The Observer

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The topic this month is our web server - a computer named (not by me) "morinehtar," which is owned by New Dream Network, LLC, doing business as DreamHost. Actually, not so much the computer but the software running on it. For good reasons, but at a time not of our choosing, it has become a project once again.

The Anatomy of Ivaas.org

I moved us to DreamHost about two years ago; prior to that we used a company called Bluehost, and at the time they were not meeting our needs. We were being pushed to implement HTTPS (HyperText Transfer Protocol, Secure) by the publishers of browser software, mostly Google, since their Chrome browser is now the most popular. They thought it was a good idea that everyone should use HTTPS (and it is), and they thought the way to go about achieving this was to make Chrome do its best to frighten anyone using a non-HTTPS website, a practice called "browser-shaming." Since we don't want our website users to be frightened, we went to the trouble of meeting their security expectations.

DreamHost offered an easier and lower-cost means of doing this than Bluehost, and in fact, as a non-profit organization we receive a 100% discount on our service with them. You can't beat that. And they have been great! I am totally pleased with their service, even when they do things that cause me some trouble, if it's for a good reason.

Let's talk about that software. It's easiest to think of most software systems as being built in layers, like the floors in a high-rise, and the term most often used is a "stack." At the bottom of our stack is the Linux operating system, which at this point is used by almost every website. It's free software in every sense of the word: you can use it without paying anything, and if you have the expertise, you can re-engineer it at will to do whatever you want. It is almost dead-nuts stable and reliable and perfectly suited for the purpose.

On top of that is the web server software, a program called Apache. Like Linux, as well as all of the other layers in our stack, Apache is both "free as in speech" and "free as in beer." It is probably the most popular web server software, but it does have strong open-source competitors. Apache's job is to listen on the network for a "request" from a web browser, and then to martial a "response" and send it back. In many cases, the "request" can be filled by reading a file from the web server's disk and sending it out; this is the case for some parts of lvaas.org, such as the monthly Observer newsletter that you are now reading. Apache can serve these kinds of requests without help from any other software besides the Linux OS.

Many websites, including ours, need to keep track of structured data that has to be updated frequently, such as the events on our calendar or the content of the articles on our home page. For this we need a database, and it is provided by software called MySQL. While still free in both senses, MySQL's popularity has declined since it was purchased by Oracle, who also make the best-selling commercial database software. So far, Oracle has kept MySQL free, but the more libertarian-leaning geeks in the web development universe have become skeptical, and it has strong competitors that are not under the shadow of any mega-corporation. But for the foreseeable future, it is working very well for us.

Websites that need databases generally need a programming language, and the most popular one for the purpose is PHP, a free language that was created especially for websites. It is the one we use. It's reliable, efficient, and well-maintained, although it lacks many of the sporty features and sleek architecture that all the cool kids like to have. It's kind of like a minivan in the programming-language landscape; great for getting the kids and all their stuff to the beach, but the only way to look cool while using it is if you play in a band.

Using Linux, Apache, MySQL, and PHP makes us boringly typical. It's so popular and so tried-and-true that their is a name for it, that everybody working on web stuff knows: it's the "LAMP stack." All of those layers are provided for us by DreamHost, in a standard installation that they maintain on all of their servers.

Our stuff

The next flight up brings us to a "content management system" or "CMS" called glFusion. It was written in PHP, to run on Apache and use MySQL, by a team under the leadership of a Texan named Mark R. Evans, and he his still doing a great job of keeping it up-to-date. It was chosen by LVAAS' previous webmaster, and although it is not in the top-10 most popular CMS packages, it's been working well for us.

On top of glFusion there is a "theme" plugin called Chameleon. It defines the visual style of our site, subject to a bunch of configuration settings, such as our logo and the layout of our menus. I'm not sure who developed it.

Finally, there is our content: the files in our download area, and all of the calendar events, user profiles, stories, and other data stored in our MySQL database, all under the control of glFusion running on the LAMP stack.

All of this, by the way, is being automatically backed up by DreamHost. It is also backed up, automatically, to a server belonging to a completely separate company named BackBlaze, also at no cost to us. And, there is a trail of breadcrumbs that starts with a piece of paper in the possession of two other board members, Tom Duff and Blaine Easterwood. If aliens come to Earth and abduct me, and even if they vaporize the entire DreamHost company and their server network, it should still be possible to recover our website starting from that document.

However!

One problem with all of the above is that we have not kept up with our software updates. We are running a version of glFusion that was released in 2013. We started looking at upgrading a couple of

months ago, using a test version of our site, and thanks to Mr. Evans' outstanding efforts the upgrade seemed to mostly go very smoothly. The only problem is that our "Chameleon" theme plugin is no longer supported by the newer version. It will be necessary to redesign the layout of our site using a different theme in order to upgrade. Truth be told, I've been wanting to do this for a while, so to me it's not all bad news.

But coming up with the new site design will require some give and take, and inevitably not everyone will be happy with the final result. We began with the idea that we could take our time figuring out what we wanted.

And that was the theory until earlier this month. We are using version 5.6 of the PHP language, which was released in 2014 and was supported by DreamHost two years ago, when we moved. PHP5.6 became officially obsolete about one year ago, and earlier this month I received an email from DreamHost letting me know that they would be taking it away from us sometime in the next few months. This is all very reasonable, but for us it's inconvenient, because our old version of glFusion will not work with the new version of PHP.

