The Observer

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Cover image description: *Valentine's Day evening was very cold (15 degrees F,) so rather than move up closer to the fireplace, real imagers headed outside where the sky was clear and fingers and toes started to tingle very quickly. I've wanted to get star trails over this barn for quite a while, but unfortunately Emmaus and Allentown are directly behind the barn, so the ever-present light pollution makes images near the horizon particularly hard to acquire. It was my intention to have Polaris directly above the barn, but since I couldn't see it, or the Big Dipper or Little Dipper because of the light pollution, the image is a bit off-center from where I wanted it to be.This was a typical star trails shot but with a Lightroom CC tweak. I shot this in raw but forgot that the startrails programs prefer jpgs, so I uploaded the roughly 100 images to Lightroom CC, exported them as jpgs and then blended them using Starstax 2 and saved the final image as a jpg that I then tweaked a bit in LR CC to bring out the red and tan in the barn and knocked down some of the light pollution haze by adjusting the white balance. Camera settings were: Nikon D5500, ISO 2500, f/9.0, 50 mm, 20 sec. ss, Tamron SP AF 17-50 mm f2.8. Courtesy of Mike Waddell*

ad astra **********

Rarely, a 25% third-quarter moon happens twice in the same calendar month. The last time this happened was December, 2018, and the next time will be October, 2021. This unusual event is called a Coffee Moon, because it doesn't rise until well after midnight, and normal people would only see it if they get up early in the morning.

Did you know that? I hope not, because I just made it up. The part about it being called the Coffee Moon, I mean; the rest of it is accurate. But "Coffee Moon" is fake news. Of course, if the popular media gets hold of it, it will probably make the front page in 19 months. I'm getting tired of the news outlets fabricating headlines out of commonplace events, attributing colorful names and exotic traditions to something that is about as newsworthy as the little hand being on top of the big hand. But I sympathize, because here it is, time for me to write another Ad Astra, and I struggled to think of something to ramble on about. So, I guess we're going to cover some basic, but factual, naked-eye lunar astronomy.

Moon Factoids

The moon is a giant ball in the sky that shines because it is illuminated by the sun. This has been understood since ancient times; in fact, it is obvious to anyone with reasonable powers of observation and decent vision. I imagine that near-sighted people, way back then, must have wondered what was up with their friends who could really see the moon. Dude, what are you going on about, with the horns of the crescent moon? It doesn't have any horns, it's just this fuzzy blob in the sky. "Crescent" just means the same thing as "relatively dim," right?

But, hold a round object up to the daytime moon and you can see the obvious resemblance. I'm sure that some ancient hunter-gatherers must have noticed this, using a fruit or just a round rock, rather than a styrofoam ball stuck on a kabob skewer as pictured here. The moon goes through an orderly progression of phases every 29.53 days, revealing its angle of illumination in its phase, which is correlated with its angle to the sun in the sky. I believe this relationship has to be one of the earliest observations of geometric order in the natural world.

The Moon orbits Earth every 27.32 days, and Earth orbits the Sun every 365.25 days, and this is the origin of the 29.53-day "synodic month" of the visible phases. The formula is 1/29.53 = 1/27.32 - 1/365.25, give or take a few decimals. For all practical purposes, this has been a constant relationship for the entire existence of humanity. There is some variation to the character of each moon through the course of a year, due to the relative tilts and eccentricity of the orbits and axes, although this explanation was understood only relatively recently in our history. The patterns were simply recognized by the ancients, and taken advantage of. The Harvest Moon, for example, is so-called because it gave farmers an edge, a bit of extra light at the right time when the crops needed to come in.

The moon's position in the sky changes every night, but in a systematic fashion that is amenable to everyday thinking: it's roughly an hour later every day, a factoid pointed out to me by my Dad. The actual average is approximately 51 minutes, based on the orbital and rotational periods. This can be confusing stuff. The formula for the number of minutes is 24*60*(1/((365.25+1)/365.25-1/27.32)-1), and it took me a bunch of tries to get that right. (For these complex, gyrating astro-word-problems, I'm checking my work by generating custom ephemerii using the Skyfield library for the Python programming language.) So, if the moon is just over the peak of your neighbor's roof at 11:00 p.m. on any given night, it will be in about the same place, give or take, at 11:51 p.m. the following night.

The "give or take" part amounts to as much as about 6.5 degrees in 2020 (about 13 moons) and it comes from all of those tilts and eccentricities. Mostly, it comes from the tilt of the Earth's axis, which varies the angle of your viewpoint relative to the earth-moon plane over the course of a day. The moon's orbit is also inclined with respect to the plane of the system, by about 5 degrees, and the direction of this tilt precesses in an 18-year cycle, so the 6.5-degree amount also varies from about 4.5 to 7.5 degrees, on the same cycle. The next maximum is in 2024, when the 5.15-degree orbital tilt will align to enhance the effect of the 23.5-degree axial tilt.

And — that's too much detail. The simple rule is: one day later, almost an hour later, the moon will be in roughly the same spot with respect to your earthly surroundings. If you need more precision than that or you need to go more than one day, fire up your favorite planetarium program and just ask it. Let's get back to some rules of thumb that are useful for keeping track of our celestial buddy, without so much mental torture.

Rise and set times can vary by more or less than the 51 minutes, because the path of the moon makes an angle with the horizon that varies by the season. In Autumn, the rise time at full moon varies less than average, another benefit for ancient farmers — that bright nearly-full moon was there when they needed it for several days in a row. One thing to remember is that the full moon is opposite the sun in the sky, so it rises at roughly the same time that the sun sets, and vice-versa.

Going through a phase

The new moon is near the sun, of course, and the quarter-moons are halfway in-between. The third-quarter moon is only seen against a dark sky if you stay up really late, or get up early, since it rises at about midnight and sets at about noon. (Coffee Moon, remember?) First quarter is high in the sky in the early evening, a key factor in planning LVAAS Star Parties, where the moon is a favorite target. The way it worked out, there will be two May Star Parties this year. Maybe we should call that one the Confusion Moon.

The summer sun is high in the sky, and the summer full moon is low. Similarly, the winter full moon gets very high, opposite the low winter sun.

Besides all this thinking about the time of day, I know of two mnemonics that can help you tell, just by looking at the moon, whether it is coming or going. The first one I learned as a school kid: observe which way the crescent moon is oriented in the sky, compared to a capital "C" (the horns pointed to the right) or "D" (horns pointed left). Associate D with "Daring," meaning that the moon is coming on, waxing, growing towards fullness. A "C" moon is "Coy," waning in brightness as it moves closer to the sun.

The other is from a song by my favorite band: Cowboy Junkies' *Crescent Moon*.

> *Reach a hand to the crescent moon*
> *Grab hold of the hollow*
> *If she sits in the palm of the left*
> *That moon will be fuller tomorrow*
> *If she sits in the palm of the right*
> *That moon is on the wane*
> *And the love of the one who shares your bed*
> *Will be doing just the same*

Both of these mnemonics only work in the northern hemisphere (and that last one's prognostication of romantic failure works best, I guess, after Valentine's day is over with.)

