

# The Observer

The Official Publication of the Lehigh Valley Amateur Astronomical Society

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

A few years ago, Pete Detterline was scheduled to present the 6 p.m. planetarium show at one of our public star parties. As most of you know, these early shows are aimed at a younger audience, and at the time I was just learning how to use the planetarium projector and present shows myself, so I decided to sit in on his presentation.

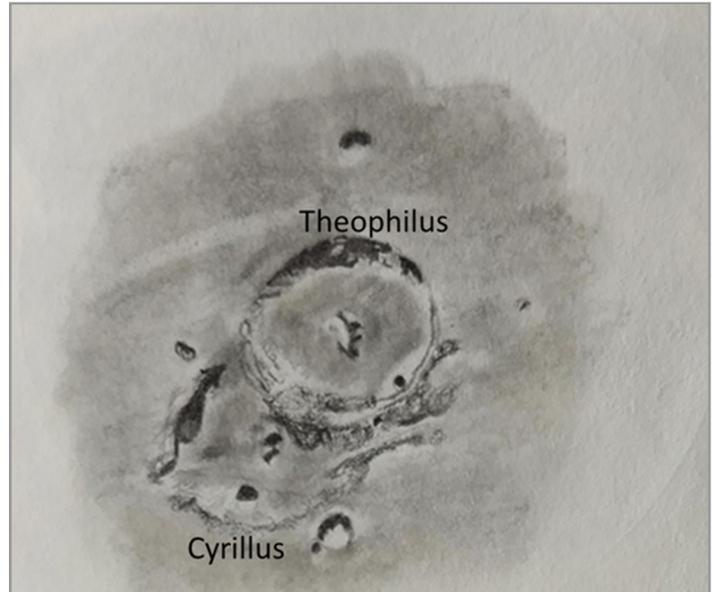
He started out the same way most presenters do by introducing the audience to the Big Dipper, but then all of a sudden this green light zoomed across the dome. He continued as if nothing had happened and then there it was again ..... and again. “Oh, that was a shooting star,” he said. Then after giving a very brief explanation about what they were, stating that the Earth was currently passing through the debris left behind by a comet, he continued with his presentation, however, the "shooting stars" didn't stop. His audience was captivated and some of the children started gasping and giggling every time they saw a “shooting star.” They wanted to know more.

Pete clearly has a passion for astronomy and his enthusiasm is infectious. For 36 years, Pete taught astronomy at Boyertown High School and was Director of the Boyertown Planetarium. He retired last year to spend more time on his hobby, although he still teaches part time at several local colleges and universities. Pete is the 2018 recipient of The Thomas J. Brennan Award, presented by the Astronomical Society of the Pacific (ASP), for demonstrating excellence in teaching astronomy at the high school level in North America.



A photo of Pete Detterline standing in front of the Elon Musk Observatory at the Mars Desert Research Station, near Hanksville, Utah, taken by Gary Becker.

Since retiring, Pete has turned his attention to lots of astronomy related projects, one of which involves the Moon, and this was the subject of his presentation at our September General Meeting. During his talk, he made us realize that while many of us could identify the Lunar Maria and a few large craters, only a few of us could name some of the smaller features that you can see through a telescope. Also, the appearance of these features changes with time. Some are visible only for a few hours when the sunlight is at a specific angle. Well, Pete wanted to find out more.



Here is Pete's first sketch of a lunar crater drawn 6.5 days after a new moon on November 25th, 2017.

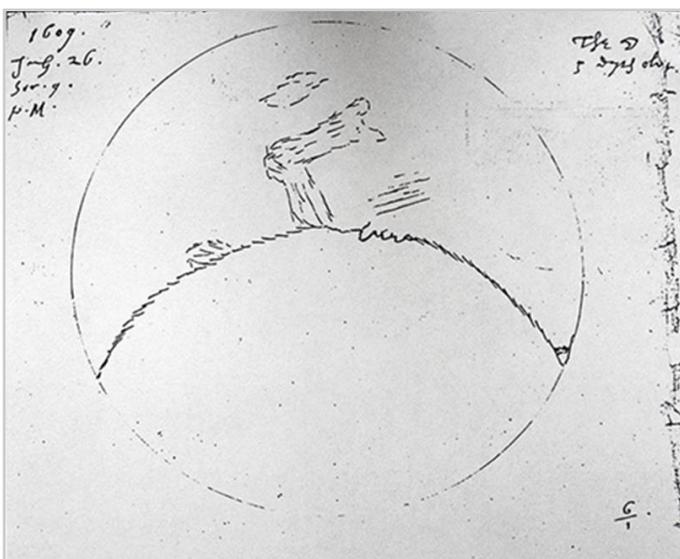
Pete has always liked drawing so he decided to join the Astronomical League's Sketching Club.

But why would you want to draw the features you see through a telescope when you can take a photograph or look at the images taken by NASA's Lunar Reconnaissance Orbiter (LRO)? Well, as you sketch a particular feature, you spend much more time gazing at it, much longer than you would a photograph, and you soon become familiar with its ever changing appearance. If you are lucky (and talented) the finished product is a piece of art - just think how many of us would prefer to hang a drawing or a painting rather than a photograph of a person or a landscape on the wall at home.

If you would like to find out more about astronomical sketching, why not visit

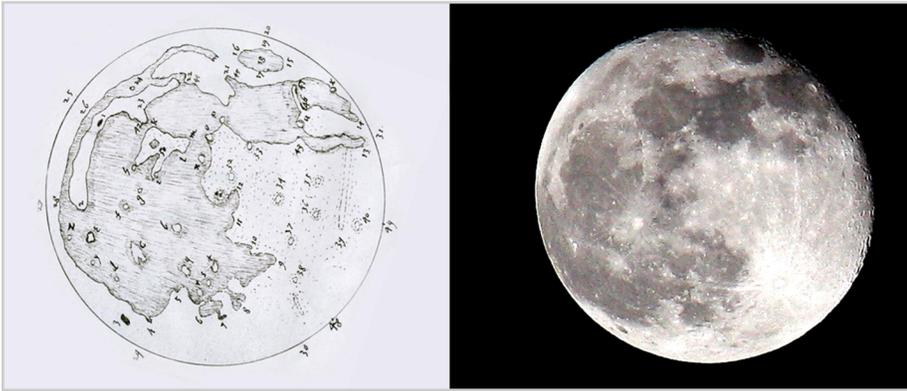
<https://www.astroleague.org/content/sketching-resources>

Also, a DVD of Pete's fascinating talk will soon be available to borrow from the library, thanks to the videoing skills of our librarian, Dave Raker.