So what's the plan?

This just gives us some new priorities: we will adopt a new website design that doesn't require the Chameleon style plugin, so that it will run on the updated glFusion which will run on the updated PHP. And we need to do this pretty darn soon. We'll do the best we can to come up with something that everybody can live with, knowing that we can continue to evolve it in the future, but I'm not planning on a long period of testing and debate about the finer points of the design. A short period of testing, yes, and debate if possible — but the priority is to get something in place that will continue to work. If time allows I will invite the membership to participate in the process, but I'm not going to make any promises I might not be able to keep. My main priority is to enable the site to stay online with no major interruptions.

In that spirit, we are also going to skip *The Schlegel Report* this month. With the exception of getting ready for winter, not much is happening on that project, so I'll save what little I do have to report for future issues.

LVAAS in the news

Check here for some great coverage of our Transit of Mercury event at Da Vinci Science Center on Nov. 11. We had become resigned to the show being a bit if a dud, thanks to paying too much attention to the weather forecasts, but the clouds mostly stayed away, and LVAAS showed up, and so did plenty of visitors! The WFMZ news crew was just a perfect cherry on top of an unexpectedly tasty outing.

What the story doesn't mention (and we didn't try to make a "thing" out of it) is that this was an LVAAS event, for which Da Vinci Center kindly allowed us to use their lawn and parking lot. We had received a number of requests to do something, and we made plans and started working our way down a list of possible venues, where we could track the sun from daybreak to early afternoon. The lawn at the East end of Da VInci's building was our first choice, so here's a big **Thank You!** to the staff at Da Vinci Science Center for helping us stage the event. Ad Astra!



A light shines in the darkness; A view of the sunrise from Pulpit Rock. Photographed by LVAAS member Bill Dahlenburg in August 2019.

Torturing the Latest AI by Rich Hogg

There was a news article in February about GPT-2, an AI program that some guys at OpenAI had developed. A neural network, which they "trained" by feeding it a bazillion or so books and news articles, it was capable of generating eerily real-sounding -- um, nonsense, mostly. They announced that the potential for misuse made this "too dangerous" to release to the public.

In early November they changed their minds. With a shrug and an eye-roll, they not only made this menacing Skynet clone available, they even created an easy-to-use website so that any fool (like me) could do their worst with it. Why not? I fed it the same "seed text" and sampled some of its responses:

The Pleiades are high in the evening sky. That means it's time to renew your membership in LVAAS!

LVAAS is the Long-Awaited Lunar and Asteroid Awareness and Tracking Association of America. It was formed in 1991 by a group of astronomers who had become increasingly concerned about the dangers to the public of NASA's failed plans to study the far side of the Moon, an area that contains millions of dollars worth of valuable resources. NASA now says it's going to study the Moon's far side in the 1980s and 1990s, but LVAAS is still the only group of astronomers who have had a chance to study the far side.

Seriously, you can't make stuff like this up. It takes a sophisticated AI program to do that.

The Pleiades are high in the evening sky. That means it's time to renew your membership in LVAAS!

LVAAS is a professional organization devoted to the study of astronomy. We have a membership of amateur and professional astronomers from around the world. Each month, LVAAS holds an open night, during which we give presentations on astronomy topics, and invite people to come see the stars. Our meetings are held on Saturdays and Sundays at 2:30 p.m. at The Temple of the Pleiades.

The LVAAS Observatory is a small observatory near the city of Tucson. It offers public access to skywatching, including telescope viewing, in a safe and friendly atmosphere. Our observatory has a 30" f/2.8 Newtonian reflector, two 80" f/4 Schmidt-Cassegrain telescopes, and a 10" Newtonian Reflector.

Maybe we should rename South Mountain "The Temple of the Pleiades." I like the "safe and friendly atmosphere." But come on, who needs TWO 80" f/4 SCTs?

The Pleiades are high in the evening sky. That means it's time to renew your membership in LVAAS!

LVAAS (the Pleiades and Arcturus Association of Solar Observers) is a volunteer organization of amateur astronomers, led by a board of directors who are professional astronomers. LVAAS offers education, events, and opportunities for membership. The organization is also an active observer and host of a number of public events for the public, and hosts a website with a calendar of all public events and the opportunity for the public to join and/or purchase a "day pass". LVAAS is a 501c3 organization.

Some of those are actual facts. That's the scary part, I guess. It all sort of sounds real, but a lot of it is just cottage cheese.

The Pleiades are high in the evening sky. That means it's time to renew your membership in LVAAS!

If you're a member, why not renew your membership now?

Now we're talking! Download your renewal form from here and get your check in the mail right away!

WAAS General Meeting and Holiday Party

Saturday, December 14, 5:00 p.m.

Da Vinci Science Center, 3145 Hamilton Blvd Bypass, Allentown PA

"Astronomy Trivia Contest"

featuring Live Trivia Host, Jack Callaghan's Ale House

Dave Melman

This will be our Holiday Party/Pot Luck Dinner. (Stay tuned for additional information about organizing the dinner!) Also, for the third time (and for the second time with Dave Melman) we will have an Astronomy Trivia Contest!

Here is how the contest works: everyone will be asked to organize in teams of about 6 players, and choose a team name. (If Dave is impressed by your team name, he may award an additional point!) There will be five rounds of questions (read aloud), with 10 answers each (written on an answer sheet), with scoring after each round. At the end of the contest, prizes will be awarded to the teams with the highest scores.