Hot Dogs

Speaking of Star Parties, the first one is coming up in a few more weeks, and I am starting to get ready. The inventory of sodas and snacks in the Red Shift needs to be brought up to snuff, and I need to make sure that the equipment and supplies are in order. It's not a lot, but it is really the responsibility of the LVAAS Member Services Director, an open position which I am filling on an acting basis. If you are interested in taking your volunteer contribution to LVAAS to the next level, and becoming a member of the LVAAS Board, please get in touch! I promise you I will give you lots of help so it won't be too much work for you.

Ad Astra!

— *Rich Hogg*

LVAAS General Meeting - Open to the Public

Sunday, March 8, 2:00 p.m.

Trumbower Hall, Muhlenberg College, Allentown, PA

"Night Sky Photography"

featuring

Steve Miller

Steve is a lover of all things outdoors. His outdoor passions include mountain biking, hiking, camping, trail building and photography. He especially loves to experience and photograph dark night skies! Steve is an equipment specialist, staff trainer and photography instructor at Dan's Camera City. He has been with Dan's since 2004. Steve has led several photography workshops including waterfalls, birds in flight and of course, photography of the night sky.

Minutes for the LVAAS General Meeting - February 9, 2020

The February 2020 LVAAS General Meeting was held at 2:00 p.m. on Sunday, February 9, at Trumbower Hall, Muhlenberg College in Allentown PA. Approximately 65 people were in attendance. Director Rich Hogg opened the meeting at 2:05 p.m. and introduced the guest speaker, Clif Ashcraft, PhD.

Clif is a retired chemist (organic and polymer synthesis) and has a PhD from Berkeley and a BS from the University of Cincinnati. He enjoys singing, computer music, building telescopes, taking planetary images with a webcam, double star observation and hanging out with his dog, Chewbacca. He is a member of Philomusica as a tenor, and Amateur Astronomers, Inc. His astronomy club, AAI, meets on the campus of Union College. Clif's scopes include a CPC-1100EdgeHD, a 10" Newtonian, a 12.5" Newtonian, a 7.25" Schupmann Medial, a 13"Schupmann Medial, and a C14.

Clif discussed some of the challenges of observing Mars. As Mars gets closer to the Sun, it presents a greater opportunity for dust storms, making observations and imaging difficult. Many of these dust storms can engulf the entire planet. Clif took us through a slide presentation of his observations, describing the events of each evening, the challenges of each observation and the methods he used to overcome those challenges. The results of his innovations yielded detailed images from what were initially blurry views. He closed by noting that Mars will be closest to the Sun in late July and will be in opposition in early October. Let's hope for no dust storms. After Clif's talk, there was a brief intermission and the meeting moved to LVAAS business:

Meetings:

There is an Astroimaging meeting on Thursday, February 13 at South Mountain.

Tom Duff also gave a reminder about NEAF coming up in April.

The next Board of Governors meeting is on Sunday, February 23 at South Mountain.

Treasurers Report: Scott Fowler

2020

Scott reported $7,717 income and $7,118 expenses.

Actually only $3260 in expenses if you consider that $2450 was for the 40" optical set and $1390 was for the new planetarium bulb which came from the general reserve.

Of the $7717 income, $6290 was from dues.

Donations can be made directly at meetings, through the United Way and also via Amazon Smiles.

The general reserve is at $43,254.

Additional funding will be required for the roof at South Mountain.

Membership: Gwyn Fowler

2nd Readings:	**1st Readings:**
Michael Salter	Jeff Lovaasen
Madison Salter	Jocelyn Myers
Leon Homm	Becca Lamar
Jim Thoma	
Matthew Urich	
Bradbury (Brad) Pomeroy	

Star Parties: Carol Kiely

Carol is looking for volunteers to assist with the Star Parties that will resume in March. She is 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. The March 7th Star Party talk will be on Space Rocks.

The Director of Member Services position is still open. Rich has been covering it but would like a volunteer to relieve him. Position entails running the Red Shift, as well as getting supplies for the Red Shift, summer picnic, and the holiday party. If anyone is interested, please let Rich know.

LVAAS Book Club: Blaine Easterwood

Blaine is looking to start an LVAAS Book Club. This is his Plan:

Step One: Express your interest. If you are interested, contact Blaine.
Step Two: Choose a book. Books being considered are

- Astrophysics for People in a Hurry, by Neil deGrasse Tyson
- The Future of Humanity, by Michio Kaku
- A Brief History of Time, by Stephen Hawking
- Moonshot: What Landing a Man on the Moon Teaches Us About Collaboration, Creativity, and the Mind-set for Success, by Richard Wiseman
- The Trouble with Gravity: Solving the Mystery Beneath Our Feet

Step Three: Set the meeting schedule.
Step Four: Read, enjoy, discuss, and learn!

Articles for Sale:

Dave Raker has some items from the library: books, a DVD, and a T-shirt.

Announcement:

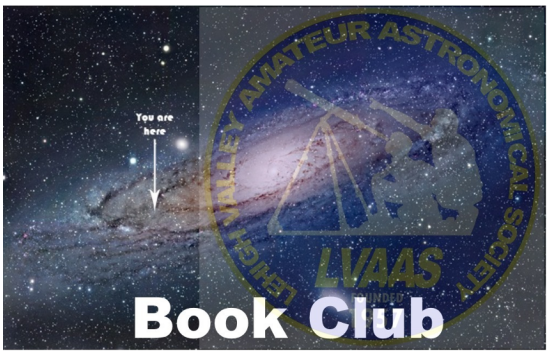
Dave Moll has stepped down from his Board positions as Director of Risk Management and Director of Light Pollution Abatement. A proposal is being considered to amend the bylaws to remove these two board positions. Dave's contributions to LVAAS have been extremely valuable over the years. Dave will remain a member of our greater team, though not a member of the Board.

Next General Meeting:

The next General Meeting will be 2:00 p.m. Sunday, March 8 at Trumbower Hall, Muhlenberg College in Allentown PA. The speaker will be Steve Miller, discussing Astrophotography.

The meeting was adjourned at approximately 3:30 p.m.

Submitted by Dennis Decker, Secretary



Looking for something to read? Looking to share the experience with fellow LVAAS members? Join our book club!

Here's the Plan:

Step One: Express your interest. If you are interested, let me know either in person, or via email: blaine@ieee.org. I will add you to our private Facebook group. If you don't have Facebook, let me know, we can setup an email list and communicate that way too.

Step Two: Choose a book. We will do this via our private Facebook group and email (if there are any who do not use Facebook.) So far the following are in the running:

1. The Big Picture, by Sean Carroll
2. Astrophysics for People in a Hurry, by Neil deGrasse Tyson
3. Moonshot: What Landing a Man on the Moon Teaches Us About Collaboration, Creativity, and the Mind-set for Success, by Richard Wiseman
4. The Trouble with Gravity: Solving the Mystery Beneath Our Feet

Step Three: Set the meeting schedule. Our plan is to meet in the library, but we can augment that with online conversations.

