nightwatch
Newsletter of the Pomona Valley Amateur Astronomers

They don't tell me nothin' So I find out all I can.
Phil Collins

CHECK OUT PVAAs YOUTUBE CHANNEL

Volume 43 Number 8 ***nightwatch*** **August 2023**

Club Events Calendar

Aug 4	**IN PERSON General Meeting - 6:00 PM**
	Tim Thompson "JWST"
Aug 12	**Big Bear – BBVAS Astronomical Star Party**
Aug 19	**Star Party – GMARS**
Sep 16	**Star Party – GMARS**
Sept 20	**Board Meeting**
Sep 29	**General Meeting - Time TBD**
Oct 14	**Star Party – Joshua Tree Night Sky Festival**
Oct 18	**Board Meeting 6:15 PM**
Oct 27	**General Meeting Time TBD**
Nov 8	**Board Meeting 6:15 PM**
Nov 9-12	**Nightfall www.NightfallStarParty.com**
Nov 17	**General Meeting - Time TBD**
Nov 18	**Star Party – GMARS**
Nov 29	**Board Meeting 6:15 PM**
Dec 9	**Holiday Party**

PVAA Officers and Board

Officers

President ….....	Mathew Wedel	909-767-9851
Vice President ..	Joe Hillberg	909-949-3650
Secretary	position is currently open	
Treasurer	Gary Thompson	909-935-5509

Board

Jim Bridgewater (2024).....	909-599-7123
Richard Wismer(2024)	
Ron Hoekwater (2023).....	909-706-7453
Howard Maculsay (2023)……	909-913-1195

Directors

Membership / Publicity....	Gary Thompson .	909-935-5509
Outreach	Jeff Schroeder	909-758-1840
Programs	Ron Hoekwater	909-391-1943

PVAA General Meeting 07-07-2023

Giant Sundials in Italian Cathedrals

The PVAA General Meeting's main speaker of the night was Gary Fix. Gary toured Italy and visited many cathedrals, focusing on the sundials built into the wall and floor. The floor will have a usually metal line running exactly North and South. A small diameter hole, or Oculus, usually high up the Southern facing wall, steeple, or ceiling, shows the sun as a dot on the floor or wall. The metal line is delineated into days of the year, with the summer and winter solstice at North and South ends respectively. The spring and fall equinoxes are in the middle. Astronomers called these lines Meridian Lines, while the Italians called them Gnomons. Using this meridian line, you could accurately determine the Vernal (Spring) Equinox. This would in turn have the church determine when Easter should be celebrated, which is the first Sunday after the first full moon, after the Vernal Equinox. The reason Italy has so many churches with meridian lines is because Italy started out with many city-states, each being their own government entity. Each needed to know when the Vernal Equinox was, without relying on another city-state.

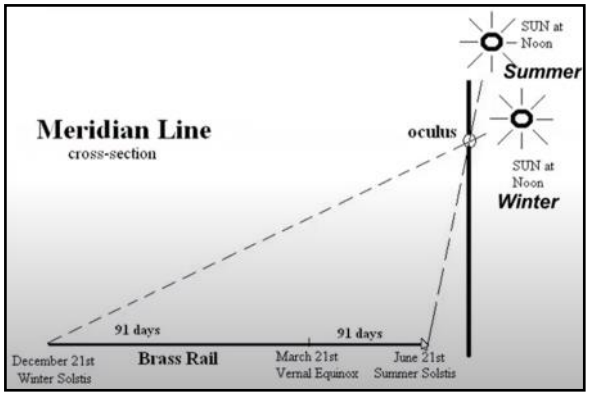
The San Petronio Duomo Church in Bologna has the longest meridian line in Italy at 219.2 feet. Gary was able to go to Mass in this church and take several pictures of the Oculus and meridian line. This means the image of the sun moves more than a foot each day, making it easy to show each day of the year on the floor. At the Santa Maria degli Angelie e dei Martiri in Rome the Oculus is in the southern wall instead of the ceiling. They have, in seven languages, what the meridian line is, its significance, and made it artistically beautiful. Some churches, not knowing its significance, would have the meridian line covered by rugs. In Milan the meridian line continues up the northern wall from the floor, to mark the first day of winter.