Drawing what you see through a telescope is nothing new: before the invention of photography in the 1800s, astronomers relied on sketching to record their observations.

In the summer of 1609, an Englishman named Thomas Harriot acquired a telescope known as a Dutch 'trunke' which he used to take a more detailed look at the moon. It had a magnifying power of about 6. On July 26th, 1609, he made this sketch of the Moon - ***the first known drawing of a view through a telescope.***



It was the first of many that he used to construct this quite remarkable map of the Moon, shown above. It wasn't until 1840 that John William Draper managed to take the first photograph of the moon through a telescope .



**Thomas Harriot**

## A Call for Star Party Volunteers



Continuing with the lunar theme, the next LVAAS star party will be held on Saturday, October 20th which also coincides with NASA's International Observe The Moon Night. Pete Detterline will be presenting both planetarium shows (6 p.m. and 8 p.m.) and I will be giving a talk at 7 p.m. entitled,

### **“Our Beautiful Moon”**

So if you would like to help out, please do not hesitate to contact me.

Let us hope that the viewing conditions are as good as they were during our September Star Party. I got the best view of Saturn I've ever seen through the 14" - Thank you Pete (Brooks)!

By now, you must all know that one of my favorite constellations is Sagittarius because not only does it contain lots of fascinating deep sky objects, it also is the home of the "teapot" asterism. It is particularly special at the moment because Mars and Saturn are positioned on opposite sides of the teapot. Being English, I just cannot develop a taste for iced tea so I was rather surprised when, at the last general meeting, Dave Green gave me a top from a bottle of Snapple. "Take a look inside," he said.

Sure enough, there was something printed inside the cap. It read, "There are more trees on Earth than stars in the galaxy." OK, so it should have said, "...in *our* galaxy," but nevertheless I had to check this out. So of course, I asked Ron Kunkel how many stars there were in the Milky Way. He said there were probably close to 300 billion. Finding out a reliable estimate of the number of trees on our planet took a bit longer. Then I stumbled across a study carried out by group of scientists from Yale University in which they used 429,775 ground sourced measurements of tree density from every



continent except Antarctica to generate a global map of forest trees. Their results were published in the journal Nature (September 10th, 2015.) They estimated that there were 3 trillion trees on Earth. So yes, Snapple is correct. Snapple has a list of 1476 scientific "Real Facts" on their website and there are quite a few that are astronomy related.

The most famous quote associated with the number of stars, of course, comes from Carl Sagan who said, "The total number of stars in the Universe is larger than all the grains of sand on all the beaches of the planet Earth." So far, people seem to agree with him. This is Snapple's Real Fact #1440.

I had to laugh however, when I read # 1368. "A neuron star is as dense as stuffing 50 million elephants into a thimble" which should, of course, have read, " A *neutron* star is as dense as 50 million elephants stuffed into a thimble."

If you have some spare time, why don't you check out a few of them for yourself.

**THANK YOU DAVE!**

I had however, heard Real Fact #1368 before and very recently. The analogy was made by Professor Dame Jocelyn Bell Burnell in a talk I recently watched on YouTube. Many of you will probably know that Jocelyn Bell was the graduate student who discovered pulsars. Her findings were published in *Nature* on February 24th, 1968. Unfortunately, she was overlooked by the Nobel committee and it was her Ph.D supervisor, Anthony Hewish, who was awarded the 1974 Nobel Prize in Physics for “his decisive role in the discovery of pulsars”.

She did not let this hold her back and remains cheerful about the whole matter. She recently told *The Guardian* (a British newspaper) “If you get a Nobel prize you have this fantastic week and then nobody gives you anything else. If you don’t get a Nobel prize you get everything that moves. Almost every year, there’s been some sort of party because I’ve got another award. That’s much more fun.”

Last month, fifty years after her work was published, Professor Bell Burnell was awarded a Special Breakthrough Prize in Fundamental Physics

(\$3million) for "fundamental contributions to the discovery of pulsars, and a lifetime of inspiring leadership in the scientific community." She said she was delighted to receive the prize, but rather than keep the money, she has set up a fund that will be administered by the UK’s Institute of Physics to create scholarships for women, underrepresented minorities and refugees who want to study physics.

If you would like to find out more about her life and how she discovered pulsars, there are lots of videos on the web - some are definitely worth watching.

Well, our next general meeting is on October 14th at South Mountain and will include a presentation entitled,

**“Reaching the Outer Limits: The Exploration of The Solar System”  
by Professor Gary DeLeo**

Hope to you see you there,

ad astra,

Carol Kiely, Director



**Professor Dame Jocelyn Bell Burnell**  
(Image credit: University of Oxford)

# LVAAS General Meeting: Open To The Public

## Sunday, October 14, 7:00 p.m.

LVAAS South Mountain Headquarters  
620B East Rock Road Allentown PA 18103

*featured program*

## "Reaching the Outer Limits: The Exploration of the Solar System"

*presented by*

**Professor Gary DeLeo**  
Lehigh University Dept. of Physics



Spaceships from Planet Earth have been cruising through our solar system for the past half century. Some carry people, like the space shuttle and the mighty Saturn V rockets that transported humans on their two hundred and forty thousand mile journeys to the surface of the Moon. Others, carrying robotic eyes and powerful instruments, have explored all the planets in our solar system out to Neptune, two and a half billion miles away, and even Pluto. Some have visited asteroids, comets, and the moons of other planets. How did we get to the Moon, and what did we find there? What is it like on the other planets, and is there life? To find out, you must participate in this great LVAAS adventure. Only then can you experience the awe and mystery which reaches from the inner planets to the Outer Limits of our solar system!

# Election Of Officers Of LVAAS For 2019 Term

NOTICE -- A Business Meeting will be convened for Election of the 2019 Society Officers at the October General Meeting

The LVAAS October General Meeting will be held on its regularly scheduled date, 7:00 p.m, October 14, 2018 at South Mountain, during which a Business Meeting will convene for the purpose of election of our 2019 LVAAS Officers.

