The Observer

The Official Publication of the Lehigh Valley Amateur Astronomical Society

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Mercury transit 11/11/2019; Questar 3.5 inch Maksutov Cassegrain telescope with Company 7 chromium polished glass solar filter; Imaging camera: Nikon D750; ISO 100; 1/250 second exposure. Imaged by Jason Zicherman.

Cover image: **Triangulum Galax**y NGC 598, imaged in LRGB; TEC 140, camera QSI 683; date 10/19/2019; 100 minutes luminosity, 75 minutes in red, green , and blue for a total of 5.4 hours. Imaged by Jason Zicherman.



I drove by Martin Heap a few weeks ago. The newspaper reports said that it would take six months to a year to clean up the mess after the tower was imploded in May. By the looks of things, it seems like it will be well into the new decade before the mess is gone, and the memory can begin to fade.

I wrote about Martin Tower in Ad Astra for February, 2019, along with Frank Lyter's photograph of it from Pulpit Rock. We had calculated that if it were possible to see Freedom Tower from there, it would be just to the left of Martin Tower. In checking up on the project just now, I learned that there has been a fatal accident in the cleanup effort. I'm sad for the life that was lost, and for the landmark that I used to enjoy seeing.

"The Lord Taketh Away"

I remember when The Old Man of the Mountain, a rock abutment in New Hampshire, collapsed in 2003. It was a popular tourist attraction that I had never seen, and now never will: a rocky outcropping that bore an uncanny resemblance to the craggy face of a wizened father figure, overlooking the lake below. It was the state emblem of New Hampshire, and now it's a place where people stop by to leave memorial bouquets.

More or less the same thing happened to The Old Man of Joshua's Mountain, also known as Profile Rock in Freetown, Mass., last year. Old men get older, and fall down, and sometimes they don't get back up. The same



thing will happen to me, probably long before New Orleans fully recovers from Hurricane Katrina, or Notre Dame is open for tours again in Paris, though hopefully not before the Martin Heap is cleaned up. Nothing lasts forever. Less than a month ago, Puerto Rico lost the famous natural stone arch Punta Ventana to an earthquake.

Celestial Transience

A couple of things that we take for granted, but that we are fortunate to enjoy during this era of exploding human awareness of the cosmos, also won't last forever. The Moon is just the right distance from the Earth to barely cover the brilliant face of the Sun during total eclipses, one of which thrilled a bunch of LVAAS'ers in 2017. But it's moving farther away, though very slowly. The final total solar eclipse on the surface of the Earth will be in about 600 million years. Saturn's rings will probably be long gone by then, but I assume humanity will either be gone from this Universe, or be everywhere in it, observing countless other wonders throughout this galaxy and many others.

Polaris has served well as a bright indicator of True North for many centuries, and will keep getting better (closer to the North Celestial Pole) for about another 80 years; after that, the precession of Earth's axis of rotation will cause it to slowly start moving away. (Good thing we have GPS now.)

Comets come and go; meteors flash by in an instant. Some things last longer but no material thing is truly eternal.

Stellar Spectator Sport

In his StarWatch column published here last month, Gary Becker wrote about the fainting of Betelgeuse, which has apparently been going on for a few months and still continues. People are talking about it in the online forums and blog posts. There was an article in Sky & Telescope. If it hasn't been mentioned in any particular astronomy-related vehicle, it probably will be soon.

Betelgeuse is the red supergiant in the "upper-left" corner of Orion. It is a semiregular variable star, but the current cycle is possibly the faintest we have ever seen it. Our friend Prof. Ed Guinan, along with his colleagues at Villanova University, are credited for being the first to note this event, and have attributed it to coinciding troughs in the star's two recurring cycles of variation.

But the astrophysicists have been telling us that Betelgeuse is also near the end of its life as a supergiant. It is almost out of hydrogen fuel, and it could become a supernova just about any time in the next 100,000 years or so. As a result, the current fainting is generating a lot of excitement: this could be it! The start of one of the most spectacular astronomical events in human history. A supernova only 650 light-years from Earth would be quite a sight.

I share in this excitement to a limited extent. First of all, it's probably not warranted; the current fainting cycle is only, possibly, slightly deeper than previous ones we've seen, and likely not a harbinger of a big boom. But also, and this is the point that few people seem to think about: after the supernova, in a few months to a year or two, Betelgeuse would be gone! Yes, there would probably be a nice new nebula left over, likely visible in binoculars or even naked-eye for quite a while...