Step Four: Read, enjoy, discuss, and learn! We can do this both in-person and through online discussions.

This is the first time we are doing this, so I consider it "experimental." I am completely open to suggestions and changes as we go.

Thank you!

Blaine Easterwood, Education Director

Exciting, New, Live-Action Game!!!

RED SHIFT REVENUE

- **Operate an Astronomy Club Gift Shop!**
- **Optimize product lines!**
- **Purchase inventory!**
- **Manage production!**
- **Complete sales!**
- **Report revenue and expenses to the Board!**
- **Help a great organization do a valuable public service!**

As our LVAAS Member Services Director, you will enjoy the challenge of operating the Red Shift Gift/Snack Shop at LVAAS Public Star Parties.

The only way to lose is to not play!

Contact *director@lvaas.org* to sign up!

ASTRONOMY EQUIPMENT FOR SALE

I am continuing to draw down equipment that is left over from my astroimaging adventures. I still have the following equipment for sale, most of it like new, at a substantial reduction from the original cost.

For inquiries or to express interest, please contact me by e-mail at polaris41n@outlook.com

Dave Moll

	ORIGINALLY	YOUR PRICE
Celestron 9.25 Schmidt-Cass (not Edge), OPTICAL TUBE ONLY, like new, with T-adapter, 2" diagonal, f6.3 reducer/corrector, Borg SCT thread 2" filter cell, both Vixen and Losmandy bottom rails, ADM Vixen top rail, flexible dew shield. -Requires suitable mount-	$1,835.00	**$1,300.00**
12" Vixen rail, male-to-male adapter	$39.00	**$20.00**
Telrad finder with Vixen shoe	$36.00	**$20.00**
T-adapter for Celestron Edge HD 9.25/11/14	$58.00	**$30.00**
Chesire collimator, 1.25"	$40.00	**$20.00**
Orion Lasermate collimator, 1.25"	$50.00	**$25.00**
Astronomik CLS CCD imaging LP filter, 1.25"	$100.00	**$50.00**
Neewer moon filter, 13% T, 2" dia.	$17.00	**$10.00**
Uranoport "piggyback" 1.5X Barlow (mounts like a 1.25" filter)	$75.00	**$40.00**
SCT counterweight, 4 pounds, mounts on front end of Losmandy mounting rail, counterbalance for imaging train	$65.00	**$35.00**
3 ea. add-on counterweights, 1 pound each, screw into a drilled & tapped toe saver, and/or into each other (piggyback)	$25.00/ea	**$15.00/ea**
ADM Vixen rail camera mount (1/4X20 tripod screw)	$55.00	**$30.00**
10" diameter Astrozap heated dew shield, slight crack on stitching line, perfectly operational	$82.00	**$40.00**
3 ea. Tube adapters, purpose unknown	?	**FREE**
Also: Huge selection of electrical cables, etc: All cables & adapters $2 each, power supplies $5 each		

From the LVAAS Archives:

The Total Solar Eclipse of March 7, 1970

by Sandy Mesics

In the March, 1970 Observer, Richard Cressman noted that 31 LVAAS members and assorted friends had plans to observe a total Solar Eclipse in Lumberton, North Carolina. Most of the LVAAS members observing this event stayed at the Redwood Motor Lodge on I-95 just north of Lumberton.

On the morning of Saturday, March 7, 1970, the LVAAS contingent of 36 people set up at Jones Lake in Bladen Lakes State Park near Elizabethtown. Twenty-two members used telescopes, cameras and other equipment to observe. Interestingly, the Observer reported “A safe way to view the partial phases will be to project the solar image onto a screen or view through two thicknesses of completely exposed and developed black and white film.”

While there were scattered clouds and thick fog in the early morning hours, they lifted by at 9 a.m. As first contact approached at 12:10 p.m., the temperature was 65°F. Fifteen minutes later it was 62°F, and some minutes after the end of totality, bottomed out at 55°F.

1. Members assemble at the observing site.

Totality began at 1:28 p.m., and Bailey's beads were visible, followed by the diamond ring effect. The Observer reported that "A chorus of sighs followed by spontaneous applause rang through the air and, as if to reply, Venus seemingly blazed into view as the ring quickly faded into totality."

2. Ernie Robson observing the eclipse.

Totality lasted from 1:28 p.m. to 1:33 p.m. According to The Observer, "At the site, cameras clicked and whirred as observers exercised their practiced procedures in an attempt to capture shadow bands, Bailey's beads, diamond ring, coronal studies, prominences, and comets near the sun." Members' projects included shadow band photography, comet search, coronal studies, photography, and environmental changes." Observations continued throughout the evening. Last contact was at 2:46 p.m.

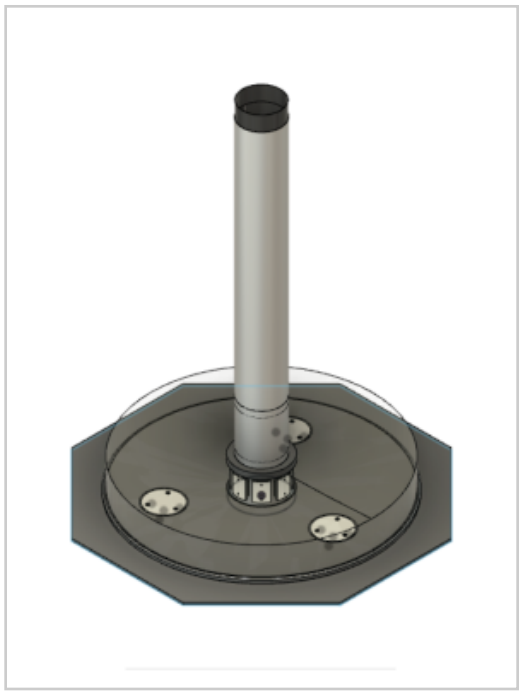
Afterwards, LVAAS culled over 350 slides of the eclipse and offered two sets for sale: one of totality, consisting of 28 slides, and one set of the site, members, and equipment, consisting of 18 slides. Apparently, Kodak had problems duplicating the slides, and there were many rejections. The Observer noted, "...this ... is quite disappointing. We are frankly very puzzled that a firm of such high stature... should come up with such mediocre work."

3. Members observing the eclipse.

The author isn't sure if the slide set was ever published. No further information was available in either the subsequent meeting minutes or in subsequent issues of The Observer.

Schlegel Observatory Report

by Rich Hogg – March 2020



This month I'm presenting a design that I've worked out for a central hub support for the main mirror.

First, a recap: the mirror needs to be supported in two directions. The "axial" support, up and down in the illustration at right, takes the mirror's weight when the telescope is pointed more or less straight up. It is composed of three adjustable collimation pads and an airbag. It was designed and built years ago and we think it will work fine.

The "radial" support handles the other direction, side-to-side in the illustration, but the direction that gravity will attempt to pull the mirror when the target is low in the sky. This aspect of the design has never been completed. The "concrete mirror" that served as a stand-in for the glass during construction was supported in a way that is not suitable for the glass.