LVAAS full members in good standing (current dues paid) are entitled to vote for the candidates for office. Candidates for the position of director, assistant director, treasurer and secretary were announced at the September 9th general meeting. The nomination process is now closed in accordance with society by-laws. The slate of candidates for our society officers is as follows:

<b>Director:</b>	<b>Richard Hogg</b>
<b>Assistant Director:</b>	<b>Thomas Duff</b>
<b>Secretary:</b>	<b>Earl Pursell</b>
<b>Treasurer:</b>	<b>Scott Fowler</b>

The newly elected officers will assume their responsibilities on December 1st, 2018 and continue until midnight November 30, 2019.

With sincere gratitude and much appreciation, thank you to our outgoing director, Carol Kiely and treasurer Gwyn Fowler.

Regards,

Bill Dahlenburg, Nominating Committee Chairman

# What's the (LVAAS) Buzz?



by Rich Hogg  
LVAAS Technology Director

Our website <https://lvaas.org> has a feature called "Forums" that was intended to allow us to keep each other in the loop about various topics related to astronomy and LVAAS. The problem is that not many of us bother with Forums these days. As far as I know, few LVAAS members check the forums or receive notifications when forum messages are posted, and even fewer ever post a message, perhaps figuring that almost no one will see it.

For a few years now the Board has been using an email-based service to keep in touch, and earlier this year, after Frank Lyter asked for a better way to communicate with members about Pulpit Rock activities such as observing sessions and work parties, we decided to try an email-based solution. And so, the Buzz was born!

You should sign up for the **Pulpit Rock Buzz** if you are interested in observing sessions, helping at work parties, or other activities at Pulpit Rock.

You should sign up for the **South Mountain Buzz** if you are interested in observing sessions, helping at work parties, or other activities at South Mountain.

If you are planning or considering anything at either site, you should send a message to the appropriate Buzz to let others know. Please keep in mind that since the Buzz is new and is not mandatory, it is always possible that you will find someone using the facilities without posting on the Buzz. That's OK! We're all friends in LVAAS, and while we are usually happy to let each other know what we're planning, we also welcome unplanned, spontaneous visits to our facilities.

**Subscribing to the Buzz is easy!** You can get the process started either by sending an email to [pulpitrock-join@buzz.lvaas.org](mailto:pulpitrock-join@buzz.lvaas.org) and/or [southmountain-join@buzz.lvaas.org](mailto:southmountain-join@buzz.lvaas.org), **or** visit the sign-up page at <http://buzz.lvaas.org/listinfo.cgi/pulpitrock-lvaas.org/> and/or <http://buzz.lvaas.org/listinfo.cgi/southmountain-lvaas.org/>

**Please use the same email address that you use for other LVAAS purposes.**

After you do this, the system will send you an email to confirm that you really want to subscribe. You must either reply to this email, or click the link you will find in it. Then, an administrator will need to confirm your subscription. **The Buzz is limited to LVAAS members.**

**Sending a message to the Buzz is easy!** After you subscribe, just send an email to [pulpitrock@buzz.lvaas.org](mailto:pulpitrock@buzz.lvaas.org) or [southmountain@buzz.lvaas.org](mailto:southmountain@buzz.lvaas.org). **For complete instructions:** see <https://lvaas.org/staticpages/index.php?page=thebuzz> (you must first be signed in to the website.)

**CATCH THE BUZZ!**

## Minutes for the LVAAS General Meeting - September 9, 2018

The September 2018 LVAAS general meeting was held on September 9, 2018 at the LVAAS facility on South Mountain in Lower Saucon Twp. The meeting was opened by Carol Kiely, Director, at 7:00 p.m.

The talk for the evening was "Looking Lunar ... Cool Things You May Have Missed On The Moon" by Pete Detterline. Pete is the director of the Boyertown Planetarium, a professor at Montgomery Community College, and has qualified as a Master Observer for the Astronomical League.

Most beginning astronomers start off by looking at the Moon, so Pete started with a brief quiz on features of the Moon (for example: "mare" are the dark areas on the moon, while the lighter areas are referred to as "highlands.") There are many resources available to make observing the Moon easier such as phone apps, like *Lunar Map HD*; the magazines *Astronomy*, and *Sky & Telescope*; The *Astronomical League website* (many observing programs, including "Lunar" and "Lunar II," that anyone can join); and the *Association of Lunar and Planetary Observers (ALPO)*. A good way to get to know the features on the Moon is to sketch them. It's not *that* hard, and they don't have to be very good, but they really get you thinking about what you're seeing. Features appear and disappear, depending on the phase of the Moon with the location of the terminator (the border between the dark and light.) In addition, although the same side of the Moon always faces Earth, the Moon also librates, or wobbles, allowing us to see about 59% of its surface over time. It may take about 2 years to see all the stuff that is "around the corner"! Pete showed a selection of photos he had taken with his 11" scope and digital camera illustrating these seldom seen parts of the Moon. Since the Moon is so bright (on the illuminated part, at least) it is possible to take hundreds or thousands of exposures in a short period of time, then have software pick the best ones and stack them to see more detail than one could optically. There is also an article in the September 2018 issue of *Sky & Telescope* describing, in detail, libration of the Moon. After a Q&A session, a break was called at 8:00 p.m. The business meeting began at 8:17 p.m.

Carol noted that NASA is celebrating its 60th birthday this year. Legislation creating it was signed on July 29, 1958, but operations did not start until October 1st. Also of note: LVAAS is older than NASA!

Jocelyn Bell Burnell, who discovered the first pulsar as a graduate student but was passed up for the Nobel Prize in Physics (it was awarded to her supervisor and another scientist,) has recently been awarded the Special Breakthrough Prize in Fundamental Physics, worth \$3 million (\$2 million more than the Nobel.) She will be using the money to set up a special scholarship fund for women, under-represented ethnic minorities and refugees, in science. "I don't want or need the money myself and it seemed to me that this was perhaps the best use I could put it to," she said.

Scott Fowler, Membership Chair, reported there was one second reading: Andrew Heilman. There were four first readings: Dr. Mike Yaddell - rejoining, last having been here 40 years ago! He recently purchased a 4" refractor; also Rachel and Gabe Noska (husband and wife) - just beginning, having only a pair of binoculars so far, and Josh Kochan - another former member looking to rejoin. He has an old Meade LX-90 he is hoping to get running. Also, his grandfather, John Frisch, was one of the original founding members of LVAAS.