The Trivia Contest is a lot of fun! Just ask anyone who participated in years past (or who goes to Callaghan's on Wednesdays.) And as part of a team, you don't need to worry about the gaps in your own knowledge, since you will be working out the best answer with your teammates.

Don't miss it! Come to the LVAAS Holiday Party, enjoy fellowship with your friends (and some special guests from Da Vinci Science Center), share a delicious Holiday meal, and join in the exciting Astronomy Trivia Contest!

Minutes for the LVAAS General Meeting - November 10, 2019

The November 2019 LVAAS General Meeting was held on November 10th at the LVAAS facility at South Mountain in Upper Saucon Twp. Attendance was approx. 45 people. Director Rich Hogg opened the meeting at 7:00 p.m.

The speaker was Steve Conard and his talk was entitled "Occultation Timing With The IOTA." Steve has been an amateur astronomer since 1971. His teenage enthusiasm for telescope building led to a 35+ year career building space optical instrumentation for the Johns Hopkins University. He also serves as the director of the Roelke Observatory at Bear Branch Nature Center in Westminster, Maryland.

Measuring the size and shape of small solar system bodies using occultation timing has been receiving increased attention recently due to the outstanding success of the pro-am team that measured 2014MU69 "Ultima Thule" prior to the New Horizons encounter. Future NASA and JAXA missions, such as Lucy and DESTINY+ are currently using the technique to determine the properties of their future encounter objects. The recent increased success of this technique can be directly attributed to the ESA Gaia astrometry mission.

These measurements can easily be made by moderately skilled amateurs, who occasionally make some exciting discoveries and regularly are credited in scientific papers. The International Occultation Timing Association, IOTA, is the leading amateur group for coordination of these observations. Steve described the techniques used to make these measurements and showed some of the equipment used, as well as the results of past measurements.

Occultation has had many uses in the past, like measuring features on the Moon, or to determine the size of planets. With modern equipment, occultation can be used to:

- split double stars
- study the atmosphere of planets
- measure the size, shape, and position of asteroids, which can, in turn, be used to determine their orbits and masses
- identify ring structures around Centaurs (asteroids following and trailing Jupiter in its orbit) and Kuiper Belt Objects (KBOs)

Much of this work is done by amateurs because the equipment needed is small (portable) and relatively inexpensive, scattered throughout the world, and it's a part time activity (a few measurements a month.) Results are published regularly, and professionals request their assistance regularly (e.g.: a group of amateurs measured the shape of Ultima Thule before the New Horizons mission got there.)

How is it done? Individuals spread out to get different views of the event, due to parallax, because the shadow of the object has finite dimensions. The observers time the blink out of the star and determine a cord across the object. Some observers will see nothing if they are not in the shadow! Combining all the observations allows the shape of the object to be determined.

Steve showed examples of how data is combined to get the results. Data can now be collected with automated stations so one user can have multiple observations. Although Steve uses a telescope on a driven mount, some observers built small scopes from inexpensive binocular halves on fixed mounts with automated cameras.

The scope+camera are pointed at a portion of the sky where the occultation event will occur in, say, a few hours, and the stars rotate into position to be photographed. In this way, one observer can set up a scope, drive a few miles down the road, set up another, and so on, to get multiple observations of a single occultation. More data is better! For high value targets, 30+ people may observe, resulting in very good data on the size and shape of the object.

One unexpected event was the discovery of a satellite orbiting Agamemnon, a Trojan asteroid orbiting Jupiter's L4 point, identified by a second, brief, winking out of the star (not yet confirmed, but only the 2nd Trojan to have a satellite identified.) The best estimate is that it is about 4 km across and about 280 km from Agamemnon. The discovery resulted in co-authorship of a paper with a professional astronomer in California! A separate event involving the star Beta Orionis, which was thought to be a variable star, identified it as a double star with a very close companion, possibly explaining the variability. Large institutional telescopes at various locations were used to examine the atmosphere of Pluto. If the observation is at the center of the object, the atmosphere results in a visible "flash" which was observed by 2 of the instruments.

Software is available to predict occultations (with varying degrees of certainty): Occult and Occult Watcher. The database of the latter can be searched for occultations occurring near your location. It is a very team-oriented activity, and if one person posts that they will be trying to observe a particular event, others will join in, since multiple observations are required for good data. The hardest part is getting people to get started. Steve has taught several people the procedures. You must get the scope pointed to the correct star field, since there is nothing to actually point at, just the pattern of stars and mini-asterisms. Of course, a GoTo mount is very helpful. An 8" f/4 should be able to visualize stars down to magnitude 11 or 12. Light pollution is not really an issue. The events must be timed to about 1/30th sec. Unfortunately, Windows introduces too much error, so separate timing equipment is required. The location and timing can be measured with a GPS device, so some people have set up SCORE boxes -- small cases that contain all the required equipment. There is an impressive array of freeware for analyzing the data. The biggest drawback is that if you make observations 3 or 4 times a month, you might get 3 to 6 successes (dimmings) per year. Should note that not seeing dimming also provides data as to the size limit of the objects. IOTA provides great resources on their websites (e.g.: a 500 page users guide!) Membership is only \$25/yr, but you can access everything on the website without joining! They have a booth at NEAF every year, for even more information.