But Orion would never be the same. It's my favorite constellation! (I like the Big Dipper also, but that's not a constellation, it's an asterism.) Orion has a unique, almost-perfect symmetry — the large rectangle of the "knees" and "shoulders" neatly bisected by the jauntily tilted belt. Up until the current fainting event, the brightness of Rigel in the lower-right was neatly balanced by Betelgeuse in the opposite corner.

Did you recognize the star map I left on the previous page? That's Orion, 3rd-magnitude stars and up, with Betelgeuse taken away. (I included Cursa, or β Eridani, since it's "right there" and I wanted to throw you off a bit more.) It makes me a little sad just to look at that.

If I manage to outlive Betelgeuse, I think I will likely feel significant nostalgia for it, a little bit of heartache every time I see the wounded hunter in the sky, despite the spectacle its demise will have been.

Phone Tag, Anyone?

The other sport of the current season, for me, is observing StarLink satellites. SpaceX has launched 182 of these craft as I'm writing this, and have plans to launch 60 more roughly every two weeks until there are enough in orbit — thousands! — to provide satellite Internet service to remote areas.

During the first couple of weeks after launch, the satellites chase each other in a slowly-spreading train that is easily visible if you know where to look. I've been using the SATFLARE website to track them and plan observations, and it seems to be quite accurate. There is a lot of concern that these orbiting Wi-Fi routers will create a major distraction for visual astronomy, and an impairment for astro-imaging.

LVAAS member Terry Pundiak and I have been emailing about our investigations, and Terry has an idea that we should organize a "phone tree" to let each other know about short-term events of astronomical interest.

A participant would expect to receive a phone call if something was up, such as a StarLink satellite pass that was observable in the area, or maybe something like a nearby supernova; and in turn would be expected to call or text two or three others to pass on the real-time news. If you are interested in participating in something like that, please email Terry at terrypun@mac.com.

Would you like fries with that?

I'm looking ahead to another season as Acting Director of Member Services, which means cooking hot dogs at Star Parties. (As for fries, well, you'll have to settle for potato chips.) But even though I don't much mind the job, I really should be working harder to find someone to fill this position officially for at least a year or two. The main functions are buying stuff and selling stuff, and a bit of cooking on the hot dog machine. It involves being at Star Parties but mostly being inside. If you're interested in the job, please get in touch with me! I promise you will have lots of help, in fact, I can be the one to run the Red Shift for at least half of the Star Parties this year, so you can be my boss in that role and you won't even have to show up half the time.

Priscilla Jacobsen has been giving me some off-season help, cleaning up apparel cabinets for the new season. Thanks, Priscilla! Also thanks to Rose Bachik who helped me run the store a bunch of times last year. A few others have helped also, and there are always extra hands at clean-up time. If you're someone who would like to help out, also please let me know.

Ad Astra!

— Rich Hogg

LVAAS General Meeting: Public Welcome!

Sunday, February 9, 2:00 p.m.

Trumbower Hall, Muhlenberg College, Allentown PA

Program: MARS THROUGH THE DUST STORM Presented by Clif Ashcraft, PhD

Member, AAI of New Jersey

Website: https://www.wa2guf.org/



Clif's presentation is based on his own images of Mars taken during the 2018 opposition when the entire planet was obscured by a long lasting dust storm. To deal with the opacity of the atmosphere, Clif did telescopic imaging with a CMOS digital video camera equipped with a 850 nm long pass filter. This gave him an NIR band pass from about 800 nm up to 1100 nm. It penetrates all but the densest dust storm clouds and allows imaging of surface features that would be completely invisible in 400 to 800 nm visible light. Telescopes used for these observations included his 7.25" Schupmann Medial and the C14 in his home observatory in Perrineville, NJ, as well as the 13" Schupmann Medial at MacGregor Observatory on the Stellafane site near Springfield, Vermont.

Minutes for the LVAAS General Meeting - January 12, 2020

The January 2020 LVAAS General Meeting was held on Sunday, January 12, at 2:00 p.m. at Trumbower Hall, Muhlenberg College in Allentown PA. Attendance was approximately 53 attendees. Director Rich Hogg opened the meeting at 2:10 p.m. He announced that everyone in attendance was welcome to meet over at the Muhlenberg dining hall, noted as the finest in the area and at a special rate through the generosity of Judy Parker. Rich then introduced the guest speaker, Joe Latrell of Mini-Cubes, LLC.

