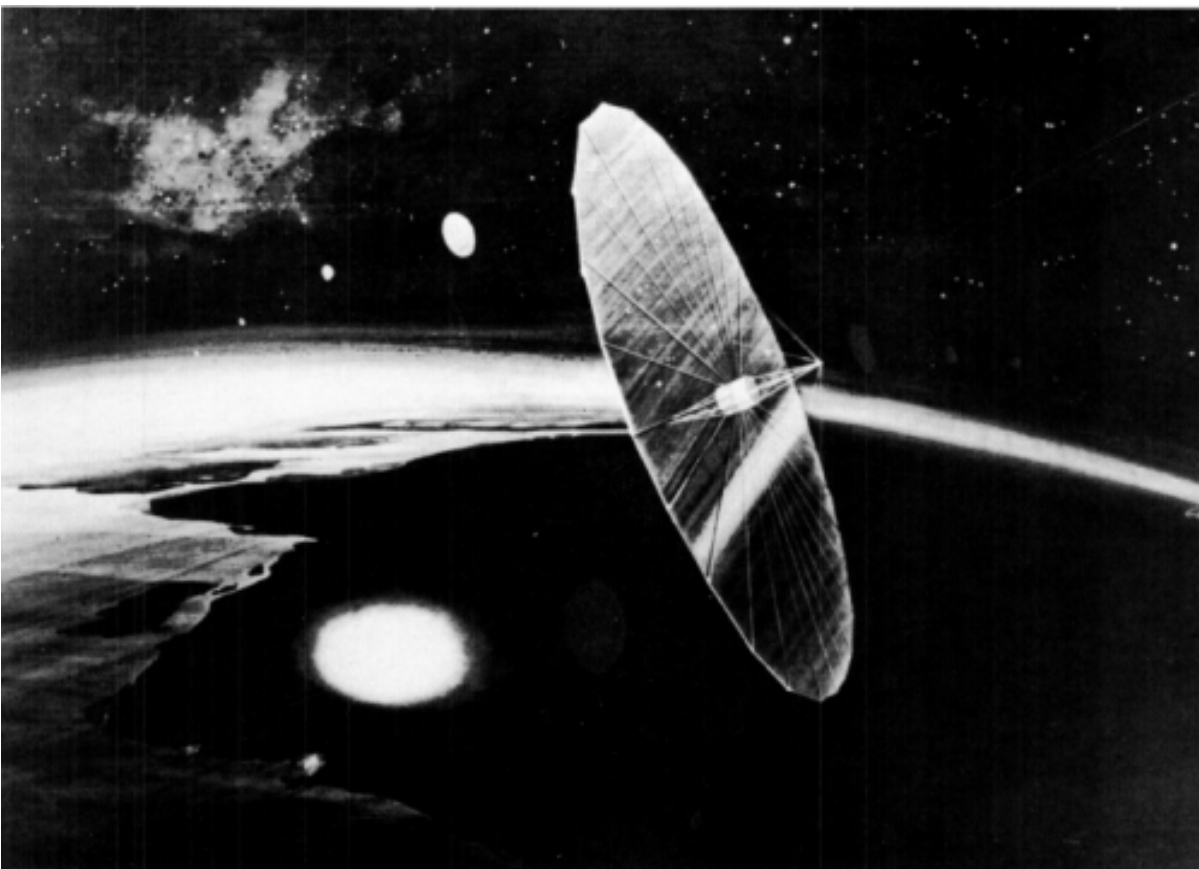
Velikovsky died in 1979. His books are still available, and his papers reside at Princeton University.

## **Night Lights in Space?**

At the February general meeting there was also a report about an orbiting reflector for nighttime illumination and a multitude of other interesting applications. No doubt this was alarming as the ultimate in light pollution. Actually, this concept was originally described in 1929 by the German space pioneer Hermann Oberth in his book entitled "Ways to Spaceflight." He envisioned a space mirror for military surveillance, illumination, and heat. "...wide stretches of land in the north could be made habitable by means of dispersed light; in our latitudes, the feared sudden drops in temperature (ice men) in spring and the night frosts in fall and spring could be prevented, thus saving fruit and vegetable crops of entire provinces."