Gwyn Fowler, Treasurer, gave a brief report: For the General Fund, the income since the last meeting was \$389.73, while expenses since the last meeting were \$301.22, and we received a \$1000 donation to the PROD Fund. The proposed 2019 budget was discussed and voted upon. The biggest budgeted expense will be for a new roof for the main building at South Mountain. According to the bylaws, we can only budget \$10,700 of the cost (estimated at about \$16,000,) and we'll have to fund-raise for the remainder. A motion was made by Bill Dahlenburg, seconded by Tom Duff, to accept the proposed budget. The motion passed unanimously.

Election of Officers - Nominating Committee Chairman Bill Dahlenburg reported the following nominees: Director: Rich Hogg; Asst. Director: Tom Duff; Treasurer: Scott Fowler; Secretary: Earl Pursell. Nominations were closed at the end of the September general meeting. Elections will be held at the October general meeting, and also a vote will be taken on adding any excess funds from 2018 into the roof fund for 2019.

Blaine Easterwood has agreed to take on the role of Director of the Education Committee. He has a background in both IT and education, and his son works at the DaVinci Science Center.

Carol also noted that we still need volunteers for the following appointed positions: Membership Services (Red Shift snack bar) and Star Party Coordinator.

Dave Raker has been the club's librarian and historian for 20 years now! Congratulations! The annual library inventory has been completed. We now have 917 books plus a wide selection of videos, including the presentations at the monthly general meetings, which are available for loan. He asked that if any member knows of interesting books that would be appropriate for our library to let him know.

The next Star Party is September 15th. Gary Becker will be doing both planetarium shows, while Blaine Easterwood will give a presentation entitled "10 Cool Things About Our Solar System." As always, volunteers are needed to staff the door, help park cars, and to operate the telescopes.

Bill Dahlenberg, Director of South Mountain Maintenance, reminded everyone that a group of members usually is at South Mountain every Saturday from 9:00 a.m. until noon doing maintenance, and everyone is welcome to show up and help. In addition, members can get certified on telescopes, get keys, and ask for help with their personal telescopes.

Ron Kunkel, Director of Pulpit Rock Maintenance, announced that if any members without gate keys wish to visit, a time can be arranged by contacting him at the e-mail address on the club's website.

Rich Hogg, Technology Director, noted that SM-, PR-, and Astroimaging- BUZZ mailing lists have now been enabled to allow interested members to notify each other of ongoing activities for these three groups.

Frank Lyter, Pulpit Rock Observatories Director, reported that there are many volunteer opportunities at our western-most site. Lots of prep work still needs to be done for the 40" before the mirrors are installed (April/May 2019.) The computerized 12" Meade is being installed in the rolloff observatory, requiring some work, including replacing the metal roof.

Tom Duff, Astroimaging Director, announced that the group would resume monthly meetings, after their summer hiatus, on Thursday, September 27th at 7:00 p.m.

The meeting was adjourned at 8: 58 p.m.

Minutes recorded and submitted by LVAAS Secretary, Eatl Pursell

# **LVAAS Library Announcement**

David Raker, LVAAS Librarian

## **New books to the collection:**

Leaving Orbit by Margaret Dean  
Into the Black by Rowland White  
Chasing Space by Leland Melvin  
Catching Stardust by Natalie Starkey  
The Glass Universe by Dava Sobel

## **New videos to the collection:**

Nova: The Day the Dinosaurs Died  
Nova: Black Hole Apocalypse  
The Real Story: Apollo 13  
Steve Conard: New Horizons Spacecraft  
Carol Kiely: The Microscopic World of Lunar Dust  
Earl Pursell: Night Vision and Astronomy  
Peter Detterline: Unusual Features on the Moon

*After performing inventory, I found the following books and videos to be missing from our collection. These items were not signed out. If you have them, please return them at the next general meeting, star party or board meeting. No questions will be asked. Thanks.*

## **Books missing:**

Sun, Moon and Standing Stars by John Wood  
Alvan Clarke & Sons: Artists In Optics by Deborah Warner  
The Beginner's Observing Guide by Leo Enright  
Galaxies and Other Deep Space Objects by Gary Mechler  
Astrophotography by Barry Gordon  
Endless Universe by Paul Steinhardt  
Aurora: The Mysterious Northern Lights by Candace Savage  
Earth Science 7th ed. by Edward Tarback  
Earth History by James Walker  
Physical Geology: Earth Revealed by David McGearry  
Aurora 7: The NASA Mission Reports by Steve Whitfield

## **Videos missing:**

Comet Halley  
Comet Collision  
Space: The Frontiers and Beyond  
New Solar System  
Infinite Cosmos  
19 Minutes to Earth



# Meade Relocation Project

Contributed by Frank Lyter

Progress is good on relocating the 12” Meade telescope to the 12-inch Spacek Observatory. Ron (Kunkel) and I were at Pulpit today, September 16, and completed the following:

- Newly painted support pier was installed and the telescope mounted - looking good! (see attached photo)
- We worked on cutting a trench in the concrete floor for installation of new conduit to supply power to the scope. (see attached photo)

We have another couple hours of work to complete and the task is going well.

- Ron has Boy Scouts at Pulpit this coming weekend and the plan is to use this scope for the event.

Work remaining includes:

- Complete installation of the 120 vac outlet on the pier and wiring in the drive key switch to enable power to the outlet
- Complete a precision polar alignment
- Thoroughly check out settings on the Meade controller
- Write-up instructions for use of the scope including where to park
- Replace the corrugated steel roof with new material - Glicks scrap metal yard in Fleetwood is a source for the material.

We are looking to procure the material in the next week if possible.

This item will be completed, but will not impact the near-term use of the telescope.

I would estimate that the telescope work will all be completed in the next two weeks at which point it could be available for training on the use of the scope.

Frank & Ron

*Images page 13: Trench cut into concrete floor;  
Frank Lyter and Ron Kunkel with the Meade.*



**UPDATE:** Progress is good on relocating the 12” Meade telescope to the 12-inch Spacek observatory. Ron and I were at Pulpit today, September 23, and completed the following:

- We completed embedding the new conduit into a trench in the concrete floor and installed the wiring to supply power to the scope (see photos page 14.)
- Completed installation of the 120 vac outlet on the pier and wiring in the drive key switch to enable power to the outlet.
- Rich, Ron and Cindy (Kunkel) completed a precision polar alignment earlier in the week

Work remaining includes:

- Paint the observatory inside and out.
- Thoroughly check out settings on the Meade controller
- Write-up instructions for use of the scope including where to park
- Replace the corrugated steel roof with new material -Replacement roofing material has been purchased from Glicks scrap metal yard in Fleetwood.