While it might seem obvious to design something that would cradle the mirror around the outside rim, I've done some analysis that seems to indicate that a central support, like the hub of a wheel, would perform better. And, I think it will be easier to build. So, I've worked out a complete design that I am presenting this month. I plan to do some further analysis and prototyping of parts of it before committing to anything, but I think this idea is probably good enough. However, I also think it might be improved.

I'm asking for help. If you are mechanically inclined, please look over what I've done and give me your ideas. Whether you want to suggest improvements to this design, or a whole different approach to the problem, I'm all ears. I plan to work on something else for a while and then come back to this, with the benefit of some reflection and hopefully some great ideas from other members. This is a challenging part of the design and I'm not ready to declare it finished.

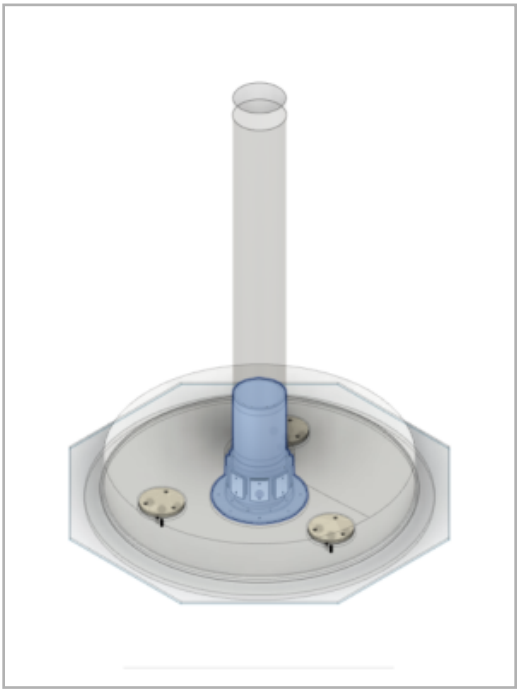
Requirements **-** a hub support system needs to accomplish the following:

- support the approx. 430-pound weight of the mirror when the telescope is pointed horizontally, in *any direction* (this rules out the sling-based rim support typically used on large Dobs)
- distribute the support evenly over the glass surface of the central 8.55-inch-diameter hole (4.3 in. thick at the edge of the hole)
- allow the mirror to move no more than about 0.025 inch under gravitational load in the radial direction
- allow thermal expansion of the hub structure by about 0.006 inch in radius relative to the glass, due to thermal expansion, without undue strain on the glass
- allow the mirror to tilt slightly to allow for collimation adjustment

The thermal expansion requirement necessitates some form of compliant element, or "suspension," to absorb the expansion. The tolerance for some movement makes it possible to include this. Part of the reason that we can tolerate this movement is because it is in the same direction that the truss will deflect and the secondary mirror will also move, so they will to some extent cancel each other out. And, since the tolerance for movement is over 4 times the thermal differential, we should be able to keep the maximum stress from thermal expansion to less then 1/4 the stress from gravitational load.

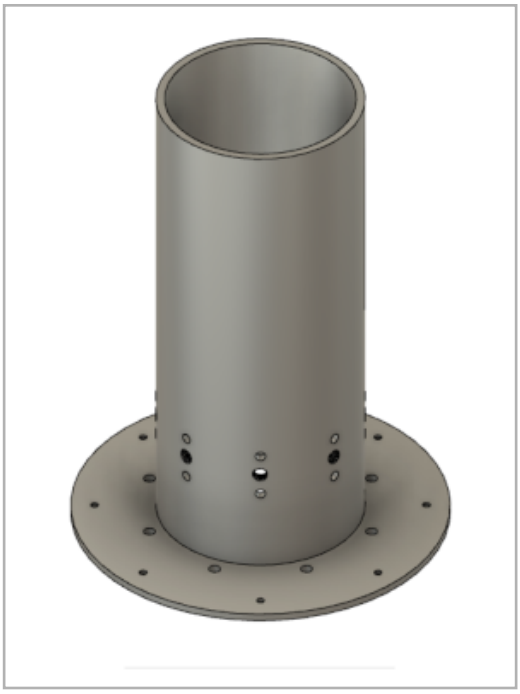
(Note that this equation does not work as well if we tried to do the same thing with a rim support. The linear dimension of the expanding metal is almost 5 times greater - 20 in. from the center versus 4.25 - so we would have to tolerate a lot more stress on the glass and/or a lot more movement under load.)

In addition to supporting the mirror, the hub system (highlighted in the illustration below right) also needs to allow for mounting the main baffle tube, as well as a retaining ring to prevent the mirror from sliding off the hub when the telescope is pointed slightly below horizontal (which can occur during maintenance activities.) For this reason, the hub structure extends above the height of the mirror by some amount (I chose 10 inches in this exercise.)



In the following pages we'll go through the elements of this proposed design. We'll do this from the inside, working out, although that is not the order in which it would be assembled.

We start off with the basic structural element, which I call the "hub." It's made out of either stainless steel or aluminum, as are all the other fabricated metal components. Each choice has its pros and cons. Stainless steel is stronger and has a lower coefficient of thermal expansion than aluminum. However, it is harder to machine, and heavier. The hub would weigh over 30 pounds in SS. I think the design will be OK in either material, although I lean towards SS just to have the confidence of the stronger material and the lower CTE.

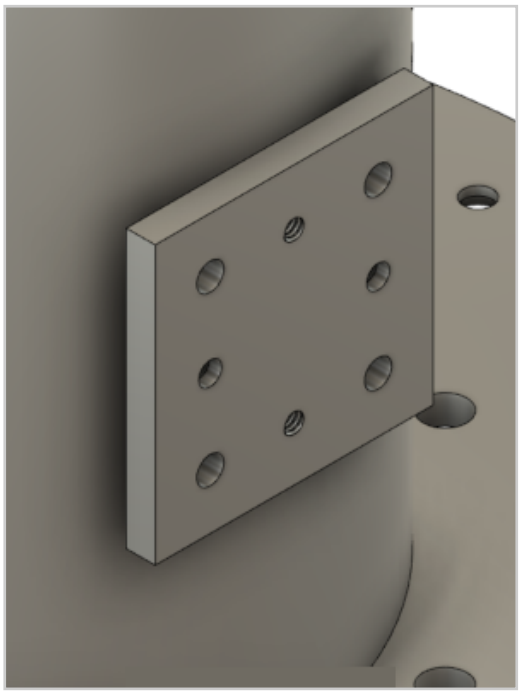


I've designed around the idea of a section of Schedule 40 pipe, which is readily available, with a diameter of 6 in. This needs to be welded to a flange with a matching ID and a 12 inch OD. I don't think we need "machined tolerances" here, but we need to keep the flange very flat and parallel, since it forms the datum around which the entire telescope will be aligned. We need to keep the pipe section perpendicular to and centered on the flange to within (I'm guessing) about 0.05". The thicknesses are 1/4". (If we cannot meet those tolerances in the fabrication, we might need to start off with thicker material and then machine it.)