This idea resurfaced 38 years later by Arthur G. Buckingham. Buckingham's early efforts were primarily concerned with illumination from space for both civil and military applications. Much of the work was released in 1967 and 1968 in papers written by Buckingham and H. M. Watson (refs. 2 to 4). Buckingham also received a patent for “A system and method for generalized irradiation of relatively large surface areas of a planet, such as the earth, the moon, etc. for illumination, heating, weather control, etc., employing one or more planet-orbiting self-erecting planarreflector satellites controlled in attitude and orbit position to reflect energy from the sun to a desired area on the planet’s surface.”

During this time, solar reflectors were studied for use in the war in Vietnam by several companies. The technology existed for fabricating and launching the reflector sizes under consideration (approximately 250 feet in diameter), but even with the advocacy of NASA and the Air Force the project was canceled, primarily because of an anticipated early end of the war.



L-82-165

(a) Artist's conception of solar-reflector spacecraft.

Figure 1.- Illumination from space.

Sources:

1. Oberth, Hermann: Ways to Spaceflight. NASA TT F-622, 1972.  
[https://archive.org/stream/nasa\\_techdoc\\_19720008133/19720008133#page/n520/mode/1up](https://archive.org/stream/nasa_techdoc_19720008133/19720008133#page/n520/mode/1up)
2. Buckingham, A. G.; and Watson, H. M.: The Uses of Orbiting Reflector Satellites. AIAA Paper 67-786, Oct. 1967.
3. Buckingham, A. G.; and Watson, H. M.: The Uses of Orbiting Reflector Satellites. Preprint 67-118, American Astronaut. Soc., May 1967.
4. Buckingham, Arthur G.; and Watson, Harold M.: Basic Concepts of Orbiting Reflectors. Spacecr. & Rockets, vol. 5, no. 7, July 1968, pp. 851-854.

# Highlights of the February Sky

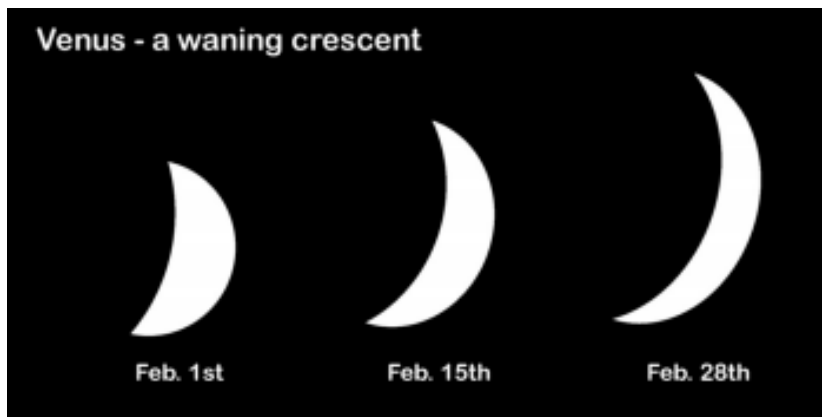
by  
Carol Kiely



Clear skies seem to be few and far between at the moment. I hope things improve because the February sky is a stargazer's dream.

In the early evening, the planet Venus will shine brightly (mag. -4.8) in the southwestern sky. It owes its brightness to its hot dense atmosphere, most of which is carbon dioxide, that reflects close to 90% of all the incident sunlight. It also comes closer to Earth than any other planet. This is a great time to observe Venus through a telescope. Take note of the change in appearance as the month progresses - the waning crescent will become thinner and increase in size as the planet makes its way

towards Earth. Many experienced astronomers prefer to observe Venus during the daytime when the contrast between the illuminated region of the planet and a blue background is not so large, and also because it's not so close to the horizon. If you decide to do this, ***please be extremely careful; you do not want to accidentally catch the Sun.*** If you are new to astronomy, or if you are putting your new telescope through its paces, it would be wise to wait until the sun sets. You will still get a



great view of the planet, especially at the beginning of the month when it will be well above the horizon. Attaching a filter to your eyepiece will also reduce the glare.