During the Q&A, Steve also gave us a brief update on New Horizons: they are looking at new KBOs a few times per year, allowing us to get more information about them than we can just from Earth-based instruments, since it can see the objects at different angles that we can from Earth. And, of course, the other instruments on the probe (dust measurement, zodiacal light, etc.) are still working, and they are already getting close to the edge of the Kuiper Belt. Steve raffled off a t-shirt for the Dragonfly mission (quadcopter to Mars) and it was won by Priscilla Jacobsen.

There was a break at 8:05 p.m. and the meeting resumed at 8:16 p.m.

Rich announced that our Holiday Party would be on December 14th at about 5:30 p.m. at the Da VinciCenter. This is after their normal hours, so we will have the facility to ourselves. We are not sure how many Da Vinci staff will be joining us or if we will be able to roam around the exhibits. LVAAS member Blaine Easterwood's son works at Da Vinci and will be our contact for the event. There is a sign-up sheet for the dishes-to-pass. Rich has a paper version and there will also be one on the website. The entertainment will be a trivia contest.

On November 11th (Veterans' Day) a group from LVAAS will be setting up outside the Da Vinci Science Center to observe the transit of Mercury. The transit is from about 7:30 a.m. to 1:00 p.m., so the plan is to arrive and set up at around 7:00 a.m. Steve Novak of Lehigh Valley Live wrote about it and Priscilla Jacobsen said her seniors' astronomy class may stop by. The event will be open to the public.

Planetarium: Last month, the membership voted to spend up to \$4000 on a new bulb for the projector. We decided to get the older style Xenon arc lamp, at a cost of \$1388. The old bulb assembly was shipped to Spitz (they are local-ish: Chadds Ford, PA.) and it was returned to us repaired. It was installed in the projector and is working fine.

Membership: Gwyn Fowler - there were no first readings. There was one second reading: Bret Begovich. He is now a full member of LVAAS, entitled to, among other things, obtain keys to the facilities and be trained on and use club equipment. Gwyn also reminded everyone that this is the season to renew their memberships. This can be done in person at a meeting, or by mail. The revised renewal form is on the website.

Treasurer: Scott Fowler - nothing additional to report.

Library: Dave Raker - this is the last day we will be meeting at the South Mountain HQ until April. The December meeting is the holiday party and the January, February, and March meetings will be at Muhlenberg College. Tom Duff noted that they will begin at 2:00 p.m. Bill Dahlenburg spoke with Judy Parker and she confirmed that she had reserved the auditorium.

Astroimaging: Tom Duff - the next meeting will be November 14th.

Board of Governors Meeting: November 24th, 7:00 p.m. at South Mountain. All society members are welcome to attend.

Rich Hogg announced that our website will be getting a forced upgrade in a month or two, as our host is upgrading its software and our current version will not run!

Pulpit Rock Maintenance: Ron Kunkel - Ron reminded everyone that the road to the summit is not passable once it is covered with snow.

Programs: Sandy Mesics -

- January will be Steve Miller on astrophotography
- February will be Steve Latrell on cubesats

Sandy urged anyone with ideas or contacts for programs, speakers, etc., to please contact her. She also noted that some speakers are available only as Skype presenters. The general feeling was that this was okay, as we might get speakers that would otherwise not be available to us.

The meeting was adjourned at 8:36 p.m.

Submitted by Earl Pursell, Secretary

LVAAS SKY SURVEY

It's Sky Survey time! Now that it's getting darker earlier in the evening, we would like to collect some data on just how bright the lights of the Lehigh Valley are, and what affect they are having on our hobby. Beginning on the evening of our next General Meeting, October 13, 2019, and continuing for two months until December 13, we are asking that members and friends of LVAAS help the club gather sky brightness measurements in the area. The process will be totally on your schedule. There are no fixed times for measurement, but we'd like to have readings include times from just after dark (stars visible) to just before dawn breaking, for every night possible during the two-month survey period. So, if you decide you would like to help out, you can take as many readings as you would like, on as many or as few nights as you would like. We will compile the data and use it to bolster our arguments for lighting ordinances and light trespass controls across the region. For the purposes of this project we are defining the "region" as the local news coverage area of WLVT-TV, Channel 69.

So, you will need an iPhone or an iPad in order to participate. Unfortunately, Android phones will not work for this purpose because the cameras in Android phones are not standardized as those in an iPhone are, so there are no sky brightness metering apps available for Android devices. We apologize profusely to those with Android devices, but the circumstances are beyond our control. We are not happy about this, either, because it will very much limit the final size of our dataset.

You will need to purchase and install the <u>Dark Sky Meter</u> app by DDQ from the App Store. Unfortunately, the Dark Sky Meter app is not free, but it is only \$1.99. Consider it a small donation to LVAAS! Once installed on your device you will use this app to take readings of the brightness of the night sky.

The process is very simple:

- 1. Using a microfiber cloth or lens tissue, wipe off the protective glass of your device's camera
- 2. Start the Dark Sky Meter app
- 3. Cover the camera and take a dark frame (press button 1)
- 4. Point the camera straight up at the sky (zenith) and press button #2 to take a reading
- 5. Enter the sky conditions
- 6. Either take a screen shot or write down the resulting SQM number
- 7. When the results are displayed, enter the sky conditions.
- 8. DO NOT PRESS the SUBMIT button
- 9. Repeat the process four more times, at an altitude angle of 45°, to the N, S, E, & W
- 10. Send your results to <u>darksky@lvaas.org</u> (DO NOT submit through the app), and include:
 - a. Your location coordinates from the GPS in your phone
 - b. The time you started each five-shot sequence
 - c. The sky conditions you chose from the app drop-down menu
 - d. The SQM number and the pointing direction for each shot.