There are holes in the flange, for mounting and for access to the remaining components for inspection, and holes in the pipe for mounting. I am not showing the mounting for the retaining ring and the baffle; they still need to be worked out, but should be fairly simple. Now we'll look at the mounting holes for the suspension/support structure.

What we have is a pattern of 3 holes, that is repeated 8 times around the pipe, and needs to be at the correct height to support the mirror evenly. The center hole is tapped for a 1/2-13 set screw, which pokes through from the inside of the hub. The other two holes are for retaining screws, needed to hold everything together during assembly, but which I've designed to be spring-loaded and loose to allow movement.

The set screw would be backed off by a turn or two for assembly, and then advanced to bring the rest of the system into contact with the inside of the hole in the mirror. We would also pre-load the "suspension" a little bit, depending on temperature, so that everything would remain snug as the metal contracted, to the coldest anticipated operating temperature.

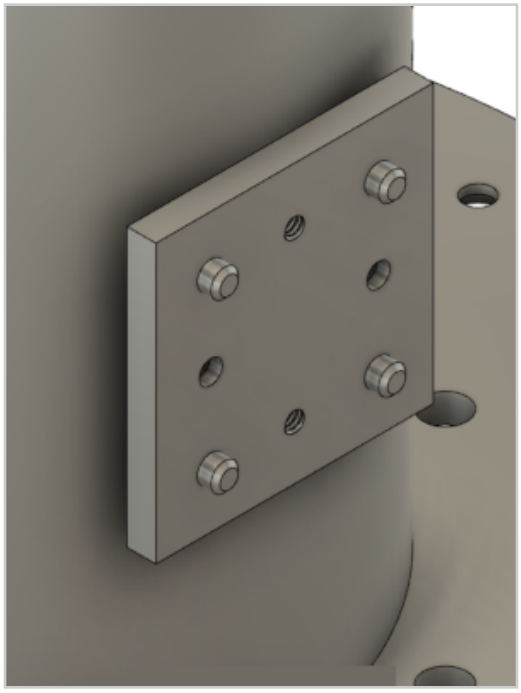


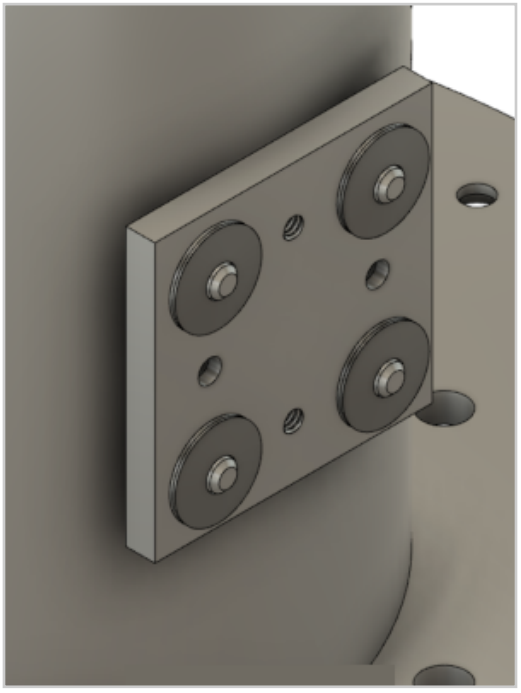
Here, in the image at left we see the next component, the inner plate. It's a flat piece of metal 1/4" thick with some holes, and a socket machined into the inner side that sits on top of the set screw. Thus, the inner plate can swivel and rotate by a few degrees on the tip of the screw, more than enough to allow for the movement that we need for collimation.

It's held in place during assembly by two spring-loaded screws, as shown in the at right, in a view from inside the hub. The holes (hidden by the washers under the springs) are oversize to allow for the movement.

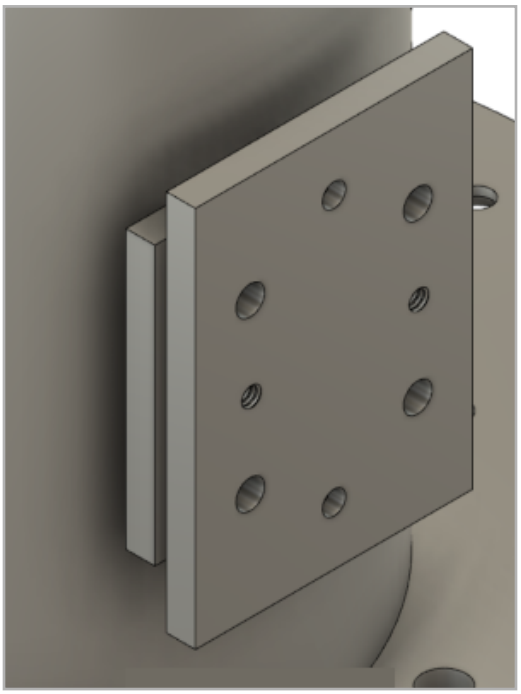
We press-fit four short steel pins into the holes in the corners, as shown here. These are 6mm pins , slightly less than 1/4".

These pins serve as guides for four stacks of Belleville disc springs, McMaster part number 9713K18, There are two springs per stack, in a face-to-face configuration that doubles the displacement of each spring for the same force applied. The springs have a 1/4" center hole, which should move freely on the 6mm pins (though we will need to test this.) The arrangement is shown to the right. These springs in this configuration should meet our requirements to cushion the force of thermal expansion while permitting only an acceptable movement under gravitational load.

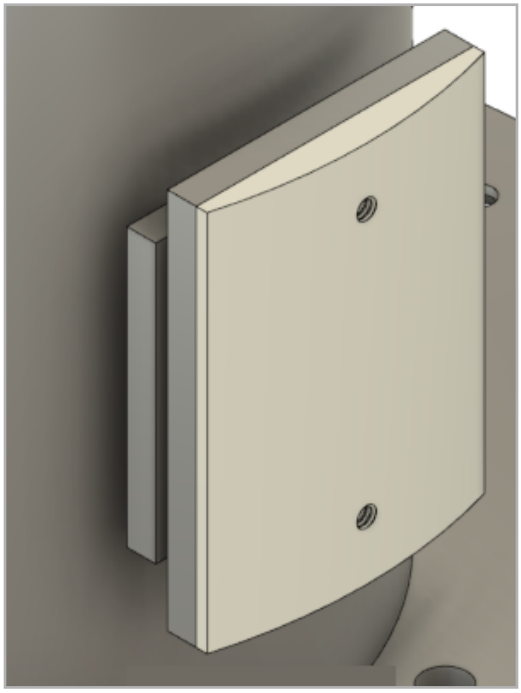




To finish that sandwich we need the outer plate, another piece of either SS or aluminum 1/4" bar stock. It is fastened from the back with a pair of screws, with holes big enough for the inner plate to slide on, allowing the springs to work. It has holes to receive the tops of the pins, again large enough (1/4" +) so they can move.