Joe is a self-proclaimed recovering rocket scientist who has had a storied career that included working in IT, a wastewater quality engineer, video games designer, and head of a rocket company. He spoke about developing the Pocket Cube concept of a super small satellite through his company Mini-Cubes, LLC. His design is a 50mm, 250g or less satellite that will have a total power budget of 15 watts; the CPU is 10 watts, the radio is 1 watt, the sensors are 2 watts, and the battery recharge is 2 watts. It has been designed to accommodate a 150C temperature differential, can withstand up to 300 lbs, and is designed to maintain position and orbit and disintegrate safely into the atmosphere once it is no longer able to maintain an orbit. The satellites, 48 of them, once launched, will orbit at 390 km and travel at 17,500 mph and are expected to have a two-year life span. The launch is planned for Q4 2020, scheduled on Alba Orbital Cluster 3, and flying on Rocketlabs Electron out of New Zealand. There are some risks: failure to reach orbit, power failure, communication errors, and regulatory issues. Joe estimates a 1% chance for success.

What is the purpose of all of this? The goal is to help the world by having these 48 satellites look at the visible spectrum of clean water on Earth, first with cameras and eventually with spectrometers. Clean water monitoring is poor and local governments are looking for 3rd party clean water monitoring resources. It is expected that this will become a competitive market.

Joe works from a home base in Akron, PA. He is able to transmit and receive, currently in the amateur band but looking to move to the S band, and has his own clean room. Tours are welcome. Joe's collaborators are Alba Orbital, Teachers in Space, Friendly Elec, and WG Malden. He has great praise for all the contributions and assistance from Teachers in Space.After Joe's talk, there was a brief intermission and the meeting moved to LVAAS business:

Meetings:

There is an Astroimaging meeting on Thursday, January 16 at South Mountain. The next Board of Governors meeting is on Sunday, January 26 at South Mountain.

Treasurers Report - Scott Fowler:

For **2019** there was \$20,300 income and \$25,700 expenses. The deficit was actually part of \$10,400 for the 40" project, and the 40" optical set. \$10,700 was put aside for the roof last year. The roof work has not yet been done. An additional \$5,300 will be added for the roof this year.

Starting off **2020** with \$5,600 income and \$3,600 expenses. \$5,600 was from membership revenue and donations. Donations accounted for 27% of revenue. The largest expense so far this year was \$1,390 for the new planetarium bulb.

Membership - Gwyn Fowler:

1st reading for new members Leon Homm, Jim Thoma, Brad Pomeroy and Matthew Urich.

Pulpit Rock: Ron Kunkel:

Rich announced that there is a need to assist with Scouts camping at Pulpit Rock. Looking for volunteers on full moon weekends, Friday and Saturday, in March, May, and June to stay overnight with the Scouts, give some talks, etc. The volunteers will need to have a key for the gate at Pulpit Rock.

Star Parties - Carol Kiely:

Carol is asking for volunteers for the Star Parties that will resume in March. She is also looking for speakers to do 40 minute talks. LVAAS members who are teachers are encouraged to reach out to their students to see if they would be willing to do a talk. As always in addition to the talks, there will also be a need for volunteers to operate the telescopes, work the door, coordinate parking, etc.

DaVinci: Blaine Easterwood:

Blaine is coordinating the DaVinci Abbey Space Party. This is a sleepover party for outdoor observing only, weather permitting. Date is January 25, from 5:00 p.m. to 9:00 p.m. Please contact Blaine if interested.

Articles for Sale:

Dave Raker had some items from the library.

Earl Pursell had some UACNJ calendars for sale.

The next General Meeting will be at 2 p.m. on Sunday, February 9 at Trumbower Hall, Muhlenberg College in Allentown, PA. The speaker will be Clif Ashcraft on the topic of Observing Mars.

The meeting was adjourned at approximately 4:00 p.m.

Submitted by Dennis Decker, Secretary



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When shopping through AmazonSmile, you can choose a charitable organization to which you'd like to donate, and we are hoping you will consider LVAAS.



Happy Shopping & Many Thanks!!