After studying the various Meridian Lines for many years, a solution to the drift of the equinox day was proposed, and Pope Gregory decreed that Thursday October 4th was to be followed by Friday October 15th, to put the calendar back on track. Also: The rule for leap years is:

> Every year that is exactly divisible by four is a leap year, except for years that are exactly divisible by 100, but these centurial years are leap years if they are exactly divisible by 400. For example, the years 1700, 1800, and 1900 are not leap years, but the year 2000 is.—*United States Naval Observatory*[2]

Some churches still use the old Julian Calendar, (like the Greek Orthodox and Russian Orthodox), but most of the world uses the Gregorian Calendar.

If the Earth's path around the Sun were a perfect circle, the Sun's path would be a perfect straight line instead the 'figure eight' caused by our elliptical path around the Sun



Gary found another Meridian Line in the Saint Sulpice Church in Paris. It was used to measure the Earth's tilt on its axis at perihelion – when the earth is closest to the sun. This happens on January 3rd. (We are closer to the sun in winter, and furthest away in summer, it is the tilt towards the sun that determines winter and summer, not the distance.)

Two books Gary recommends RE 'Chasing the Sun' by Richard Cohen, and 'The Sun in the Church' by J. L. Heilbron. You can go to Gary Fix's website at: http://www.garytheastronomer.com/ and you can email him at: garytheastronomer@gmail.com.

Gary Thompson

The meridian line in Milan continues from the floor, up the wall.

Abell 71 in SH2-115 and the Milky Way

The heat during the new moon weekend was predicted to be hot and it was! While we managed to stay relatively cool given the heat, the temperature was high enough to keep a lot of people away. Like last month, we went out Thursday and came home Sunday, July 13-16, so three nights of imaging. The second night started questionably but cleared up later in the evening. Not too many frames were lost due to clouds although the image from my tracker suffered. The trip home Sunday morning was quite eventful, though. Several miles from the campground, still far from "civilization", i.e., good cell phone range, one of our rear tires blew out. It took several hours before we could get anyone to come put a new tire on. AAA was no help and the first company that said they could help called after an hour to tell us they didn't have a tire and wouldn't get one. Fortunately, in the end, we were safe and there was only a small amount of what appears to be minor damage to the RV. Since then, we've changed all 6 of the tires, using the new tire as a spare. The RV will be going in for repairs and should be back to us before the next outing.

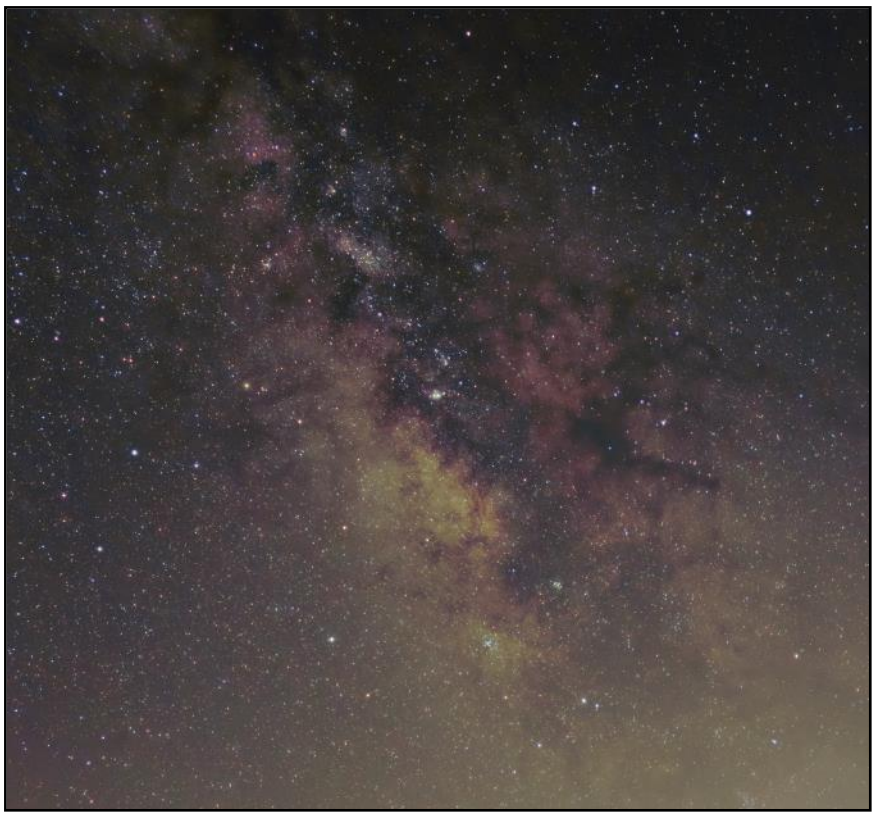
The primary target for the long weekend was the faint emission nebula Sharpless 115 (SH2-115) located about 7,500 light years away in Cygnus. As you may recall, emission nebulae glow by radiating light from specific atoms excited by UV light originating from nearby stars, similar to the way that a neon light works when excited by an electric discharge. In this case, hydrogen absorbs the UV-light radiating from the embedded young cluster of stars known as Berkley 90 and the excited hydrogen then emits red light. Given the scale of my image, the nebula spans a region of about 2 degrees by 1.5 degrees, or about 4 full moons across, making this a very large object. One of my goals when taking this image was to capture Abell 71, the smaller circular nebula located nearly halfway between the center and upper right corner of the image. Originally thought to be a planetary nebula, it is now believed to be another emission nebula because of the lack of oxygen normally found in planetary nebulae. Abell 71 is much closer to Earth at only 2,500 light years away. In addition to the nebulae captured, one thing I particularly enjoy about this image is found about midway along the left edge.