Future work party activity to replace roof. This item will be completed, but will not impact the near-term use of the telescope. The installation of the telescope is complete.

Frank & Ron





*Images credit: Cindy Kunkel*



*From the LVAAS Archives:*

## Phenomenal Perseids & Power to the People

By Sandy Mesics

In the October, 1968 *Observer*, Gary Becker reported an exceptional meteor count for the August 1968 Perseid meteor shower. Between August 10-12, members recorded 207 meteors, despite being just 2-4 days past full moon. The Perseids typically have a predictable norm of about 30-60 meteors per hour, but with wide fluctuations.

The contingent of LVAAS observers in Emmaus reported a dramatic increase in meteors at 3:30 a.m. on the night of August 12, going from 12 per hour to more than they were able to record. Gary Becker estimated roughly 68 meteors per hour during this time period. Of the 207 observed meteors, 105 were considered Perseids, ranging in magnitude from -4 to 6th, the majority white or yellow, of which 43 meteors had trains.



**Figure 1.** In the 1970's, LVAAS had a meteor observing platform at Pulpit Rock

What we didn't know in 1968 is that the Perseid meteor shower is influenced by Jupiter. More specifically, when Jupiter passes close to the orbit of Comet Swift-Tuttle, the source of the Perseids, more debris is released, which shows up approximately 2 years later. This causes an increase in the number of Perseid meteors: this occurred in 1921, 1945, and in 1968, which delighted the 17 LVAAS observers who recorded the event. More recently, the increase in Perseid meteors has occurred in 1980, 2004, and 2016.

In October, 1968, LVAAS efforts were focused largely on Pulpit Rock. After significant negotiations with Metropolitan Edison Company, electrical power was brought to Pulpit Rock. The cost to LVAAS was \$1,138.00, which would be paid up front, but credited back to LVAAS at the rate of \$31.60 a month for three years. The installation of the approximately 25 poles and line cost Met Ed \$12,170.

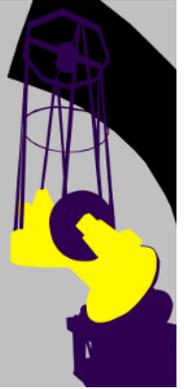
The club was rushing work on the Schlegel-McHugh Observatory in order to have it under cover by winter. Work included painting the steel, installing the floor joists, erecting the dome, and applying the siding.

### Reference

*The Observer*, October, 1968

# Schlegel Observatory Report

by Rich Hogg – October 2018



## ***Putzing Around***

One time this month, I posted an email to the Pulpit Rock Buzz that I was planning an afternoon of "putzing around" (with LVAAS' 40-inch Cassegrain telescope project in the Schlegel Observatory at Pulpit Rock, which is what this column is about, for those of you just tuning in.) I was thinking that a more appropriate word would have been "puttering" until I looked them both up and realized that they mean basically the same thing, as do "tinkering" and "dabbling" and "monkeying around."

That is, they connote application of casual effort with little to show for it. That's not what I intended, and I don't think it accurately describes what's been happening, but that's sort of what it feels like. Anyway, I haven't come up with a better word yet.

What I mean to say is that for the past few weeks I've been bouncing around between a number of different tasks on the project, and that includes several sessions up at the site. Instead of focusing on one big sub-project, it's been a time for spreading my attention around on a number of smaller tasks. But all of them are important and I think all of them have benefited from the attention, so it hasn't been a waste of time.

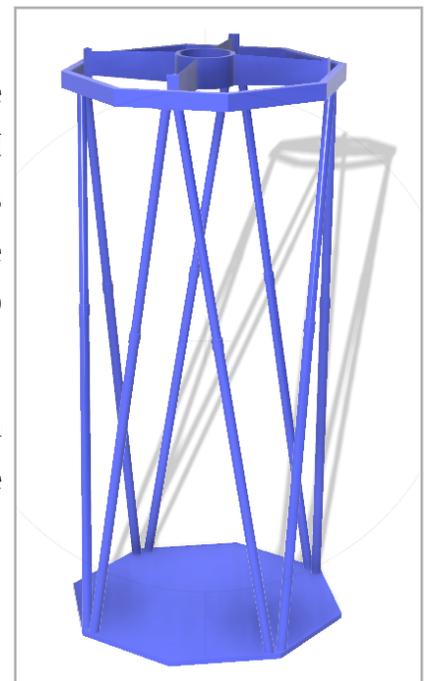
## ***More Engineering Analyses***

It came to my attention that an old friend had become an expert in the Finite Element Analysis method for evaluating structures, and that if I could come up with the right kind of CAD model for our proposed truss design, he might be able to check our results on how much deflection we will see. This seemed worthwhile, so I undertook another round of CAD modeling. Here is a rendering of the model.

I'm not sure my friend wants publicity for his help on our project, so I'm holding off on mentioning his name this time. If possible I'll tell you more about him in a future column.

## ***More CAD Software***

I keep hearing that AutoDesk's Fusion 360 is worth learning for this kind



of work, and since this analysis would be done using AutoDesk software, it seemed like the right time for me to take another look at it. Well, I guess I am a convert for the foreseeable future (that is, as long as it keeps working as well as it has been for me, and as long as the price — free as of right now, for hobbyists — doesn't go up too much.) I'll probably stick with it and stop using the other tools I've used on this project (SketchUp and FreeCAD.) Every one of these tools has a different take on the problem of how to represent 3-dimensional objects in software, and how to help the user build them. If you've been frustrated by the differences in email clients, or document processing programs, or web browsers, well, you ain't seen nothin' yet. Fusion 360's method isn't objectively much better or worse than the others, but it's as different as they are from each other. But given the other things that it can do, it's fine. (FINE, I tell you.) It just took some getting used to.

### ***Secondary Consideration***

I've started fiddling around with designs for the secondary mirror cell. There's another word, "fiddling," that seems to imply that I'm more or less wasting my time, which I don't think I am. OK, I have begun a program of exploring the design space for the collimation system in the secondary cell.