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Jim Blandford's Snow Day





Ron Kunkel's strong advice is to stay off the road to Pulpit Rock when it's snowy. It's good advice for most of us, but our friend Jim Blandford is an exception, in more ways than one.

Jim, who lives in Hamburg, is an accomplished ultramarathon runner. He and his running buddies like to use our road, as well as the steep, rocky trails in the area, for training runs. For them, a little bit of snow just makes it more interesting! He and his friend Ryan visited Pulpit Rock on foot on January 19, after the first snowfall of the New Year, and took these great photos which he gave me permission to share with readers of The Observer.

Jim also sent me this link to a video he shot in 2011, on top of the mountain right after an ice storm. He said that there was so much ice falling off the trees that day that he was afraid to run down the trail. I can believe it!

Follow this link to see Jim's full post, with more photos, on Facebook.

— Rich Hogg







From the LVAAS Archives: A Nobel Prize Winner Speaks at LVAAS

by Sandy Mesics

In the general meeting minutes of May 3, 1970 LVAAS Secretary Gary Becker wrote, "The program consisted of a very interesting talk by Dr. P.J.E. Peebles from Princeton University who discussed a theory which he originated on the evolution of the universe."

The May, 1970 Observer reported that Peebles was an Associate Professor of Physics at Princeton, and his subject was "The Primeval Fireball and the Origin of the Galaxies." Following his presentation at the May meeting, the June 1970 Observer reported that his lecture was descriptive and lively, and proposed the place of the Quasars in the latest cosmological theories.



According to Wikipedia, Phillip James Edwin Peebles is regarded as one of the world's leading theoretical cosmologists in the period since 1970. Peebles was born in Winnipeg, Canada in 1935. He earned his Bachelor of Science from the University of Manitoba in 1958, and his PhD in Physics from Princeton University in 1962. Peebles stayed at Princeton for his entire career.

In 1964 he began his theoretical work on the origin of the universe. At the time, this was not considered a desirable area of scientific inquiry, because there was so little empirical evidence to support theory. "When I started working in this subject — I can tell you the date, 1964 — at the invitation of my mentor, Professor Robert Henry Dicke, I was very uneasy about going into this subject because the experimental observational basis was so modest. ... I just kept going," Peebles said. By the time of his 1970 talk at LVAAS, Peebles had established himself as the leading pioneer in the theory of cosmic structure formation. Also, at the time of this talk, Peebles contributed to establishing the dark matter problem. Peebles went on to publish extensively, including

five books on cosmology, the Big Bang Theory, and quantum mechanics.

In October 2019, Peebles was awarded the 2019 Nobel Prize in Physics "for theoretical discoveries in physical cosmology." According to the Academy "James Peebles took on the cosmos, with its billions of galaxies and galaxy clusters. His theoretical framework, developed over two decades, is the foundation of our modern understanding of the universe's history, from the Big Bang to the present day."

Peebles retired in 2000, and is now the Albert Einstein Professor of Science, Emeritus, and professor of physics, emeritus at Princeton University. His upcoming book, "Cosmology's Century, An Inside History of Our Modern Understanding of the Universe," will come out in June 2020 from Princeton University Press.

References

https://www.princeton.edu/news/2019/10/08/princetons-james-peebles-receives-nobel-prize-physics https://en.wikipedia.org/wiki/Jim_Peebles



Finally, I'm back to spending some time on the 40-inch. I had a couple of months in which there were just too many other things to do.

Now that we've received the completed mirror set, the exact optical parameters have been finalized, and I can publish them once and for all. There are a couple of minor details (such as the exact width of the chip bevels on the primary) that are estimated (from photographs or otherwise), but they are minor.

LVAAS Schlegel Observatory 40-inch optical characteristics

Primary mirror:

Overall diameter 40.0 in. Central aperture diameter 8.555 in. Chip bevel width 0.1 in. (est.) Uncoated central ring width 0.55 in. (est.) Usable overall diameter 39.8 in. Unusable central circle diameter (chip bevel plus uncoated ring) 9.5 in. (est.) FL 146.625 in. RC 293.25 in. CC -1.0 (parabola)

Secondary mirror:

Overall diameter 10.0 in. Chip bevel width 0.035 in. Usable diameter 9.93 in. FL 47.137 in. (est. *) RC 94.275 in. (est. *) CC -2.989 (est. *) (convex) (* estimate based on modeling overall system characteristics reported by optician)

System:

Mirror spacing (vertex-to-vertex) 112 in. Back focus (from vertex of primary) 18 in. EFL 551 in. (13,996 mm) f-ratio 13.84 Fully-illuminated FOV 0.276° Fully-illuminated image height 2.6 in. The unusable central area of the primary will be entirely obscured by the secondary, plus a little more by the structure to hold it, and possibly some baffling (see next page).