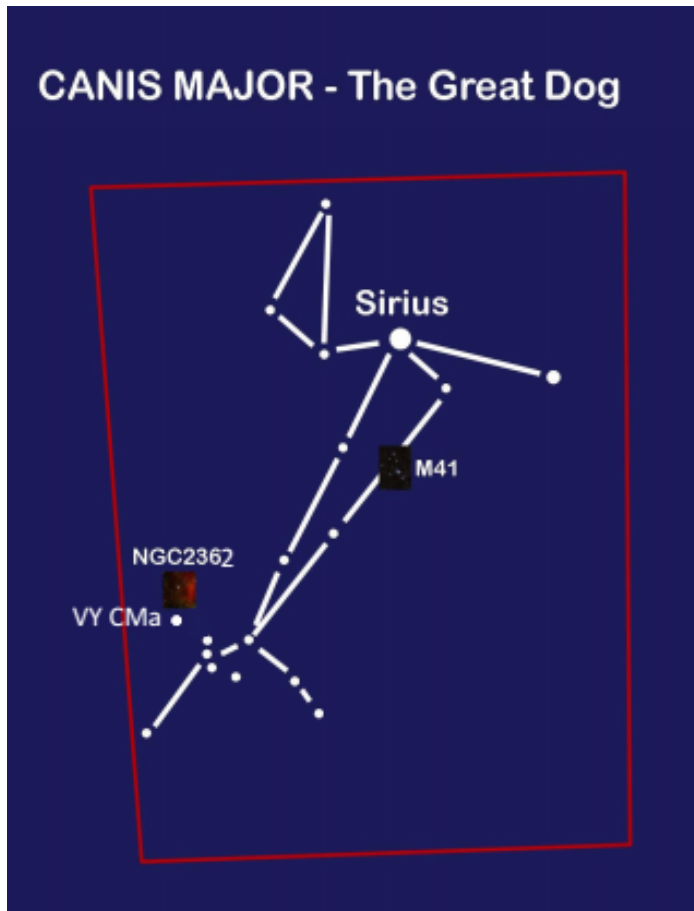
As the light fades, you will notice another bright object lying just above and to the left of Venus. This is the planet Mars. Unlike Venus, Mars has very little atmosphere and its rocky surface only reflects about a quarter of the incident sunlight. Its reddish hue comes from a high concentration of a form of iron oxide ( $\text{Fe}_2\text{O}_3$ ) on its surface. If the viewing conditions are good you may be able to see some features on the surface of the planet.

Now take a look at this region of the sky without your scope. As the stars come into view, you may notice that both of these planets are positioned in the constellation Pisces. Well, there is another planet lurking in this region of the sky. It is the ice giant Uranus. This planet is notoriously difficult to find without a 'GoTo' mount, but on the evening of February 26th at around 6.30 p.m. Uranus (mag. +5.9) will be just below Mars (mag. +1.0) in the sky and you should be able to see both with a pair of binoculars.

As well as Venus and Mars, there is also another wanderer in Pisces this month. However, it is not a planet, it is a comet - Comet 2P Encke. This is a short period comet that graces our skies every 3.3 years. It should be visible all month after sunset just above the circlet of stars in Pisces, and will be close to  $\omega$  - Piscium on Valentine's Day.

If Jupiter and Saturn are what you are looking for then you will have to wait until the early hours of the morning. Jupiter will rise around 1am and Saturn at 5.30am. You may also catch a glimpse of another object, Comet 45P. This comet has been visible with a telescope for the past two months. It will make its closest approach to earth on February 11th when it will be located in the constellation Hercules. This fast moving comet will then pass through Corona Borealis, Boötes, Canes Venatici, Ursa Major and onto Leo by the end of February. It won't return until 2022.

But, if you are like me and do most of your observing in the evening, it will not be long before you have your scope focused on the Orion Nebula. The Trapezium cluster housed within this nebula is always a fantastic sight through a telescope.



Once you've had your fill of that, there two other clusters you may want to look at: M41 and NGC 2362. Both are located in the constellation Canis Major. Simply draw a line through Orion's belt, go eastwards until you come to Sirius, the brightest star in the night sky, and then move down towards the horizon. M41 should be easy to find. See how many red giants you can see in this cluster. NGC 2362, whose central star is an O-type supergiant, is just above the tail of the dog.

Canis Major also houses a red hypergiant, VY CMa, that was, at one time, thought to be the largest and most luminous star in our galaxy. Its diameter is over 1,400 times that of our Sun and is 270,000 times as luminous. Luckily, it is over 3,800 light years away so it does not dominate our night sky. Its magnitude changes from 6.5 to 9.6 every 5.5 years. It is located just below NGC 2362.

One last thing I want to mention. On the evening of February 5th, the quarter moon will pass in front of the

Hyades cluster in Taurus. As the evening progresses, it will get closer and closer to the red giant Aldebaran. This could be a chance to take a really nice photograph.

