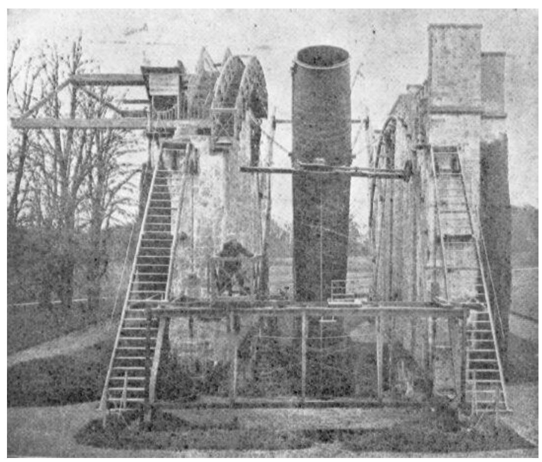
Tri-Valley Stargazers

May 2022

PrimeFocus

History of Astronomy – Leviathan of Parsonstown
Dwight Lanpher-Licensed Electrical Engineer

Any review of the history of astronomy will likely discover a large telescope called the "Leviathan of Parsonstown". Built in Ireland in 1845 by the 3rd Earl of Rosse, it was the largest telescope in the world for over 70 years. Each of two 72" speculum mirrors were alternately mounted in a 54' long tube, suspended between two purpose-built castle walls. Via Zoom, amateur astronomer Dwight Lanpher will speak about his visit last September to Birr Castle, County Offaly, Ireland to examine "the Great Telescope." His technical presentation will show detailed photos and drawings of how the telescope was operated and the modifications that were made during a $1,200,000 renovation in 1995. Images will also include the last remaining of the two, 3-ton, speculum mirrors examined during the return trip at its current location at the Museum of Science in London.



Caption: The Leviathan of Parsonstown! This was the largest telescope until the 1917 completion of the 100-inch Hooker telescope at Mt. Wilson.

When not visiting ancient telescopes, Mr. Lanpher travels throughout New England and eastern Canada attending astronomy meetings as liaison for clubs in Maine, New Hampshire and a few in Massachusetts and observing at their star parties when the opportunity avails. Professionally, Mr. Lanpher works as a licensed Electrical Engineer.

NOTE: The May meeting will be held both remotely using Zoom and in-person at the Unitarian church. As per the Unitarian Church Policy, the following guidelines for the in-person meeting are as follows:

1) In-person will require we not come if we are not feeling well or if there was recent contact with a person with COVID

2) Masks are required in the church

3) Distancing is required - 2 seats between those not of the same household - this is to protect those who maybe didn't get a vaccination

4) We will have a sign-in sheet for those attending at the church (name and email) so we can track anyone who does get sick

WHEN:

May 20, 2022
Meeting at 7:30pm
Lecture at 8:00pm

WHERE:

1893 North Vasco Rd.
Livermore, CA 94551

and via Zoom

TVS QR Code

INSIDE THIS ISSUE:

News and Notes

2022 Meeting Dates

Lecture Meeting	Board Meeting	PrimeFocus Deadline
May 20	May 23	
Jun. 17	Jun. 20	Jun. 3
Jul. 15	Jul. 18	Jul. 1
Aug. 19	Aug. 22	Aug. 5
Sep. 16	Sep.19	Sep. 2
Oct. 21	Oct. 24	Oct. 7
Nov. 18	Nov. 21	Nov. 4
Dec. 16	Dec. 19	Dec. 2

Money Matters

As of the last Treasurer's Report on 04/18/22, our club's account balance is $67,541.32. This includes $43.108.14 in the H2O Rebuild fund.

TVS Welcomes New Members

TVS welcomes new members Sandeep Lolar, El Sacramento, Warren Woellhaf, and David Wong. Please say hello and chat with them during our meetings.

2022 Club Star Party Schedule

Save the dates for the 2022 Club Star Parties.

Del Valle star parties are also public outreach events. They are jointly hosted with the EBRPD and held at the Arroyo Staging Area. The public is invited for the first 1.5-2 hours, while club members can stay the remainder of the night.

Tesla Vintners star parties are open to only club members and their guests. These star parties end at midnight, but participants can leave earlier, should they wish.

H2O Open House star parties are open to the public. The open house ends at midnight, and all participants are encouraged to stay the duration. The drive to H2O takes about 1 hour, and the caravan leaves promptly from the corner of Mines and Tesla Rds. No gas stations are available on the route, so be prepared. Admission is $3/car-bring exact change. H2O is a primitive site with two porta-potties. Bring water, food, and warm clothing, as needed. Red flashlights are to be used so observer's can preserve their night vision.