We targeted a fully-illuminated field height of 2.0", but we ended up with significantly more. Why? The main reason is that I estimated a 0.1" chip bevel on the secondary mirror. Lockwood Optics delivered the mirror with a much smaller bevel than I expected, significantly increasing the size of the field, which we generally will not be able to take advantage of.

To the right, we have an accurate drawing of the layout of the optical system, to scale, including the envelope of all possible light paths to the fully-illuminated image plane. In actuality there will be an even larger image plane, with some minor vignetting; again, this is mostly not useful because you cannot get it into an eyepiece or a reasonably-priced camera.

Also, this drawing assumes that we only need 1/2 inch of structure around the secondary mirror. We may actually need more, resulting in an insignificant reduction in light-gathering power and contrast.

Having the ray paths defined gives us a chance to think about stray light elimination, which is good because we need to get the word out that we need a nice tube to make a baffle.



At the right we have the same diagram, to which I've added a representation of the main baffle tube. It wants to poke up into the valley between the rays going up to the secondary, and the ones coming back, so that it blocks as many of the stray light paths (shown in blue, on one side only) as possible, without blocking any of the desired rays. In order to do this, the upper end of the tube wants to be 6.8 inches in diameter.

We'll probably form the upper edge of the tube, as well as the inside of the baffle, from ProtoStar FlockBoard, so we actually want a piece of structural tubing slightly larger.

WANTED: thin-wall aluminum tube, ID 6.88 in. or slightly larger, length at least 48 in.

I have on offer from Preston Smith of an old Newtonian telescope tube which is 7.25 in. OD. This would work pretty well, with some spacers to get the final piece of FlockBoard at the right diameter, but a slightly smaller diameter outer tube would be even better. Let me know if you have something we can use.

There is still a path for a little bit of light to sneak past the main baffle, as shown in green. We'll probably also make a secondary baffle, indicated by the dashed lines, to catch those (while possibly increasing the central obstruction by an insignificant amount.)

I'm also spending a lot of time working on the radial support system for the primary, focusing on a central "hub" system as I previously mentioned, but I am not quite at the point where I have something I want to share.



StarWatch

by Gary A. Becker

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The Sun: A History of Warming



Around 4.6 billion years ago an event occurred in our galaxy, perhaps a supernova, which triggered the collecting of gas and dust to form a star cluster similar to the Pleiades, found in Taurus the Bull and currently visible in our night sky. The ultraviolet radiation from those hot, young cluster stars began clearing the nest of leftover gas and dust that created them, causing secondary pockets of higher density to form which collapsed gravitationally to establish a new generation of less massive stars; one of these was our sun. Over the next several hundred million years the cluster evaporated, its outer member drifting away first, eventually leaving the sun on its own, orbiting the galaxy with its entourage of planets, moons, and smaller objects.

A star is an object that is changing matter into energy within its core, spontaneously converting less massive elements into more massive ones. The matter composing the star wants to decrease its size due to gravitational attraction. This is balanced by the outward radiation and gas pressure created by the energy being produced within the core, trying to expand the star to become larger. When these two forces are in balance, the star is said to be in hydrostatic equilibrium and stable. In the case of low mass stars like the sun, hydrogen is being converted into helium at the loss of almost 5 million tons of matter per second, but it wasn't always that way. In the beginning the sun was about 30 percent less luminous than it is today, and it was in this environment that life began on Earth and also probably on Mars. Sol's surface temperature was higher, but its luminosity was lower, implying that the sun was physically a smaller star. During the intervening 4.5 billion years, the amount of helium in the sun's core has been increasing. Because helium is more massive than hydrogen, the helium has gravitated towards the center of the core where it is squeezed and heated due to compression. This has slowly increased the activity of the thermonuclear furnace in the sun's core to produce helium at a slightly faster pace, causing the outflow of energy to quicken and the sun to react by slowly expanding to maintain its stability. Surface temperatures have dropped slightly because the density of the outer layers of the sun are expanding, but the increased surface area has overcompensated for this slight decrease in temperature causing Sol to become more luminous. This will not become the red giant phase of the sun; that happens much later, in about 5.5 billion years, and will involve hydrogen burning in a shell surrounding an inert helium core. It is simply the sun adjusting its size for the increased hydrogen core burning due to the small rise in core temperature as a result of helium compression at its center.