***Happy Stargazing!***

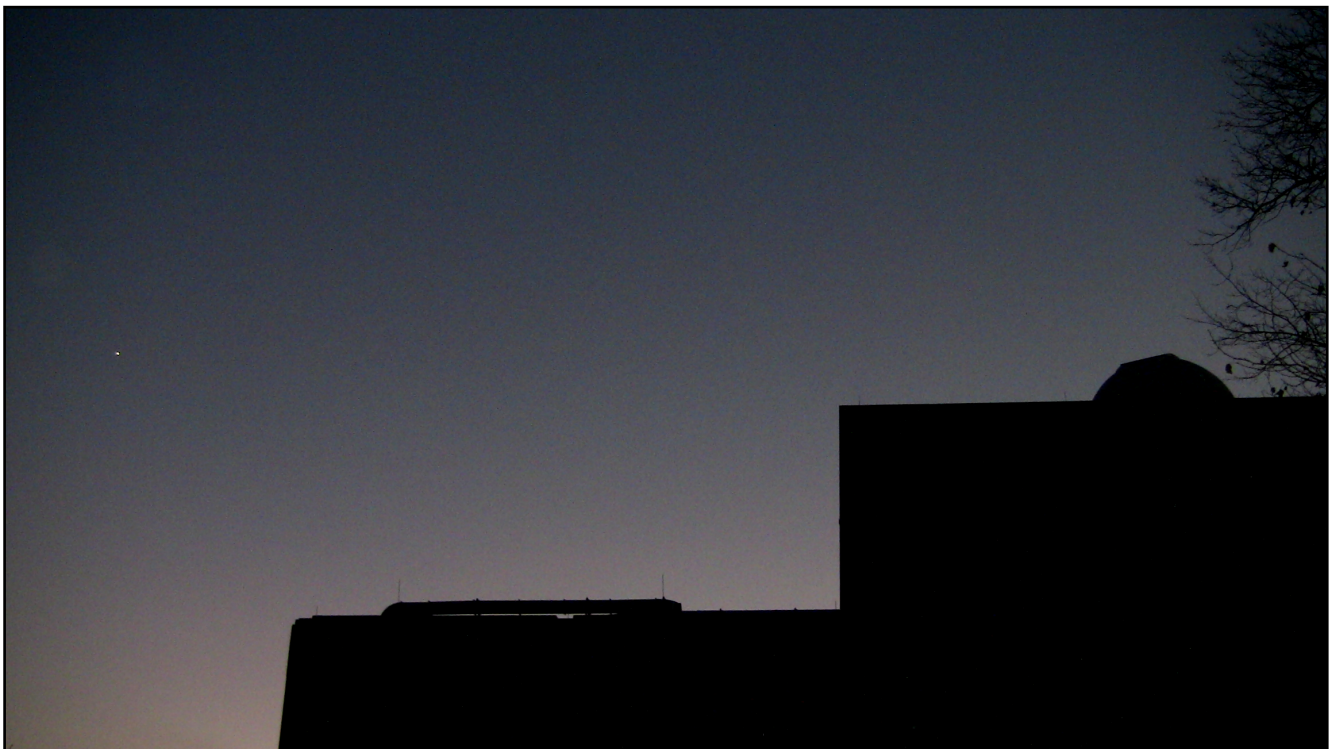
**Heads up:** Just thought I'd let you know that there is a new science journal called **Nature Astronomy**, to which they are allowing free access for a year: <http://www.nature.com/natastron/>

*LVAAS Members Share Photos...*



"Here are a few photos I took at West Chester University on December 17, 2016. One is of the observatory with Venus on the left. The remaining photos are of the planetarium area they have on the campus. The Chester County Astronomical Society does have shows in the planetarium, and the school itself has their own astronomy club."

Submitted by Dave Raker, Society Librarian





*This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit [spaceplace.nasa.gov](http://spaceplace.nasa.gov) to explore space and Earth science!*

## **Comet Campaign: Amateurs Wanted**

**By Marcus Woo**

In a cosmic coincidence, three comets will soon be approaching Earth—and astronomers want you to help study them. This global campaign, which will begin at the end of January when the first comet is bright enough, will enlist amateur astronomers to help researchers continuously monitor how the comets change over time and, ultimately, learn what these ancient ice chunks reveal about the origins of the solar system.