I really like how the glow of the small red nebula mixes with that of the yellow and blue stars

I had my tracker set up for the second night to see if I could get a better image of the Milky Way than last month. Due to the cloudy conditions, I don't think I succeeded, but I'll show the image anyway. This is a cropped image with a lot of light pollution at the lower right corner reflecting from distant city lights in the moisture in the air. This image was taken with a Canon 80D DSLR camera. It is a stack of 31 3-minute frames, stacked in DeepSkyStacker, and shot at ISO 200 and f/7.1 using a zoom lens set at 18mm focal length. I probably should have shot at least double the number of frames. I may try this again next outing, using higher ISO and shorter exposure times to see if I can improve on the image.

The technical details for imaging and processing SH2-115 follow. As usual in my images, North is up, and East is to the left. The image was shot from Bortle 4 skies which is considered bright rural skies (for comparison, home is borderline Bortle 7-8, suburban/urban transition). A StellarVue SVR90T f/7 refracting telescope was used, equipped with a 0.8x reducer/ flattener, for overall focal ratio of f/5.6 The scope was attached to a Paramount MYT telescope mount. Focusing was done automatically with an Optec FocusLynx SVX30 focuser and images captured with a ZWO ASI1600MMcool monochrome camera operating at -15C and using Astrodon Series E filters. The final image scale was 1.60 arcseconds/ pixel. Software used for image capture included TheSkyX, NINA, and Pegasus Unity Platform. Processing was done with PixInsight.

The raw stacked images were from 111 3-minute luminance frames, 56 5-minute red and blue frames, and 55 green frames for a total of 19 hours and 28 minutes of integration time. The frames were calibrated with 20 dark, 21 flat, and 21 dark flat frames without bias frames. The raw stacks had any residual gradients from light pollution removed and then the red, green, and blue frames were combined to make the RGB starting point. Except for balancing the color in the RGB stack after combining and boosting the saturation before adding the stars back, the luminance and RGB frames were processed similarly. First, noise reduction was applied before separating the stars from the images. Then the starless images were stretched to bring out the details in the nebula, followed by sharpening to improve the contrast. The star images were only mildly stretched compared to the starless ones to avoid the stars overwhelming the image and no sharpening was applied. The stars were then added back to their respective, stretched starless images before combining the luminance frame with the RGB frame. After that, final adjustments to the brightness and contrast were made



Next month we will be at a different site. The San Diego Astronomy Association hosts the Julian Starfest in Julian, CA, which we attended last year. It was their first, post-pandemic Starfest and we had a lot of fun. We're looking forward to a similar experience this year. And, as a bonus, Julian is at higher elevation compared to our usual site, so it should be a little cooler!

Until next month, clear skies!

Ron Ugolick

https://www.astrobin.com/users/ruccdu/

Gnomons, the Vernal Equinox, the Obliquity of the Ecliptic and the Precession of the Equinoxes

After our General Meeting lecture in July, a question came up about what would happen to the sun's image on Cathedral floors over time. Ken Elchert did the following analysis of the situation – see what you think!