Currently, conditions should be in balance on Earth, notwithstanding the negative human contributions to global warming, but in a billion years or so, the sun's increased luminosity will be great enough to raise temperatures to the point where the oceans will boil, and all life as we know it will cease on the Earth. For the moment it is imperative that we solve the human component of global warming, but it is interesting to note that built within the genetic, evolutionary code of all low mass stars like our sun is a natural tendency to warm throughout their lifespans, a condition over which humans have no control.



Night Sky Notebook: February *by* Pete Detterline



Sky above 40°33'58"N 75°26'5"W Saturday 2020 Feb 8 1:00:00 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/

FEBRUARY 2020

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	
						First Quarter Moon 01	
<u>02</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>	<u>07</u>	<u>80</u>	
Full Moon 09	<u>10</u>	11	<u>12</u>	Astro Imaging - 7:00 <u>13</u>	<u>14</u>	Last Quarter Moon <u>15</u>	
General Meeting - 2:00 PM Muhlenberg							
Deadline for <u>16</u> submissions to the Observer	17	18	19	20	21	22	
New Moon 23	<u>24</u>	<u>25</u>	<u>26</u>	27	<u>28</u>	<u>29</u>	
LVAAS Board of Governors Meeting							

MARCH 2020

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
<u>01</u>	First Quarter Moon 02	<u>03</u>	<u>04</u>	<u>05</u>	Scouts at Pulpit Rock 06	Scouts at Pulpit Rock 07
						Star Party
Scouts at Pulpit Rock 08	Full Moon 09	<u>10</u>	<u>11</u>	Astro Imaging - 7:00 12	<u>13</u>	<u>14</u>
General Meeting - 2:00 PM Muhlenberg						
<u>15</u>	Last Quarter Moon <u>16</u>	17	18	<u>19</u>	20	21
Deadline for 22	22	New Moon 24	25	26	27	20
submissions to the Observer	<u>L</u>		<u> </u>	<u></u>	<u> </u>	20
LVAAS Board of 29 Governors Meeting	<u>30</u>	<u>31</u>				

2020 LVAAS Event Calendar

2020 LVAAS Event Calendar												
	Sundays			Thursday	Saturday	Mondays	Multi-Day	Moon Phase				
	Genera time	al Meeting Date/location	Board meeting	submission deadline	Astro Imaging	Star Parties	Scouts at S. Mountain	Scouts at Pulpit R.	New	First	Full	Last
January	2:00 PM	12 Muhlenberg	26	19	16	no mtg		no camping	24	2	10	17
February	2:00 PM	9 Muhlenberg	23	16	13	no mtg		no camping	23	1	9	15
March	2:00 PM	8 Muhlenberg	29	22	12	7		6 - 7 - 8	24	2	9	16
April	7:00 PM	5 S.M.	26	19	18	4		10 - 11 -12	22	1 30	7	14
Мау	7:00 PM	3 S.M.	31	24	16	2		8 – 9 – 10	22	29	7	14
June	7:00 PM	14 S.M.	28	21	13	27		5-6-7	21	28	5	13
July	5:00 PM	11 S.M.	26	19	18	25		3-4-5 31	20	27	5	12
August	7:00 PM	8 Pulpit	30	23	15	22		1 – 2	18	25	3	11
September	7:00 PM	13 S.M.	27	20	12	26		4 - 5 - 6	17	23	2	10
October	7:00 PM	11 S.M.	25	18	15	24		2 - 3 - 4 30 - 31	16	23	1 31	9
November	7:00 PM	8 S.M.	29	22	12	21		1	15	21	30	8
December		12	27	20	10	no mtg		no camping	14	21	29	7

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 ** check website for time

NEAF Cherry Springs S.P. Stellafane Black Forest S.P. MegaMeet April 4 – 5 June 18 – 21 Aug 13 – 16 Sept 18 – 20 (not confirmed) May 22-24

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:

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