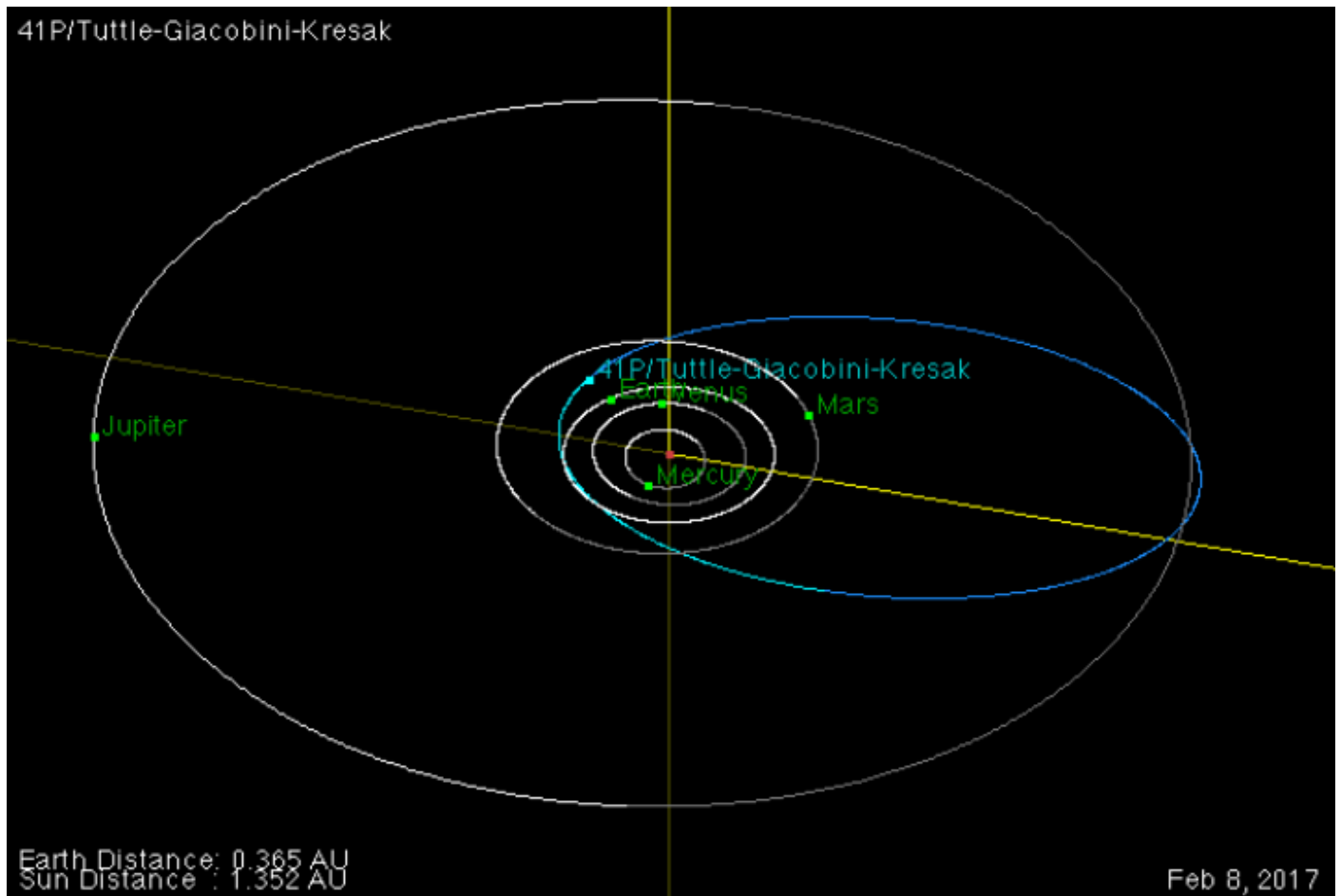
Over the last few years, spacecraft like NASA's Deep Impact/EPOXI or ESA's Rosetta (of which NASA played a part) discovered that comets are more dynamic than anyone realized. The missions found that dust and gas burst from a comet's nucleus every few days or weeks—fleeting phenomena that would have gone unnoticed if it weren't for the constant and nearby observations. But space missions are expensive, so for three upcoming cometary visits, researchers are instead recruiting the combined efforts of telescopes from around the world. "This is a way that we hope can get the same sorts of observations: by harnessing the power of the masses from various amateurs," says Matthew Knight, an astronomer at the University of Maryland. By observing the gas and dust in the coma (the comet's atmosphere of gas and dust), and tracking outbursts, amateurs will help professional researchers measure the properties of the comet's nucleus, such as its composition, rotation speed, and how well it holds together.