You can take as many or as few readings as you like during the two-month survey period. And please, if you are a true "night owl", those late-late night readings will be very useful, because a number of "bright-light" sources (car dealers, athletic fields, and the like) are dimmed or out after 11pm or so. And readings don't have to be from your home. If you are out and about, and can take the time to get a set of readings, that would be very helpful, as long as you are located in our survey region.

We hope all of you iPhone users will decide to participate. Thank you in advance for helping us out!

----- SEND ALL RESULTS TO DARKSKY@LVAAS.ORG ------

How to use this	арр							
1 Cover the back camera. Press 1.	1 DARK							
Uncover the camera and aim to the point right above your head. Press 2.	2 SKY							
3 Enter conditions*	2							
4 Submit your measurement*	SUBMIT							
*No personal details are submitted. The data is used for generating a light-pollution map on www.darkskymeter.com and scientists from the Globe at Night initiative. For more information visit www.darkskymeter.com								
Meter Clouds My read	dings Help							

Step 4 is to be done via email, NOT through the app. If you send your results through the app they will not be tabulated in this survey.

----- SEND ALL RESULTS TO DARKSKY@LVAAS.ORG ------



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From the LVAAS Archives: "The Astronomer and the Poet"

by Sandy Mesics

For those two or three of you who read this monthly column, you know that I usually look back to see what LVAAS was doing 50 years ago, or what LVAS was doing 80 years ago. But this month, I'm doing something a little different. This column involves a local individual who preceded both Lehigh Valley amateur astronomical societies, but instead made a significant contribution to professional astronomy. Bethlehem residents who visit city hall might notice a historical plaque on Church Street commemorating poet and Bethlehem native Hilda Doolittle (H.D.). Doolittle was born in Bethlehem in 1886. She lived in Bethlehem until 1895, eventually became a writer and poet, moved to Europe, and lived a very Bohemian lifestyle. I've passed H.D.'s marker on Church Street many times but never paid any attention until I read her memoir of growing up in Bethlehem, entitled The Gift. In this slim volume, H.D. writes about her father, Charles Leander Doolittle, who, it turns out, was a professional astronomer. When H.D. was a child, her father worked at Lehigh University as professor of Mathematics and Astronomy from 1875 until 1895.



Figure 1. Left: H.D.'s plaque on Church Street. Right: Charles Doolittle's army photo.

Charles Leander Doolittle was born in Ontario, Indiana on November 12, 1843. He received a good secondary education at La Grange Collegiate Institute, which was a local church-related school. From there he went to the University of Michigan at Ann Arbor, but he abandoned his college studies to enlist in the Civil War at age 17 (he lied about his age.) While Doolittle served in the army, he contracted typhoid fever, but survived. Unfortunately, his brother Alvin Doolittle also contracted typhoid fever but did not survive. In Hilda Doolittle's recollection, the brothers' mother Celia expressed regret that the fate of her sons had not been reversed. Possibly this was a factor in Doolittle's development -- he wanted to prove himself to his mother.

It was only after an interval of some years that Doolittle was able to return to his studies at the University of Michigan. During this time he studied at the Detroit Observatory (in spite of its name it was located in Ann Arbor) with James Craig Watson, the director, who was the discoverer of 22 asteroids.Doolittle graduated in 1874 with the baccalaureate degree of civil engineering (C.E.).

From 1873 to 1875 Doolittle was employed by the Northern Boundary Survey to do both office and field work. This survey was a major undertaking since it sought to establish the location of the US-Canadian boundary from the Lake-of-the-Woods to the Rocky Mountains. The boundary had been established by treaty to be the 49th parallel. Because the location of the parallel was known only approximately, entire settlements were unsure whether they were in the US or Canada. Doolittle did his work accurately despite suffering from frigid temperatures.

In 1875, Doolittle was hired by Lehigh University to be professor of mathematics and astronomy. The main research facility available to Doolittle at Lehigh was Sayre Observatory on Brodhead Avenue in South Bethlehem. Sayre Observatory was erected in 1868 because of the generosity of Robert H. Sayre, one of the founders of Bethlehem Iron Company, precursor of Bethlehem Steel Corporation. Sayre made a generous \$5000 gift to Lehigh University for the building and equipment. The land



Figure 2. Sayre Observatory in 1896. commons.wikimedia.org/wiki/File:Sayre_Observatory_1896.jpg

where the Observatory stands was originally seven acres and was granted to the university by Charles Brodhead, Esq. of Bethlehem.

At the time there were two telescopes at the Sayre Observatory: a six-inch refractor with optics by Alvan Clark and Sons, and a dilapidated zenith telescope. The latter had been manufactured by E. & G.W. Blunt in 1868. It had been found to be unserviceable by the U.S. Coast Survey and was then sold to Lehigh. It was repaired by Edward Kahler in 1875 and was used extensively by Doolittle.