May 21: TVS Club Star Party at Tesla Vintners, 5143 Tesla Rd., 8:00pm
June 18: H2O Open House with caravan departing promptly at 6:30pm from Mines and Tesla Roads.
June 22: Outreach Star Party for Camp Go Beyond, 8:30pm
August 20: H2O Open House with caravan departing promptly at 6:30pm from Mines and Tesla Roads.

Barcroft High Altitude Star Party

Reservations for the Eastbay Astronomical Society's Barcroft High-Altitude Star Party are now open to members of both the EAS and Tri-Valley Stargazer's clubs. This year's event will be held from Saturday, August 27 through Friday, September 2nd (with departure by noon of Friday, September 2nd). That's six nights. Space at Barcroft is limited to a maximum of 12 people per day, so to ensure you get the days you want, make your reservations early.

Before sending payments for reservations ($65 per night, per person), even if you've been there before, please contact Don Saito FIRST (barcroft@eastbayastro.org) to ensure the dates you wish to attend are available. You will also be asked to read the Barcroft Writeup, as it provides the information you'll need to have a safe, comfortable stay, and what is expected of guests to this University of California research facility.

For more details on making a reservation, see: https://eastbayastro.org/events/

Calendar of Events

May 14, 20, 21, 27, 28, June 3, 4, 10, 11, 7:30pm-10:30pm

What: Free Telescope Viewing
Who: Chabot Staff
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: Free

Join Chabot astronomers on the Observatory Deck for a free telescope viewing (weather permitting). Chabot's historic telescopes offer breathtaking views 1,500 feet above the Bay. Three observatory domes house the Center's 8-inch (Leah, 1883) and 20-inch (Rachel, 1916) refracting telescopes, along with a 36-inch reflecting telescope (Nellie, 2003).

For COVID-19 Restrictions, see: https://chabotspace.org/visit/plan-your-visit/

For more information, see: https://chabotspace.org/events/events-listing/

May 21, 11:00am-3:00pm

What: Investigating Space: Back to the Moon
Who: Maxwell Edmonds-Drati, Chabot Museum Educator
Where: Chabot Space and Science Center, 10000 Skyline Blvd. Oakland, CA 94619
Cost: General Admission

NASA's Artemis mission hopes to return humans to the Moon by 2025. How are they going to get there? Get a sneak peek at the Orion spacecraft, designed to take humans farther than we have ever gone before! In this latest installment of Investigating Space, learn more about the fascinating engineering approaches that NASA uses to send its spacecraft and crew safely to the Moon and back.

Calendar of Events (con't)

Join us every third Saturday of the month for Investigating Space as we explore and discuss the big topics in space exploration with some of the leading scientists and researchers in the Bay Area. In this new series Chabot Space & Science Center highlights the latest discoveries, science research and space missions.

For COVID-19 Restrictions, see:
https://chabotspace.org/visit/plan-your-visit/

For more information, see:
https://chabotspace.org/events/events-listing/

May 25, 7:00-8:00pm

What: Do Humans Have What It Takes to Thrive in This Universe?
Who: Dr. Sandra Faber (UC Santa Cruz)
Sponsor: SETI Institute
Online: www.youtube.com/SVAstronomyLectures

Modern astronomy is revealing the story of our cosmic origins -- where the Galaxy came from, how the Sun and Earth were formed, and how the elements in our bodies were forged in stars and later gathered to form "us". We are now poised to use that knowledge to predict Earth's cosmic future, and it looks bright ahead – one billion years (more or less) of a future livable planet. However, one question then glows in stark relief: does our human species – honed by natural selection – have the makings to thrive on a cosmic time scale? In this lecture, Prof. Faber will share her perspective as a cosmologist, and sketch her vision for what we humans need to do to seize this incredible opportunity.

For more information, see: https://www.seti.org/talks

June 4, 7:30-9:30am

What: Gravitational Waves: The Discovery that Won the Nobel Prize
Who: Prof. Lynn Cominsky (Sonoma State University)
Sponsor: Mt. Tam Astronomy Program
Online: Zoom: Mt Tam

On September 14, 2015, the Laser Interferometer Gravitational-wave Observatory (LIGO) received the first confirmed gravitational wave signals. Now known as GW150914, the event represents the coalescence of two distant black holes that were previously in mutual orbit. LIGO's exciting discovery provides direct evidence of what is arguably the last major unconfirmed prediction of Einstein's General Theory of Relativity and has launched the new field of gravitational-wave astronomy. This talk will present an introduction to LIGO, gravitational waves and black holes. It will also discuss the gravitational wave detection results reported to date from LIGO and Virgo.