The observations may also help NASA scout out future destinations. The three targets are so-called Jupiter family comets, with relatively short periods just over five years and orbits that are accessible to spacecraft. "The better understood a comet is," Knight says, "the better NASA can plan for a mission and figure out what the environment is going to be like, and what specifications the spacecraft will need to ensure that it will be successful."

The first comet to arrive is 41P/Tuttle-Giacobini-Kresak, whose prime window runs from the end of January to the end of July. Comet 45P/Honda-Mrkos-Pajdusakova will be most visible between mid-February and mid-March. The third target, comet 46P/Wirtanen won't arrive until 2018.

Still, the opportunity to observe three relatively bright comets within roughly 18 months is rare. "We're talking 20 or more years since we've had anything remotely resembling this," Knight says. "Telescope technology and our knowledge of comets are just totally different now than the last time any of these were good for observing."

For more information about how to participate in the campaign, visit <http://www.psi.edu/41P45P46P>. Want to teach kids about the anatomy of a comet? Go to the NASA Space Place and use Comet on a Stick activity! <http://spaceplace.nasa.gov/comet-stick/>



*An orbit diagram of comet 41P/Tuttle-Giacobini-Kresak on February 8, 2017—a day that falls during the comet's prime visibility window. The planets orbits are white curves and the comet's orbit is a blue curve. The brighter lines indicate the portion of the orbit that is above the ecliptic plane defined by Earth's orbital plane and the darker portions are below the ecliptic plane. This image was created with the Orbit Viewer applet, provided by the Osamu Ajiki (AstroArts) and modified by Ron Baalke (Solar System Dynamics group, JPL). <http://ssd.jpl.nasa.gov/sbdb.cgi?orb=1;sstr=41P>*

# Oh, Snap!



**Doug Wheelock** @Astro\_Wheels · 16h

We build formidable walls  
around empty castles

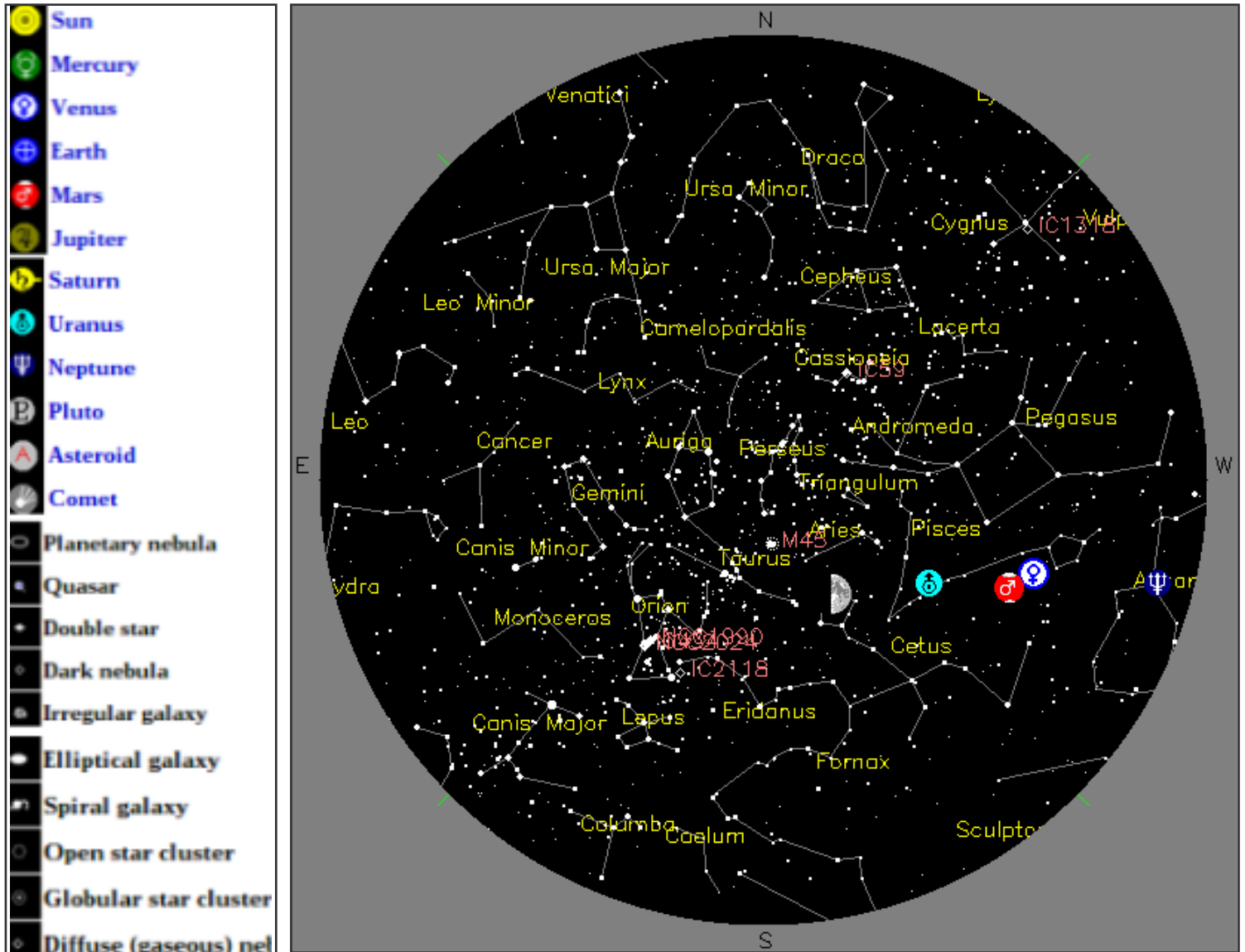
We crush others with our words  
and squander priceless treasure