For the next 20 years. He would make great use of this suboptimal instrument including a large series of latitude determinations. This data helped confirm the theory that the earth's poles varied in position. According to the Alumni Bulletin of Lehigh University (vol. 11, no. 4, January 1924), "Dr. S. C. Chandler, an author on theoretical astronomy and Editor of 'The Astronomical Journal,' of Boston, in the issue of August 23, 1892 says: 'Professor Doolittle must be regarded as a pioneer in this subject, having devoted himself to it years before the reality of latitude-variation was generally regarded as possible. The accuracy, homogeneity and continuity of his observations make the series the most valuable of any we possess.''' Doolittle's observations enabled a more accurate determination of the "constant of aberration."

During his first year in Bethlehem, Doolittle's first wife Martha died in her early 30s, probably from complications of her final pregnancy. Alfred and Eric Doolittle were two sons from Doolittle's first marriage, and Alice was a daughter who died in infancy. He married Eugenia (Wolle) Doolittle in 1882, and the couple would go on to have five children, Edith (who also died in infancy), Gilbert, Hilda, Harold, and Charles.

For much of his stay at Lehigh, Doolittle lived in the North Bethlehem Moravian community on Church Street. On clear nights, he would walk between his house and the Sayre Observatory by taking the old covered bridge that preceded the Hill-to-Hill Bridge. His daughter, Hilda, recounted seeing his beard covered with ice upon returning from a cold wintertime session at the observatory:



Figure 3. Doolittle's portrait while living in Bethlehem.

omeka.lehigh.edu/exhibits/show/planetlehigh/faculty/cld

"Papa went out of the house 'like a thief' as he used to say, 'or an astronomer,' every evening if the stars were shining. ... He measured them or measured something, we didn't know quite what. ... when Papa took us into his little domed house – with a dome like the Eskimo made of ice over their snow huts – and we asked to look into his telescope, he said that we would see nothing; you could not see what he was looking at, or looking for, in the daytime. Papa looked at a thermometer and opened or closed a shutter (that opened with ropes that pulled) in the curved roof or dome of his little house, which was built higher up the mountains, above the university buildings, the other side of the river. When we kept on asking him to let us see, he did let us see, but it was as he had told us; there was only a white glare and nothing to be seen and it hurts your eyes. It would be too late to go over there at night he said, and anyhow, at night he was busy."

While most Lehigh students probably did not value the rigors that Doolittle imposed upon them, Doolittle did foster the career of Richard Hawley Tucker, who studied under Doolittle and received a baccalaureate in civil engineering from Lehigh in 1879. Doolittle influenced him to seek a career in astronomy after which he went on to have a distinguished career at the Lick Observatory in California.

In retrospect, Doolittle's work on trying to determine if latitude variation was due to polar motion is essential in this day of GPS satellites, which rely heavily upon this information. Doolittle was a pioneer in the field even if history has not been kind to him. Consider the comments of Herman S. Davis, a researcher of the International Latitude Observatory, which appeared in the journal Science in 1903 and concerned a major retrospective report of Doolittle's early research efforts:

"This series is of exceptional value as being the earliest, as well as the most prolonged, thus far made in the investigation of latitude variation. It was begun seven years before the first proposal by [Italian astronomer Emanuele] Fergola at the session of the International Geodetic Association in Rome [in 1883], that there should be an observational test of the constancy of latitude, and eight years before [Karl Friedrich] Kustner began his observations whereby the discovery of variation was first boldly announced as proven."



Figure 5. A Doolittle publication.

omeka.lehigh.edu/exhibits/show/planetlehigh/faculty/cld "Simultaneous equations involving several variables were solved manually. Publications usually contained tables. Typically, the first of the several tabular columns was devoted to a long list of the observed data. The remaining columns were derived from the first column, the entries of which had to be generated by laborious hand calculation. Usually the number of digits involved in the computation would preclude use of a slide rule."

Doolittle remained at Lehigh for 20 years. When the University of PA established the Flower Astronomical Observatory in 1895, Doolittle was hired as its first director. He relocated his family to the new facility in Upper Darby to assume his duties and to become a professor of astronomy. Doolittle was then 52 years old. The observatory was brand new and well equipped, allowing him to continue his research into variation of latitude using superior instruments Both the observational and computational work Doolittle performed were arduous. He was often so intent on his observational work that he literally froze to the telescope. His beard and whiskers had to be thawed out occasionally. The work so engrossed him that he once stepped off a moving trolley on his way home one night, presumably so exhausted that he didn't realize the vehicle was still moving. According to Mahoney, Doolittle "had to perform a tremendous amount of hand calculation that was involved in his book and in each journal article or research report. The effort involved in preparing these publications is breathtaking. Tasks that today are done routinely by computer were in Doolittle's time done by hand."



Figure 4. Doolittle at Flower Observatory in 1900

Noted American astronomer Simon Newcomb delivered the dedicatory address for the Flower Observatory in 1897. In his address, Newcomb said that the problem of the variation of latitude was an important concept and that Doolittle had distinguished himself in the subject and that the Flower Observatory would continue to do research in this cause. Newcomb described the new instruments that were available to Doolittle as "the finest instruments ever used for the purpose."