For more information, see:
https://www.mttamastronomy.org/calendar

June 6, 7:30pm

What: Cosmic Catastrophes: Transient Phenomena and the Renaissance of Astrophysics
Who: Prof. Raffaella Margutti, UC Berkeley
Where: Golden Gate Park, 55 Music Concourse Drive,

continued on p.4

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TVS E-Group
To join the TVS e-group just send an email message to TVS at: info@trivalleystargazers.org asking to join the group. Make sure you specify the e-mail address you want to use to read and post to the group.

Calendar of Events (con't)

San Francisco
Cost: Members and Seniors $12, Guests $15

Prof. Margutti will share how new capabilities to study the night sky have led to recent discoveries and new ways to think about the universe around us. Astronomical transients are events that appear and disappear in the sky and are signs of catastrophic events in space, including the most extreme stellar (star) deaths and interactions between stars and supermassive black holes.

Thanks to new and improved observational facilities, which use measurements of gravitational waves and light, we can now sample the night sky for astronomical transients with unprecedented resolution across the electromagnetic spectrum and beyond. This effort has led to the discovery of new types of stellar explosions, revolutionized our understanding of phenomena that we thought we already knew, and enabled the first insights into the physics of how black holes and stars interact.

For more information, see:
www.calacademy.org/events/benjamin-dean-astronomy-lectures

Sensor Tilt Adjustments for Deep-Sky Imaging

By Gert Gottschalk

Successful deep sky images gain their quality by showing pinpoint star images across the field. At first the optical system needs to be able to deliver such images based on the quality of its design and manufacturing. Secondly, the user is in charge of system collimation and it is a portion of that which we will investigate here.

The first part of system collimation is the optical system itself. We need to mechanically bring the optical components into their prescribed positions with respect to each other and the focal plane. This task varies between different optical systems, refractor or photo lenses might be collimated at the factory and we will not have to change that. Newtonian systems, Cassegrains, RCs and catadioptric systems will however require collimation at first.

At this point the system will deliver a sharp image in the plane in space we call the focal plane. Our next task is then to bring the camera sensor chip exactly into that plane. We are going to discuss that task in this article.

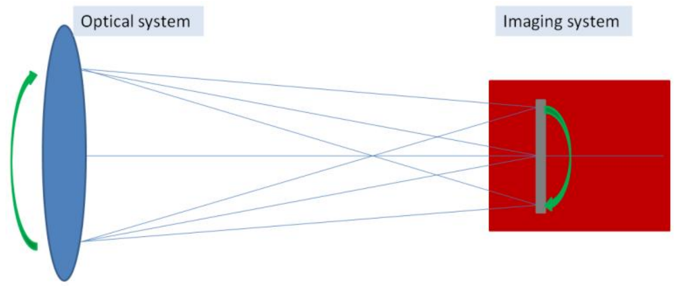


Fig. 1. Optical and imaging system alignment

Let's first estimate the requirements. The page at www.wilmslowastro.com gives as critical focus zone formula. (We assume correct pixel sampling here.)

$$\textit{critical focus zone} = 2 \times \text{focal\_ratio} \times \text{Airy\_disk}$$

Only when the sensor is square across the image plane will stars be in focus across the field. Any non-orthogonality i.e. angle of rotation of the sensor will result in out of focus stars in some area of the image. To visualize let's compute a tilt angle tolerance for a APS-C size sensor (25.1mm x 16.7mm) for systems of F6, F4, and F2. We will assume the popular Sony IMX571 sensor with 3.86um pixel size.

F number	CFZ [um]	Tilt tolerance [arcmin]
6	96.6	13.23
4	42.9	5.88
2	10.7	1.47

At an F4 system the CFZ is telling us a 42.6um focus tolerance. If that tolerance is applied to one side of an APS-C sensor's long edge (25.1mm) it will produce 5.88 arc min of angle. The 5.88 arc min gives us an estimate on the required accuracy of the sensor orthogonality.