When will we ever learn...

Source: Astronaut Doug Wheelock on Twitter  
posted February 2, 2017.

**Oh, Snap!** is a recurring feature of LVAAS members' celestial and astronomy-related items which have been generously shared for the enjoyment of our readers. Society members, kindly submit material to [editorlvaas@gmail.com](mailto:editorlvaas@gmail.com).

# Sky above 40°33'58"N 75°26'5"W at Sat 2017 Feb 4 0:00 UTC



**Your Sky** was implemented by John Walker in January and February of 1998. The calculation and display software was adapted from Home Planet for Windows.

The GIF output file generation is based upon the ppmtogif module of Jef Poskanzer's pbmplus toolkit, of which many other components were used in creating the images you see here.

ppmtogif.c - read a portable pixmap and produce a GIF file

Based on GIFENCOD by David Rowley [[mgardi@watdscu.waterloo.edu](mailto:mgardi@watdscu.waterloo.edu)].

Lempel-Zim compression based on "compress".

Modified by Marcel Wijkstra [[wijkstra@fwi.uva.nl](mailto:wijkstra@fwi.uva.nl)]

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Check out additional features of **Your Sky** at : <http://www.fourmilab.ch/yoursky/>

## FEBRUARY 2017

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			<a href="#">01</a>	<a href="#">02</a>	<a href="#">03</a> <a href="#">First Quarter Moon</a>	<a href="#">04</a>
<a href="#">05</a>	<a href="#">06</a>	<a href="#">07</a>	<a href="#">08</a>	<a href="#">09</a> <a href="#">Astro Imaging 7:00 PM</a>	<a href="#">10</a> <a href="#">Full Moon</a>	<a href="#">11</a>
<a href="#">12</a> <a href="#">General Meeting - 2:00 PM Muhlenberg</a>	<a href="#">13</a>	<a href="#">14</a>	<a href="#">15</a>	<a href="#">16</a>	<a href="#">17</a>	<a href="#">18</a> <a href="#">Last Quarter Moon</a>
<a href="#">19</a> <a href="#">Deadline for submissions to the Observer</a>	<a href="#">20</a>	<a href="#">21</a>	<a href="#">22</a>	<a href="#">23</a>	<a href="#">24</a>	<a href="#">25</a>
<a href="#">26</a> <a href="#">New Moon</a> <a href="#">LVAAS Board of Governors Meeting</a>	<a href="#">27</a>	<a href="#">28</a>				