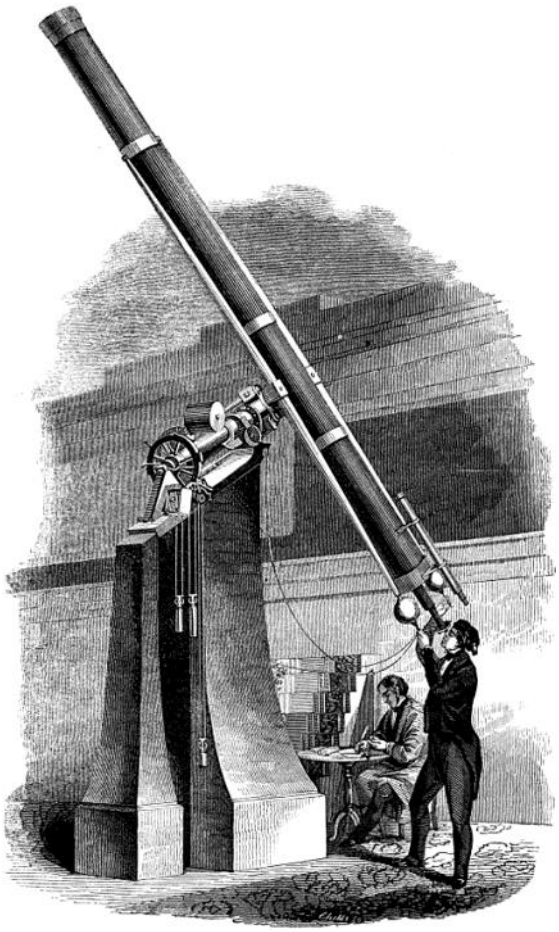
I've solved the problem discussed at July 7th's PVAA meeting concerning the effect of the precession of the equinoxes on the location on the gnomon of a sundial where the vernal equinox occurs. The answer is that the precession has no effect at all.

Here's my reasoning: The only thing that a gnomon does is to provide the precise moment when the Sun reaches the meridian which is, by definition, the time of local noon. As long as the obliquity (the tilt of the Earth's axis to the ecliptic plane) remains constant, the location on the gnomon where the Sun's rays from the oculus hit the gnomon at the time of the vernal equinox will always be the same spot. This is true whether the Earth's spin axis is pointing near Polaris as it is today or pointing near Vega in 12,000 years. And, thanks to the Gregorian calendar, the date of the vernal equinox will still be the same -- March 20 or 21.

However, the obliquity of the ecliptic is not fixed which means that the exact spot on a gnomon where the Sun's rays cross the gnomon on the day of the vernal equinox changes very slightly over time. That's why in Gary's presentation last night he had an illustration showing changes in the obliquity angle but didn't show anything on the precession of the equinoxes. According to what I've found on the internet, the rate of change in the obliquity is 46.836769 arcseconds per century. Over 5 centuries, that's a change of 3.9 arcminutes. That's an extremely small angle which wouldn't have made a noticeable change in the location of the vernal equinox on a gnomon in one of the Italian churches. The bottom line is that it's the change in the obliquity angle that is important for the sundial, not the precession of the equinoxes. At least that's the way I see it.

And here is a final update - in Wikipedia it indicates that Pierre Charles Le Monnier, a member of the French Academy of Sciences, actually used the gnomon of Saint-Sulpice Church from 1745 to 1791 to determine the change in the Earth's obliquity! He did this by visiting the church each year at the time of the summer solstice and marking the exact spot of the Sun's image on the gnomon at noon. Based on these markings he calculated the variation of the obliquity to be 45 arcseconds per century which is very close to the modern value of 46.84 arcseconds per century. Saint-Sulpice Church is one of those highlighted in Gary's presentation. So, that's the rest of this story.

Ken Elchert



NASA Night Sky Notes August 2023

This article is distributed by NASA's Night Sky Network (NSN).
The NSN program supports astronomy clubs across the USA dedicated to astronomy outreach.
Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

Super Blue Sturgeon Moon

Vivian White

On August 1st, catch a **full Moon** rising in the east just 30 minutes after sunset. We are seeing the entire sunlit side of the Moon as it is nearly (but not quite) in line with the Sun and Earth. The *Farmers' Almanac* calls this month's Moon the "Sturgeon Moon", for the time of year when this giant fish was once abundant in the Great Lakes. Cultures around the world give full Moons special names, often related to growing seasons or celebrations.

As the Moon rises later and later each night, the bright sunlit part appears to get smaller or "wane" - we call this a waning **gibbous Moon**. About a week later, on August 8th, we see only one half of the Moon alight. At this phase, the Moon rises around midnight and sets around noon. Have you ever seen the Moon in the daytime? You may notice this phase towards the southwest in the morning sky. Hold up a ball or egg beside it and see how the Sun lights up the same part.