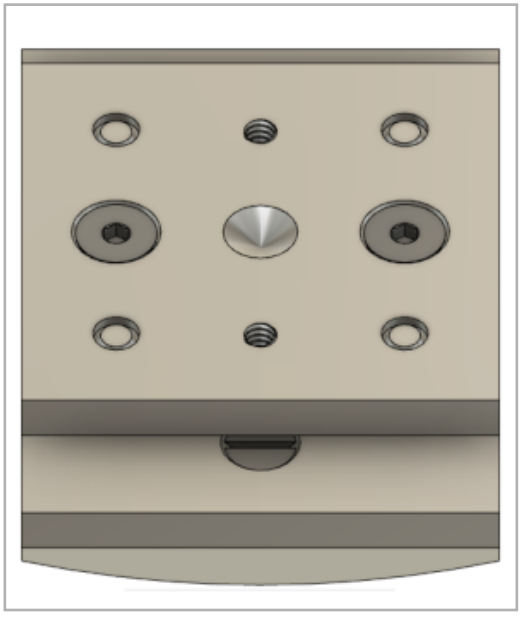
Finally, see image below left, we have a plastic pad, something like nylon, Delrin, or maybe even Teflon. It needs to be CNC machined or 3-D printed to match the inner curvature of the hole in the mirror, and we want it to be able to slide a bit on the glass. We don't want metal touching the glass; we want something slightly softer, to spread out the stress evenly. It's held on by nylon screws, from the back side.



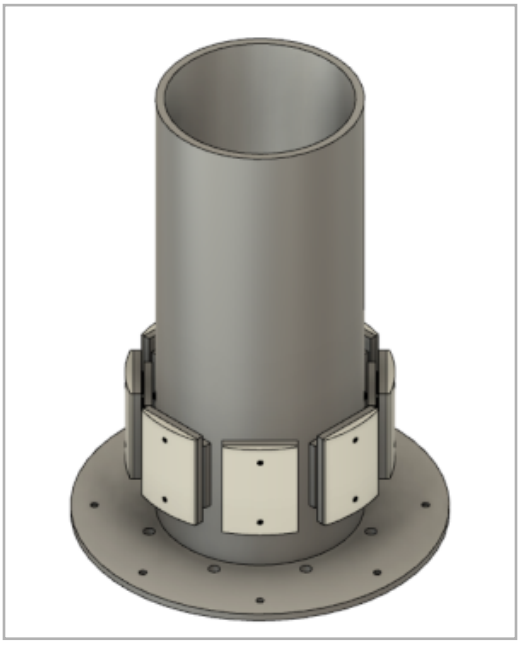
(I'm thinking about the idea of adding a thin layer of something even softer, such as some sort of rubber, but then we would need a layer of Teflon film or something to enable the sliding.)

At bottom left we have a rendering of the entire pad/support assembly, so that you can see the socket for the set screw/ball joint arrangement, and the screws holding the layers together. Obviously it would need to be assembled from the outside in, opposite to the order I presented it.

The entire system includes eight of these assemblies, arranged evenly around the hub.



On the next page, we'll wrap this up with a couple of cross-section views for another way of visualizing how everything fits together.



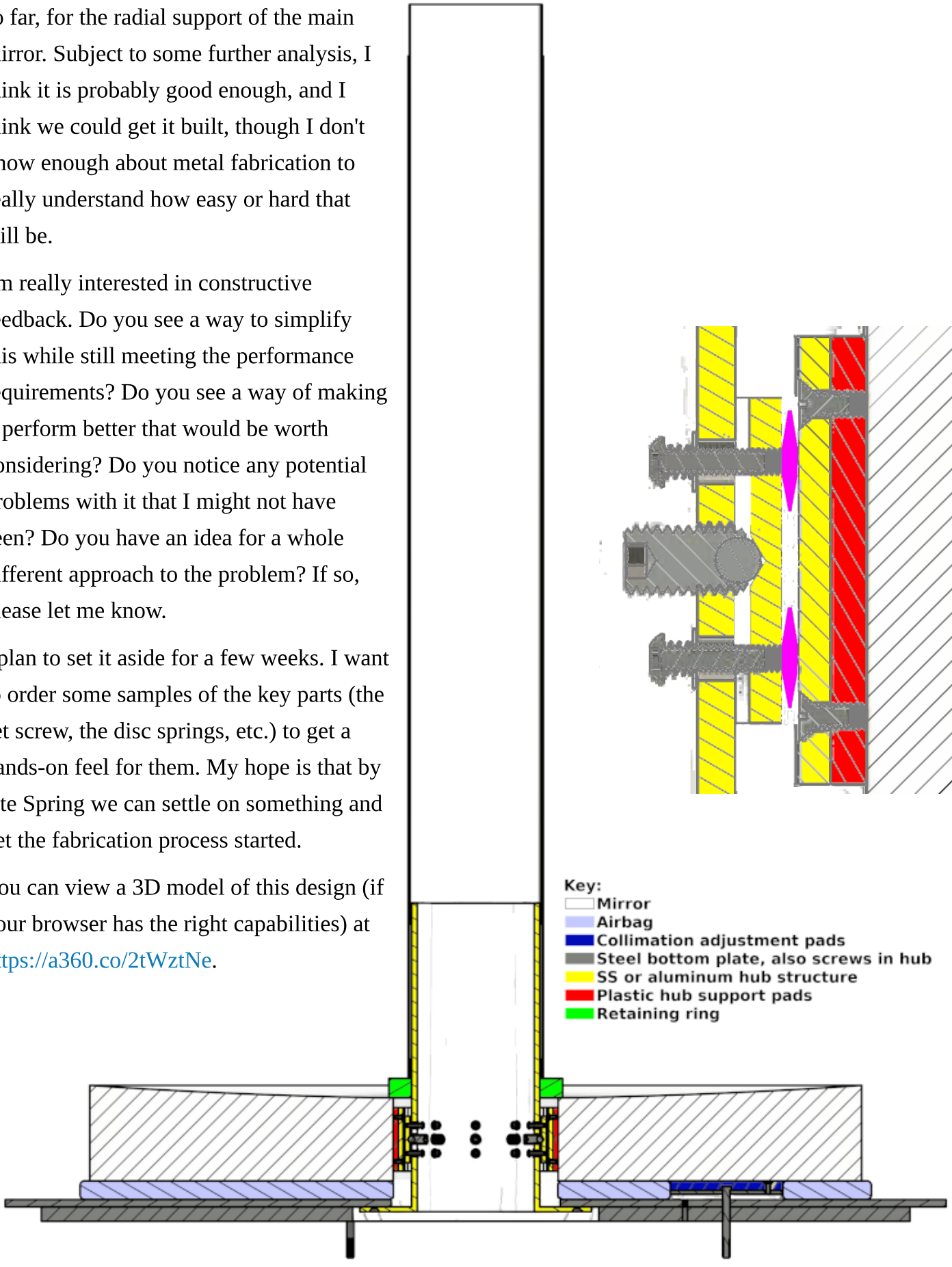
For scale, each pad is 2.4 in. wide by 3.3 in. high.