What got me started on this is that I don't like the arrangement in the 18" Tinsley system in the Schlegel-McHugh Observatory. By some miracle, we've managed to get it reasonably well collimated, but it has an annoying coupling problem.

What that means is: in each direction (transverse to the optical axis) there are two degrees of freedom: call them offset and tilt. You may recall from a previous column that I modeled both of these in an optical simulation of the 40-inch secondary. The secondary mirror can be off-center from the optical axis without being tilted, and it can be tilted while still on-center. The properly collimated mirror is neither, and the mirror mount must allow you to adjust both.

Bear in mind that when I say "tilt" what I really mean is not the absolute tilt of the mirror. For this purpose I mean the tilt of the optical surface at the centerline of the instrument, where the beam from the collimation laser hits it. That's what I am able to observe when doing the adjustments. Offset is more straightforward: the optical surface will have a center point, which the optician will mark in some fashion, and it needs to be in the center where the laser beam will hit it.

What we would like is for it to allow each to be adjusted independently of the other, which the system in the 18" does not. It allows you to adjust offset by shortening or lengthening the spider vanes, but in so doing you move the curved surface of the mirror laterally through the optical axis, changing the incident angle at the point where it intersects, which requires an ensuing adjustment to the tilt.

And doing so involves rotating the assembly around a center which is several inches behind the apex of the mirror, which means that the apex moves as the tilt changes, throwing off the offset adjustment. You need to keep going back-and-forth between the two and hope that they converge on the right setup.

What we would like — and what I am hoping to achieve — it to make the two adjustments as independent as possible. The tilt adjustment should rotate the mirror about the optical axis so it does not affect the offset, and the offset adjustment should rotate the system about the center of reflection of the mirror, so it does not affect the reflection of the laser. And all of this needs to be done in only a few inches of depth behind the mirror, to maintain clearance between the front of the telescope and the dome. So far, I think it is looking good. I'm not so much finding out if it can be done, as finding the best way to do it.

I'm not ready to share any designs yet, but here is a schematic of the concept.

### *Dust Cover Motor Circuit*

One of the coolest things about this telescope, when I was first introduced to it, was the system for protecting the primary mirror. It's sort of like a lens cap, but since it's not a lens and since it doesn't really look like a cap, I want to call it a different name. I've been using "dust cover" but I'm not completely happy with that.

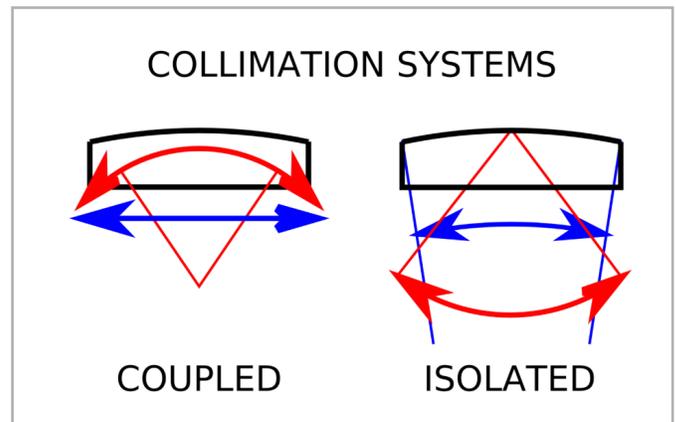


Anyway, it is integrated into the top side of the primary mirror cell, and but for the fact that it is tarnished and gray from spending too many seasons in the unheated mountain-top observatory, it looks like something from NASA — eight pie-slice-shaped metal covers over the mirror, that with the flip of a switch, open smoothly and silently like a blooming, radially-inverted aluminum lily.

Except that somewhere along the line, working on the wiring, I disconnected one too many wires, after which flipping the switch caused nothing to happen.

As we talked about working on the improvements to the truss structure, it seemed to me that the lily petals might end up in the way if we didn't get them moving again, so I undertook to find the problem and fix it, or work around it. This turned out to be harder than I expected. I initially tried reconnecting one obviously broken wire, but when that did not help I realized I would need to trace out the wiring.

It took a few tries to find my way into this project — everything was in the way of the obvious approaches; the wires were on the wrong side of the motor, and underneath or behind one of the sections. It was like an envelope containing a check that I had recently received, which I attacked with my gold-anodized letter opener, only to find that it had been so tightly sealed up with sticky tape that the



point of the letter opener could not find a way in. For a while I could not seem to get any real traction.

So, I arranged for an afternoon alone with the telescope, equipped with all kinds of ways to inspect the wiring (including inspection mirrors and an endoscopic camera) and nobody looking over my shoulder to break my concentration. I discovered that if I positioned the telescope in just the right way, and then sat on a bench with the pier pit just behind me, I could look (and reach) up into the place where the motor was wired up, and trace everything out.

The wires went to another section a couple of feet away in the mirror cell, where two relays and a terminal strip were mounted. Investigating this part required positioning the telescope differently, and using my inspection mirror as well as taking some pictures with my phone to see everything.

I also decided to remove some wires that previously had gone to the secondary mirror cover, which I had removed to enable us to work on the truss. To do this I had to undo some screw terminals when I could only see the screwdriver tip in the mirror. Operating a screwdriver using a mirror is something I had never tried before, and it is more difficult and weirder than I expected.



I found something else I did not expect in a box on the outside of the declination axis on one side: a set of slip rings! This was a surprise, since some really elaborate engineering is in place to avoid using slip rings on the RA axis, which in theory can rotate without limit. (The solution in place limits it to several complete rotations.) Since the rotation of the DEC axis is limited to about 3/4 of a full turn, I expected the connection to be made with a short

length of stranded wiring. But instead, these slip rings are in use to bring 110V power to the mirror cell, and through the relays, to the dust cover motor. Anyway, the rings look shiny and seem to be making good contact, so I cleaned out the dead bugs and put the cover back on. As long as they keep working, there is no reason to mess with them.

Finally, there was a large cluster of electrical terminal strips on the other side of the cell, the inspection of which entailed a fair amount of disassembly and liberation of another significant collection of creepy-crawly carcasses. I haven't figured out what all of these wires are for, but I did figure out how the 110V power gets to the motor circuit.