## MARCH 2017

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			<a href="#">01</a>	<a href="#">02</a>	<a href="#">03</a> <a href="#">Lunatics and Star gazers Night</a>	<a href="#">04</a> <a href="#">Star Party</a>
<a href="#">05</a> <a href="#">First Quarter Moon</a>	<a href="#">06</a>	<a href="#">07</a>	<a href="#">08</a>	<a href="#">09</a> <a href="#">Astro Imaging 7:00 PM</a>	<a href="#">10</a>	<a href="#">11</a>
<a href="#">12</a> <a href="#">Full Moon</a> <a href="#">General Meeting - 2:00 PM Muhlenberg</a>	<a href="#">13</a>	<a href="#">14</a>	<a href="#">15</a>	<a href="#">16</a>	<a href="#">17</a>	<a href="#">18</a>
<a href="#">19</a> <a href="#">Deadline for submissions to the Observer</a>	<a href="#">20</a> <a href="#">Last Quarter Moon</a>	<a href="#">21</a>	<a href="#">22</a>	<a href="#">23</a>	<a href="#">24</a>	<a href="#">25</a>
<a href="#">26</a> <a href="#">LVAAS Board of Governors Meeting</a>	<a href="#">27</a> <a href="#">New Moon</a>	<a href="#">28</a>	<a href="#">29</a>	<a href="#">30</a>	<a href="#">31</a> <a href="#">Lunatics and Star gazers Night</a>	

# 2017 LVAAS Event Calendar

**2017 LVAAS Event Calendar**

	Sundays		Board meeting	Thursday	Friday	Saturday	Mondays	Multi-Day Weekends	Moon Phase			
	General Meeting time	location		Astro-Imaging	Lunatics and Stargazers	Star Parties	Scouts at S. Mountain	Scouts at Pulpit R.	New	First	Full	Last
January	2:00 PM 8	Muhlenberg	29	12	no mtg	no mtg		no camping	27	5	12	19
February	2:00 PM 12	Muhlenberg	26	9	no mtg	no mtg		no camping	26	3	10	18
March	2:00 PM 12	Muhlenberg	26	9	3 & 31	4		no camping	27	5	12	20
April	9	S.M.	30	13	no mtg	1		7 - 9	26	3	11	19
May	7	S.M.	21	11	5	6		19 - 21	25	2	10	18
June	11	S.M.	25	no mtg	2	3		9 - 11	23	1 30	9	17
July	05:00 PM 8	S.M.	30	no mtg	28	29		14 - 16	23	30	9	16
August	12	Pulpit	27	no mtg	25	26		4 - 6	21	29	7	14
September	10	S.M.	24	7	29	30		8 - 10	20	27	6	13
October	8	S.M.	29	5	27	28		6 - 8	19	27	5	12
November	2:00 PM 12	S.M.	26	2	no mtg	25		3 - 5	18	26	4	10
December	2:00 PM 9	Grace Community	17	7	no mtg	no mtg		no camping	18	26	3	10

MegaMeet May 26th to 28th

**July, Aug & Dec are Saturday meetings with rain date on Sunday**  
**Jan., Feb., and March meetings are at Muhlenberg College**  
**August meeting is at Pulpit Rock**  
**December meeting / Holiday Party is at at Grace Community Church**  
**All meetings 7 P.M. unless otherwise noted**

## Publishing images is a balancing act!

When preparing your images for publication in The Observer, please consider the following guidelines:

### Put the quality in:

- ▶ Considering the "print" size of the image, make sure you have at least 150 pixels/inch.
- ▶ Use a reasonably good quality for the JPEG compression ratio.

### But watch the "waistline"!

- ▶ Don't go too much above 200 pixels/inch max.
- ▶ Use the lowest JPEG quality that still looks good!
- ▶ Shoot for <300KB for a 1/2 page image or <600KB for a full page.

**Tip:** If you're not Photoshop-savvy, you can re-size and compress undemanding images ("human interest", not astro-images), with an online tool such as

<http://www.ivertech.com/freeOnlineImageResizer/freeOnlineImageResizer.aspx>. It will also tell you the pixel size and file size of your original, even if you don't download the processed copy.

The Observer is the official monthly publication of the Lehigh Valley Amateur Astronomical Society (LVAAS) Inc., 620-B East Rock Road, Allentown, PA, 18103 and as of June 2016, is available for public viewing. Frances A. Kopy, [editorlvaas@gmail.com](mailto:editorlvaas@gmail.com).

Members please use above email address for submissions.

Society members who would like to submit articles or images for publication should kindly do so by the Sunday before the monthly meeting of the BOG (please see calendar on website) for the article to appear in the upcoming month's issue. PDF format is preferred. Early submission are greatly appreciated. Articles may be edited for publication. Your comments and suggestions are invited.

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For existing members to update LVAAS information or to make member contact changes or corrections, please contact LVAAS [membership@lvaas.org](mailto:membership@lvaas.org).

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