So this is the best idea I've come up with so far, for the radial support of the main mirror. Subject to some further analysis, I think it is probably good enough, and I think we could get it built, though I don't know enough about metal fabrication to really understand how easy or hard that will be.

I'm really interested in constructive feedback. Do you see a way to simplify this while still meeting the performance requirements? Do you see a way of making it perform better that would be worth considering? Do you notice any potential problems with it that I might not have seen? Do you have an idea for a whole different approach to the problem? If so, please let me know.

I plan to set it aside for a few weeks. I want to order some samples of the key parts (the set screw, the disc springs, etc.) to get a hands-on feel for them. My hope is that by late Spring we can settle on something and get the fabrication process started.

You can view a 3D model of this design (if your browser has the right capabilities) at https://a360.co/2tWztNe.



StarWatch

by Gary A. Becker

Dead Serious about Sirius

High school students would come up to me every semester and ask, “Are you serious about that, Mr. Becker?” I’d look the learner right in the eye and say, “No, I’m Procyon.” Needless to say, there was a look of confusion on the students’ faces. I’d just continue onward with the discussion. Finally, the day would happen when under the stars of the Allentown School District Planetarium (now the Learning Dome) I would be identifying Canis Major - the Great Dog - and its principal star Sirius, also referred to as the Dog Star, the brightest luminary of the nighttime sky. Then I’d move to Canis Minor the Little Dog, and identify its alpha star, Procyon. I’d pause after saying Procyon. The room was silent, and then a few students would begin to laugh.

Both Sirius (pronounced like serious) and Procyon are currently visible right after dark at 7:30 p.m. Sirius is literally due south, and Procyon will be above and to the left of the Dog Star. The word, “Procyon,” comes to us from the Greek and means “before the dog” because in the late autumn, Procyon rises about a half hour before Sirius breaks the horizon. It is often mistaken for the Dog Star, so Procyon too is a barn burner, the eighth brightest star of the nighttime sky. To Sirius’ right and above it can be found what is normally the 10th brightest star of the night, red supergiant Betelgeuse, but currently, as reported in several recent StarWatch articles, Betelgeuse, the left shoulder of Orion as we view him, has taken a nosedive in brightness, standing somewhere around the 26th brightest star this week (Feb.23) and about as bright as Bellatrix, the bright bluish shoulder star to the right of Betelgeuse. The three stars form the Great Winter Triangle, but with Betelgeuse dimmed, perhaps clouded in dust, the GWT leaves something to be desired.

If I’m correct in my magnitude estimate (Friday, Feb. 22), I believe that Betelgeuse is starting to brighten—no supernova this time, and hopefully as spring dawns, the GWT will begin to look more like itself before it sets right after darkness in mid-April, but what about the major actor of the Great Winter Triangle, Sirius? It is its lowest member in altitude, grazing the tops of my neighbors’ trees, twinkling like a mad dog because of the thicker, more turbulent layers of atmosphere that its light must penetrate. This rapid scintillation (twinkling) sometimes enhances its beauty with a spectrum of flashing colors.

Its normal, slightly bluish hue is a condition of its larger mass, twice that of the sun. This creates greater internal compression in its core and higher temperatures which cause its nuclear furnace to produce energy at a faster pace than our white sun. Yes, the sun is actually a white star, not yellow as most people think.

Although Sirius' energy output is equivalent to just over 25 suns, its distance of only 8.6 light years also contributes greatly to its brightness. It will continue to get brighter for the next 60,000 years as it approaches our solar system, but it should remain the brightest star of the night for at least the next 200,000 years. A star like Sirius has enough fuel to sustain its energy output for about one billion years, after which it will evolve into a red giant, eventually shedding its outer layers, revealing its dead core—a white dwarf star.

Since Sirius has a white dwarf companion, Sirius B, about the same age as the main star, Sirius A, the white dwarf must have been a more massive and brighter luminary that went through its evolutionary stages faster than the Dog Star, first tapping into its hydrogen supply as Sirius is doing now, and then late in life burning its helium, becoming a much brighter red giant star, creating quite a spectacle for early Homo sapiens who roamed northern Africa and Eurasia about 100,000 years ago.

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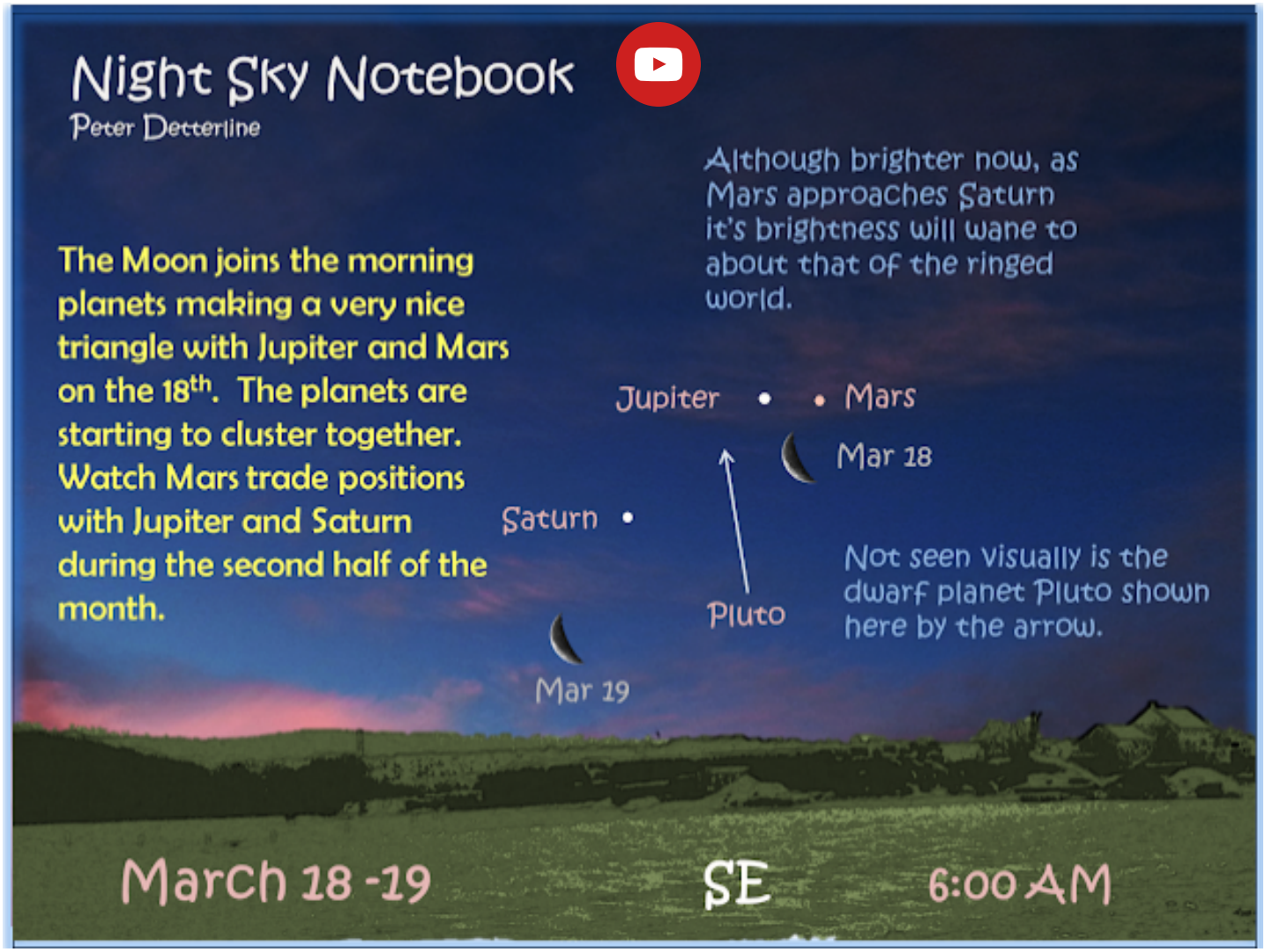
astronomy.org facebook.com/StarWatchAstro/