We had disconnected the originating end of the 110V circuit from the electrical box in the pit quite a while ago, and it needs to be integrated into the new system, which I plan to do soon. For now, there is a temporary "lash-up" in place that allows the motor to be operated: a salvaged power cord switch, wired using a salvaged terminal strip



and bound up with electrical tape, that we can plug in and operate to run the motor in either direction. That will do to get the lily petals out of the way so we can proceed with the other work.

### ***Truss Progress***

Frank Lyter has succeeded in disassembling the medial joint in the truss member we removed, and is planning to try brazing it, instead of welding. He's working on a fixture to hold the two pieces of the truss element straight while they are joined.

The plan is still to modify the truss as shown in the CAD model at the beginning of this article, but progress is slow. We have been distracted a bit by another very worthwhile project, rehabilitating the Spacek Observatory, which is now home to our 12" Meade LX200 and a very nice observatory to use.

### ***Electronics shopping***

I've also been reviewing the specifications for processor boards to be used for the new control system for the instrument. One problem I ran into with the electronics in the 18" project, where we used a combination of Raspberry Pi and Arduino boards, was not having enough I/O pins to interface with everything. This problem will be worse with the 40" so I've been concentrating on boards that offer a lot of pins.

One candidate is the BeagleBone series of boards. The only problem I have with these is that they are not rated for operation below 0°C. For a system as complex as this is, I don't want to take a chance on it not working correctly if we try to use it in colder temperatures. (There was a project to create an industrial-grade BeagleBone, but it appears to have died.)

For now, my top contender is the Technologic TS-7700. I've been looking at this company and its products for a few years now, and I think they are a good match for our requirements. They are a bit more expensive, but I think this project warrants it. An added bonus is that the boards have an FPGA, which will make it possible to implement precision-timing functionality that can't as easily be handled in software. (What I have in mind is generating the pulses to drive the RA tracking motor.)

***Current Status and Activities:*** Progress is ongoing but slow on the truss rebuild. In the meantime, we are making some progress on other areas such as the wiring, the secondary cell design, and spec'ing out the electronic system.

# StarWatch

by Gary A. Becker



## Lunar Confusion

When I first started teaching in the Allentown School District Planetarium in the fall of 1972, I found that many professionals in the elementary schools taught their students that the period of time the moon went through its phases and the time period that Luna took to orbit the Earth was 28 days. They are actually two different time intervals.

The phase sequence of the moon, 29.5 days, is very different from the 27.3 days that it takes for the moon to revolve around our planet. If the two periods are added and divided by two—56.8 divided by 2—the result is 28.4 days, or 28 days if rounded to the closest whole number. The tradition of combining these two intervals into 28 days may be universally used by teachers as that is the most common first answer given by my Moravian astronomy students who come to me from many different public and private school systems. I do not want these remarks to sound condescending, because the multiple hundreds of professionals that I have come in contact with worked diligently to instill a love of learning among their young pupils over a wide range of disciplines whereas I have spent my entire professional career in one area, astronomy education, thinking about how to teach students to “reach for the stars” and eradicate some of these misconceptions. My conclusion for teaching young children about lunar cycles would be to ignore the 27.3-day period of the moon’s revolution around the Earth and concentrate on the 29.5-day period of lunar phases.

My reasoning is simple. The 27.3-day lunar cycle is difficult to observe. In its most basic definition, it represents two transits of the moon passing a fixed point in the sky, like a star. That is a challenging observation for a novice or a child to make, especially since the moon is bright and “hides” most of the stars surrounding it. On the other hand, the 29.5-day phase period of the moon is easy to observe as we witness Luna proceeding through a day and night cycle. Yes, that is what we are actually watching, day and night on the moon as it orbits Earth and changes its shape from a **new moon** (no moon) through a **waxing crescent** (growing, horned moon,) **first quarter** (half on, half off, light to the right,) a **waxing gibbous** (growing and bulbous on both sides,) **full moon** (the near side completely lit by sunlight,) **waning gibbous** (diminishing, but bulbous on both sides,) **last or third quarter** (half on, half off, light to the left,) **waning crescent** (diminishing horned moon,) and finally back to the new moon.

The phase period of 29.5 days is directly related to our establishment of the month (from the Old English “mōnath,” “mona” for moon). The phases of the moon also form the basis for calculating the dates of Islamic and Jewish holidays, including the date of Easter in the Christian calendar. Also, the phases of the moon create the main “beat” for calculating when lunar and solar eclipses occur. The moon must be new, in between the Earth and the sun, and crossing the Earth’s orbital plane for Luna’s shadow to fall upon Earth’s surface to create a solar eclipse, where Sol (the sun) is being hidden—eclipsed—by the moon. Likewise, the moon must be full, opposite the sun and Earth, and crossing Earth’s orbital path for it to intersect the Earth’s shadow for a lunar eclipse to happen. Here, the moon is hiding—eclipsed—in the shadow of the Earth.

All of these easily visible phenomena—phases of the moon, all lunar and solar eclipses, as well as many religious events are governed by the 29.5-day phase cycle of the moon, not the orbital period of the moon around the Earth. So, I say up with the 29.5-day lunar period for kids and save the 27.3-day orbital period for science-oriented high schoolers and college students taking astronomy courses.