After a few years of using the exceptional telescopes at Flower, Doolittle felt the need for a different type of instrument that would allow for simultaneous and confirming measurements of the difficult-to-measure variation of latitude. He approached Joseph Wharton (the same Wharton who endowed the school of business at the University of Pennsylvania) to finance construction of an instrument that he called the Wharton Reflex Zenith Tube. Doolittle designed this instrument along the lines set forth by the British astronomer George Airy (1801-1892) in 1848. It was manufactured by the famous Brashear and Warner & Swasey firms, and at the time was one of only two in existence. Starting in 1903 and for the next several years Doolittle used both a zenith telescope and the Wharton Reflex Zenith Tube in parallel to further document the variation of latitude. These instruments were used in combination until Doolittle retired in 1912 when he concluded that "the Wharton Instrument has proven in some respects less satisfactory than was hoped."



Figure 6: Doolittle at about the age of his retirement.

Interestingly, the Wharton Reflex Zenith Tube utilized an open pool of mercury to provide a level reflecting surface. This pool had to have its level properly maintained and its surface had to be skimmed occasionally to remove impurities. It is speculated that several years of breathing mercury vapor could have had negative consequences for Doolittle's physical and mental health. Open containers of mercury would not be allowed in the workplace today.

Doolittle continued his directorship and his research at the Flower Astronomical Observatory until 1912 when he retired at the age of 70. His son Eric succeeded him as director. Following his retirement, Doolittle remained in Philadelphia as his health declined "from a complication of diseases for several years." Doolittle died on March 3, 1919 at the age of 75. One obituary described him as "a distinguished astronomer and a lovable man." His granddaughter recalled that "although he was a genius and a dominant figure, he seems to have been a man of great personal warmth. He cared deeply about his family and observed all the traditions – Christmas and birthday celebrations, summer excursions to huts, and parks and lakes."

Doolittle was a member of several professional associations, including the Astronomische Geselschaft, the American Philosophical Society, and the Astronomical Society of America, of which he was treasurer from 1899 to 1911. He was the author of about 50 papers and reports including a number of standard works on astronomy, including "Practical Astronomy as Applied to Geodesy and Navigation," "Results of Observations with Zenith Telescope, Sayre Observatory, 1876-95," and "Results of Observation with Zenith Telescope, Flower Astronomical Observatory, 1894-1911. The University of Michigan awarded him an honorary ScD in 1897, and Lehigh University conferred the honorary LL.D. degree on him in 1912. Doolittle was survived by his wife and several children. His surviving children were largely successful. Eric Doolittle closely followed in his father's footsteps: graduating from Lehigh with a civil engineering degree in 1891, going on to be an instructor of mathematics at Lehigh University in 1892, and then instructor of mathematics and astronomy at State University of Iowa in 1893. In 1896 Eric moved to the University of Pennsylvania Flower Observatory to carry on his father's directorship. Eric died a year after his father in 1920 at the age of 50.

Daughter Hilda Doolittle was living in London at the time of her father's death. While brilliant, she was a disappointment to her father because she had no aptitude for mathematics or science. She was bisexual, and likely suffered from bipolar disorder, which caused her father to have some fear for her safety and wellbeing. Hilda died in 1961 in Switzerland, at the age of 75.



Figure 7: Doolittle's grave at Nisky Hill Cemetery

Oldest son Alfred Doolittle, who was then doing government work in Washington, died around 1920 at the age of 34. He had been doing government work in Washington while his father was in Philadelphia, but even though Washington was an easy train ride from Philadelphia, there appeared to be little communication between father and son. Another son, Harold Doolittle of Pittsburgh who like his father was also an engineer, died in 1968 at the age of 81. Son Melvin Doolittle was an Ensign in the U.S. Navy at the time of his father's death. He was also an engineer. He died in 1963 at the age of 69. Another son, Lieutenant Gilbert Doolittle, predeceased his father by several months. He served in Company B, 303rd Division, U.S. Engineers, and was killed in action in France on September 26, 1918, less than 2 months before the end of World War I. He was 33. (The Pennsylvania Gazette, March 7, 1919). Professor Doolittle was buried at Nisky Hill cemetery in Bethlehem, "a beautiful site overlooking the rapid river named to carry on the traditions of the early days of the Indians, so successfully converted at the old

Moravian settlement. He was a man of singularly modest temperament, genial in manner and straightforward in character. These qualities were recognized by his students – one of the real tests of a man – as they have been by a wide circle of friends."

(Tucker, March 20, 1919).

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StarWatch

by Gary A. Becker

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Moonlit Geminids Next Week



If you had the opportunity of catching the spectacular conjunction of Venus and the thin crescent moon last week, you know that the moon is waxing, becoming brighter. Until it reaches first quarter, half on—half off, light to the right—it really doesn't present too much of an observational hassle. A first and last quarter moon is about 1/10th as bright as a full moon. After first quarter, however, the brightness of the moon burgeons, illuminating the sky and easily casting shadows on the ground if you are away from any direct streetlights.

I remember losing my intervalometer on a Bryce Canyon trail in 2006 while photographing the park after dark, which was one of my jobs as a Night Sky Interpreter. The device was expensive and necessary for the type of photography that I was performing. My wife was along on that hike and I left her, albeit a little nervous, on the canyon rim while I descended back down the trail, headlamp blazing.

After a few awkward steps, I stopped and turned off my light which was causing all shadow detail to disappear and the trail to look flat and featureless. The moon was almost full that evening—a fat, waxing gibbous, a beacon of bright reflected sunlight illuminating the landscape vividly enough for me to perceive the reddened rock of the canyon. Within a minute my eyes adjusted from the uber-light of my headlamp to the natural light of the nearly full moon with plenty of detail along the trail to navigate.