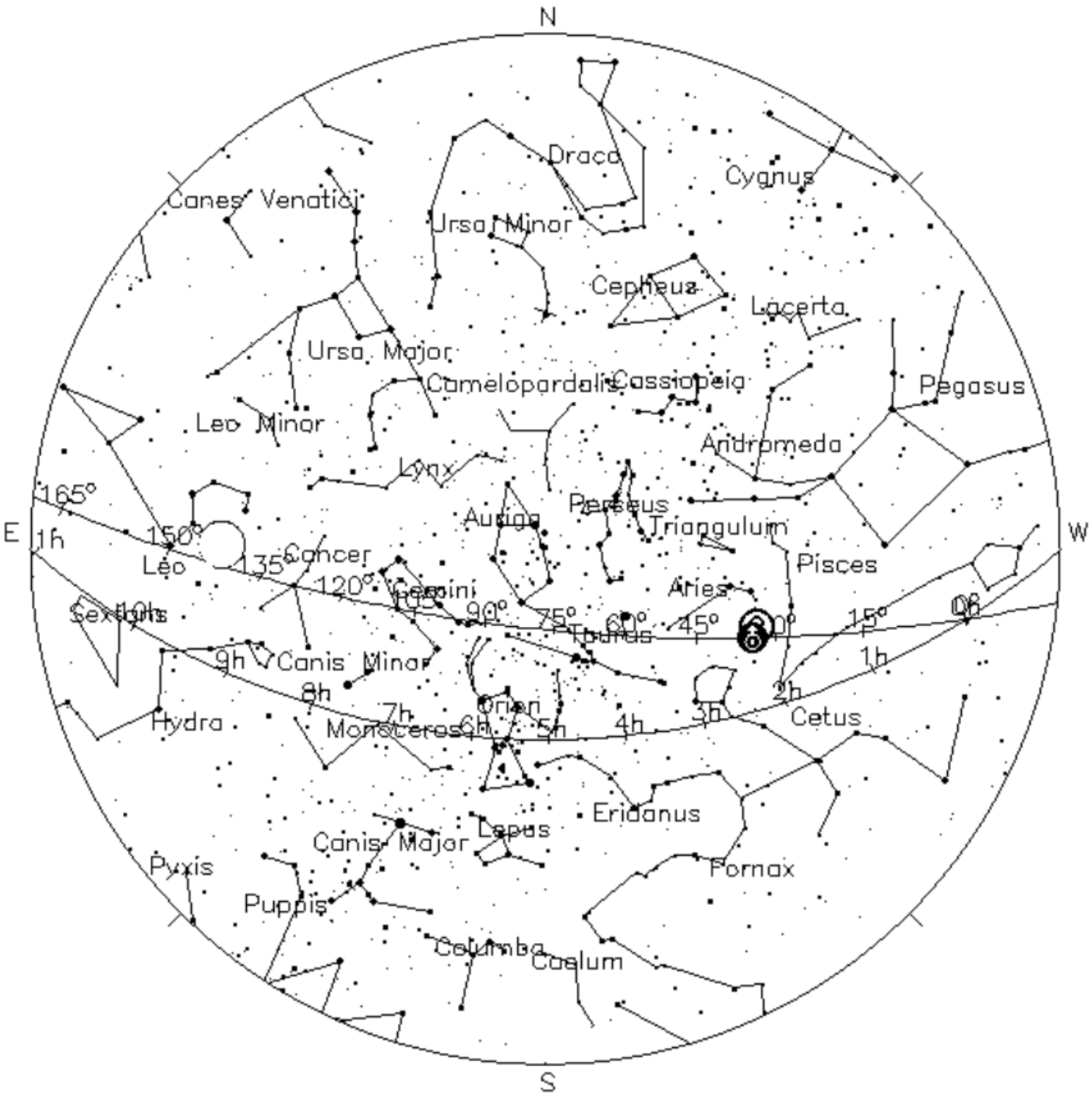
Night Sky Notebook for March

by

Pete Detterline



Sky above 40°33'58"N 75°26'5"W Saturday March 7 2020 23:00 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

Customize Your Sky -> *at* : http://www.fourmilab.ch/yoursky/

MARCH 2020

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
01	First Quarter Moon 02	03	04	05	Scouts at Pulpit Rock 06	Scouts at Pulpit Rock 07 Star Party
Scouts at Pulpit Rock 08 General Meeting - 2:00 PM Muhlenberg	Full Moon 09	10	LVAAS Scout Group 11	Astro Imaging - 7:00 PM 12	LVAAS Scout Group 13	14
15	Last Quarter Moon 16	17	18	LVAAS Scout Group 19	20	21
Deadline for submissions to the Observer 22	23	New Moon 24	25	26	27	28
LVAAS Board of Governors Meeting 29	30	31				

APRIL 2020

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
			First Quarter Moon 01 LVAAS Scout Group	02	03	Star Party 04
General Meeting - South Mountain 7:00 PM 05	06	Full Moon 07	08	09	10	11
12	13	Last Quarter Moon 14	15	16	17	Astro Imaging - 7:00 PM 18
Deadline for submissions to the Observer 19	20	21	New Moon 22	23	24	25
LVAAS Board of Governors Meeting 26	27	28	29	First Quarter Moon 30		

2020 LVAAS Event Calendar

2020 LVAAS Event Calendar

	Sundays				Thursday	Saturday	Mondays	Multi-Day Weekends	Moon Phase			
	General Meeting time	Date/location	Board meeting	Observer 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
May	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	April 4 – 5
Cherry Springs S.P.	June 18 – 21
Stellafane	Aug 13 – 16
Black Forest S.P.	Sept 18 – 20 (not confirmed)
MegaMeet	May 22-24

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: 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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LVAAS members please feel free to submit ads for astronomy equipment you have for sale, and additionally you may sponsor a maximum of three ads from non-members per year. Every attempt will be made to include submissions in a timely manner.

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