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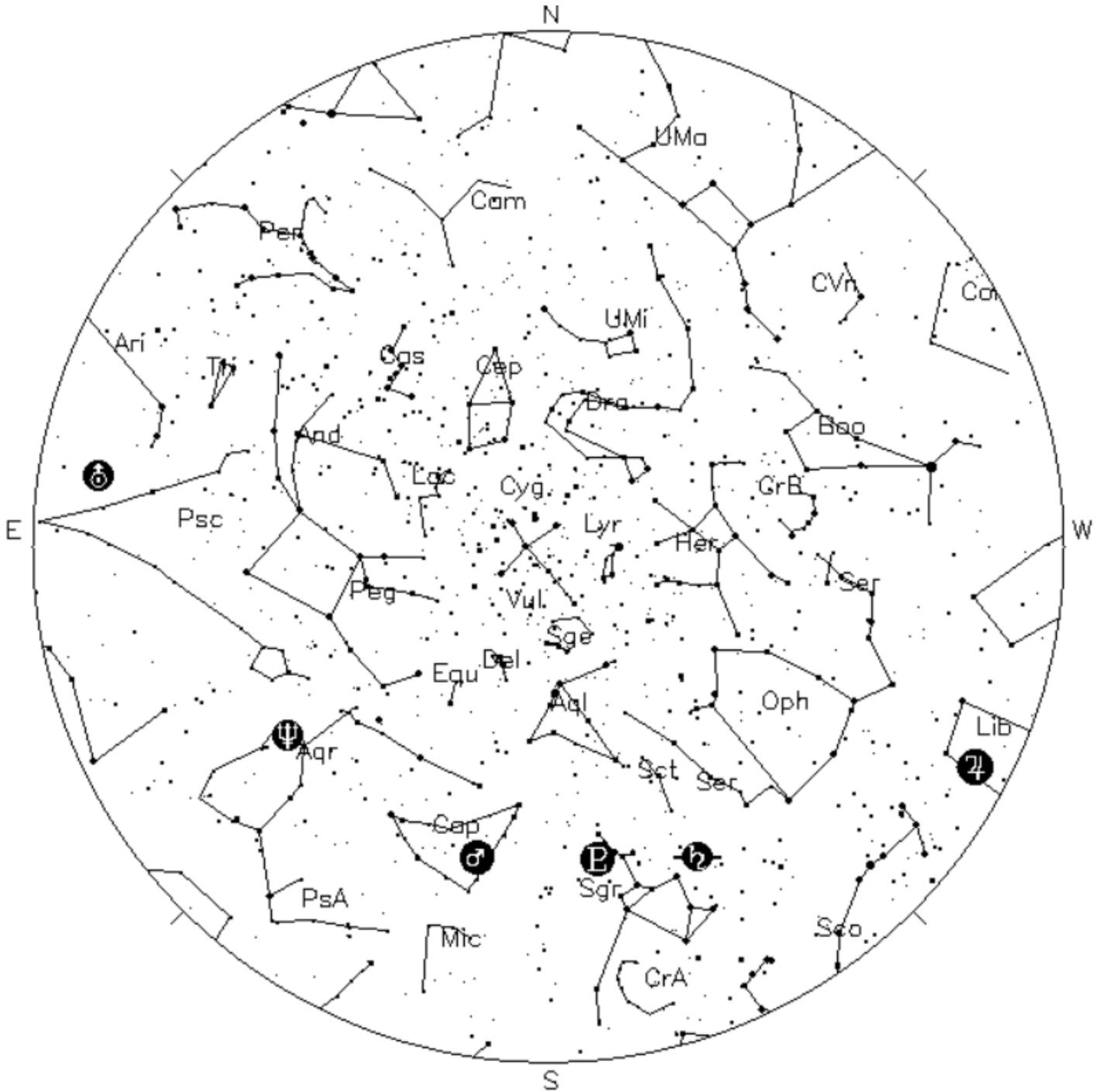
## What's Up for October 2018



## Happy Birthday, NASA



Sky above 40°33'58"N 75°26'5"W Saturday 2018 Oct 6 0:00:00 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

Lempel-Zim compression based on "compress"

Modified by Marcel Wijkstra

Copyright © 1989 by Jef Poskanzer.

[Customize Your Sky ->](#)

at : <http://www.fourmilab.ch/yoursky/>

## OCTOBER 2018

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

## NOVEMBER 2018

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				<a href="#">01</a>	<a href="#">02</a>	<a href="#">03</a>
<a href="#">04</a> Daylight Savings Ends	<a href="#">05</a>	<a href="#">06</a> Election Day	<a href="#">07</a> New Moon	<a href="#">08</a>	<a href="#">09</a> LVAAS Scout Group - South Mountain	<a href="#">10</a>
<a href="#">11</a> Veterans' Day General Meeting - 7:00 PM South Mountain	<a href="#">12</a>	<a href="#">13</a>	<a href="#">14</a>	<a href="#">15</a> First Quarter Moon	<a href="#">16</a>	<a href="#">17</a> Star Party
<a href="#">18</a> Deadline for submissions to the Observer	<a href="#">19</a>	<a href="#">20</a>	<a href="#">21</a>	<a href="#">22</a> Thanksgiving	<a href="#">23</a> Full Moon	<a href="#">24</a>
<a href="#">25</a> LVAAS Board of Governors Meeting	<a href="#">26</a>	<a href="#">27</a>	<a href="#">28</a>	<a href="#">29</a> Last Quarter Moon Astro Imaging 7:00 PM	<a href="#">30</a>	

# 2018 LVAAS Event Calendar

2018 LVAAS Event Calendar												
	Sundays		Board meeting	Thursday	Friday	Saturday	Mondays	Multi-Day Weekends Scouts at Pulpit R.	Moon Phase			
	General Meeting time	location		Astro-Imaging	Lunatics and Stargazers	Star Parties	Scouts at S. Mountain		New	First	Full	Last
<b>January</b>	2:00 PM	14 Muhlenberg	28	4		no mtg		no camping	16	24	1 31	8
<b>February</b>	2:00 PM	11 Muhlenberg	25	1		no mtg		no camping	15	23		7
<b>March</b>	2:00 PM	11 Muhlenberg	25	1		24		30-31-1	17	24	1 31	9
<b>April</b>		8 S.M.	29	5		21		27-28-29	15	22	29	8
<b>May</b>		6 S.M.	20	3		19		25-26-27	15	21	29	7
<b>June</b>		10 S.M.	24	no mtg		23		29-30-1	13	20	28	6
<b>July</b>	5:00 PM	7 S.M.	29	no mtg		21		27-28-29	12	19	27	6
<b>August</b>	7:00 PM	11 Pulpit	26	no mtg		18		24-25-26	11	18	26	4
<b>September</b>		9 S.M.	30	27		15		21-22-23	9	16	24	2
<b>October</b>		14 S.M.	28	25		20		26-27-28	8	16	24	2 31
<b>November</b>	7:00 PM	11 S.M.	25	29		17		no camping	7	15	23	29
<b>December</b>	1:30 PM	8	30	20		no mtg		no camping	7	15	22	29

July, Aug & Dec are Saturday meetings with rain date on Sunday  
 Jan, Feb & March meetings are at Muhlenberg College  
 August meeting is at Pulpit Rock  
 December meeting /Holiday party at Lower Macungie Community Center

**NEAF**  
**Cherry Springs**  
**Stellafane**  
**Black Forest**  
**MegaMeet**

**April 21-22**  
**June 14-17**  
**August 9-12**  
**September 7-9**  
**July 13-15**

## 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 astroimages), with an online tool such as:

<https://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.

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