I found my intervalometer about a half mile down the trail, 50 yards from where my last tripoded image had been taken. There was no mistaking it. After returning, Sue and I walked to a rim overlook where I captured the lightning of a distant thunderstorm playing against the surreal, moonlit landscape that makes Bryce Canyon such a national treasure. I have included that image at www.astronomy.org/StarWatch/December/index-12-19.html#12-1-19.

The same intensity of moonlight that makes Bryce by night so stunning blankets most meteors from view. In fact, the bright, waning gibbous moon will be in Gemini on the night of maximum, December 13/14, only about 12 degrees away from the star Castor, where the Geminids will appear to be radiating. That is the big negative about this year's Geminids, but there are also positives.

Because the Geminids are active between December 6-19, the nights bracketing December 13/14 should also prove fruitful. Look away from the moon, but because Luna is close to the radiant, the location from where the meteors will be diverging, Geminids will trace back to the moon.

Shooting stars are also more plentiful near dawn because that part of the Earth is plowing into the swarm of dross which creates the meteor shower, analogous to why the front windshield of a moving vehicle gets slammed by more raindrops during a downpour than the back window. In addition, the Geminids produce numerous bright meteors and occasionally a fireball which moonlight will not hide. Just make sure that the moon is not in your field of view.

Expect to see rates of 10 to 15 Geminid meteors per hour after midnight. By dawn, the bright moon will have moved into the northwestern sky, and you will have a much greater swath of the heavens to view where direct observation of Luna can be avoided. Stay warm, and enjoy the moonlit Geminids.



Night Sky Notebook for December by Pete Detterline

Night Sky Notebook Peter Detterline The Geminids are perhaps the finest meteor shower of the year. The shower extends from the 4-16th, but expect about 2 meteors a minute at its peak-December 13 beginning at 8:30 PM Meteors come through dawn! However, the bright Moon will not from the radiant allow you to see as many meteors. Orion Gemini Sleeping Bag or Blanket Chaise Lounge

Sky above 40°33'58"N 75°26'5"W Thurs 2019 December 12 1:00 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/

DECEMBER 2019

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<u>01</u>		<u>03</u>	04 First Quester Maan	<u>05</u>	<u>06</u>	<u>07</u>
			<u>First Quarter Moon</u>			
08	<u>09</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>
				Full Moon		General Meeting/Party - 2:00 PM
				Astro Imaging - 7:00 PM		
15	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	21
<u>General Meeting/Party (alternate day) - 2:00 PM</u>			Last Quarter Moon			
22	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	27	28
Deadline for submissions to the Observer			Christmas	New Moon		
<u>29</u>	<u>30</u>	<u>31</u>				
LVAAS Board of Governors Meeting						

JANUARY 2020

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			<u>01</u>	02 First Quarter Moon	03	<u>04</u>
<u>05</u>	<u>06</u>	<u>07</u>	<u>08</u>	<u>09</u>	<u>10</u> Full Moon	11
12 General Meeting - 2:00 PM	<u>13</u>	14	<u>15</u>	<u>16</u>	<u>17</u> Last Quarter Moon	<u>18</u>
Muhlenberg						
<u>19</u> Deadline for submissions to the Observer	20	21	22	23	24 New Moon	<u>25</u>
26	27	29	20	20	21	
LVAAS Board of Governors Meeting	<u>£L</u>	<u>20</u>	<u>42</u>	20	<u>27</u>	

2019 LVAAS Event Calendar

2019 LVAAS Event Calendar												
	<u>Sundays</u>			Thursday	<u>Saturday</u>	Mondays	Multi-Day Weekende	Moon Phase				
	Genera time	al Meeting Date/location	Board meeting	submission	Astro Imaging	Star Parties	Scouts at S. Mountain	Scouts at Pulpit R.	New	First	Full	Last
January	2:00 PM	13 Muhlenberg	27	20	24	no mtg		no camping	5	14	21	27
February	2:00 PM	10 Muhlenberg	24	17	21	no mtg		no camping	4	12	19	26
March	2:00 PM	10 Muhlenberg	31	24	21	16		22-23-24	6	14	20	28
April	7:00 PM	14 S.M.	28	21	18	13		no camping	5	12	19	26
Мау	7:00 PM	5 S.M.	19	19	16	11		17-18-19	4	11	18	26
June	7:00 PM	9 S.M.	30	23	no mtg	8		14-15-16	3	10	17	25
July	5:00 PM	13 S.M.	28	21	no mtg	6		19-20-21	2 31	9	16	24
August	7:00 PM	10 Pulpit	25	18	no mtg	3		16-17-18	30	7	15	23
September	7:00 PM	8 S.M.	29	22	12	7		13-14-15	28	5	14	21
October	7:00 PM	13 S.M.	27	20	17	5		11-12-13	27	5	13	21
November	7:00 PM	10 S.M.	24	17	14	2		no camping	26	4	12	19
December	2:00 PM	15	29	22	12	no mtg		no camping	26	4	12	18

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 is at

NEAF Cherry Springs S.P. Stellafane Black Forest S.P. Mega Meet April 6 – 7 May 30-June 2 Aug 1 – 4 Sept 27 – 29 **see website**

Contributed by Bill Dahlenburg

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:

<u>https://www.ivertech.com/freeOnlineImageResizer/freeOnlineImageResizer.aspx</u>. 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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