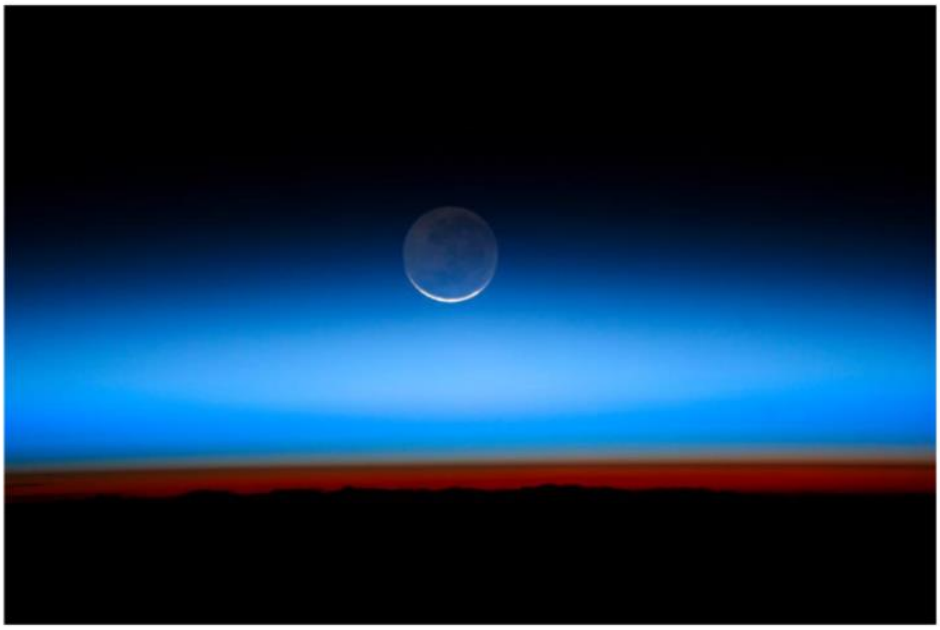
By August 16th, the Moon has gone through its crescent phase and is now only showing its dark side towards the Earth. Did you know the **dark side** and the **far side** of the Moon are different? The Moon always shows the same face towards Earth due to the gravitational pull of Earth, so the far side of the Moon was only viewed by humans for the first time in 1968 with the Apollo 8 mission. However, the dark side is pointed at us almost all the time. As the Moon orbits the Earth, the sunlit side changes slowly until the full dark side is facing us during a **new Moon**. When the Moon is just a small crescent, you can sometimes even see the light of an **Earthshine** reflecting off Earth and lighting up the dark side of the Moon faintly.

Then as the Moon reappears, making a waxing (or growing) **crescent Moon,** best seen in the afternoons. By the time it reaches the first quarter on August 24th, we see the other half of the Moon lit up. At this point, the Moon passes through Earth's orbit and marks the spot where the Earth was just 3 hours prior. It takes the Earth about 3 hours to move the distance between the Moon and Earth.

The Moon on August 30th is referred to as a blue moon. **Blue moons** are not actually blue in color of course; it refers to the second full Moon in any month. Since it takes 29.5 days to complete the cycle from full to new and back to full, most months will see only one. But occasionally, you'll fit two into one month, hence the phrase "once in a blue moon." We see a blue moon about once every 3 years on average - next in May 2026. In addition, this full Moon appears larger in the sky than any other full Moon this year - an unofficial **supermoon**. A supermoon appears larger than average because it is closer in its slightly elliptical orbit. The difference in apparent size between the smallest and largest full Moon is about the size difference between a quarter and a nickel. Even at its largest, you can always cover the whole Moon with your pinky extended at arm's length.

Follow the Moon with us this month and keep a Moon journal if you like - you may be surprised what you discover! moon.nasa.gov/moon-observation

Image of waning crescent Moon shown next to a ball on a stick that is lit by the Sun on the same side as the Moon, with trees and a blue sky in the background. Try this with an egg or any round object when you see the Moon during the day! Credit: Vivian White



Earthshine as seen from the International Space Station with the sun just set - Astronaut Photograph ISS028-E-20073 was taken on July 31, 2011, and is provided by the ISS Crew Earth Observations Facility and the Earth Science and Remote Sensing Unit, Johnson Space Center