Today's CMOS cameras have flange plates with push pull screws to allow tilt adjustment. However, that adjustment method has some drawbacks:

- Access to the screw may be blocked by filter wheels or off-axis guider components
- The push pull system might not allow accurate control of the adjustment

To address these shortcomings, some manufacturers have developed conceptually new tilt adjustment units. (www.gerdneumann.net, www.baader-planetarium.com)

continued on p.5

Fig. 2. Camera push pull tilt flange

They approach the tilt adjustment by two plates that are pulled together with strong springs and three tapered bolts that push between them. The mechanical advantage of the taper allows for very precise tilt adjustment. In the G. Neumann unit a turn of the adjustment screw changes tilt by only 0.2mm. To push between the plates the screws are also positioned more conveniently at the circumference of the device.

Fig. 3. G. Neumann tilt unit

The G. Neumann unit has clear aperture of 48mm and female 48mm x 0.75mm threads on both sides. Adapters to male 48mm and other threads are offered as accessories.

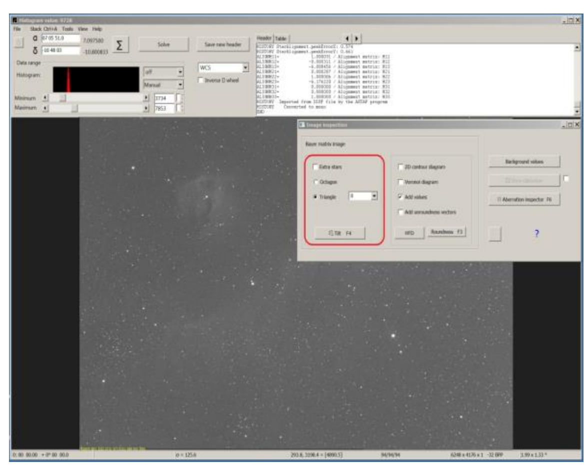
Installing the unit is pretty straight forward. It consumes 17.5mm back focus, so care must be taken if spacings between corrective optics and the focal plane are to be maintained. In my application with a Starizona Hyperstar unit a new shortened adapter between the Hyperstar and the camera imaging train was needed.

Once installed on the telescope we want a tight loop of software to:

- Take an image
- Analyze for tilt
- Visualize tilt measurement
- make adjustments and repeat

Fig. 4. Camera imaging train.

The program ASTAP (www.hnsky.org/astap.htm) is a great tool for all kinds of image measurements having its original application in field solving and astrometry. But many other very useful features are added for image annotation, mount drift analysis, focus and aberration analysis. The aberration analysis measures and reports HFR (Half Flux Radius) on the stars in the image and provides screen visualization to show its values. A tilt of the sensor will show as a variation of HFR across the sensor in the direction of the tilt. As we adjust the tilt our goal is to even out the asymmetry of the tilt numbers. We will also slightly change the distance of the sensor from the focal plane and thus introduce defocus. However, it is noteworthy that we don't need to readjust to exact focus between tilt adjustments as the measurement uses the change of HFR across the sensor and does not (within limits) rely on the absolute values. The HFR values during a tilt adjustment should not be used to measure minimum aberrations of the optics when not in perfect focus. That could be done is a separate analysis run.



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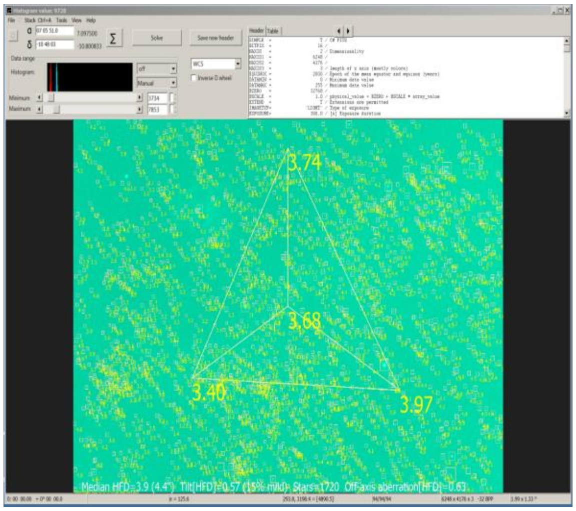

Fig. 5. ASTAP image inspection setup 9previous page) and sample result (above).

The graph shown is overlaid with a triangular visual guide. Even without extra alignment there will be one of the three adjustments screws on the tilt unit that will point to the long edge of the sensor and thus we can identify orientation and correspondence of the screw with tilt in a particular direction. A bit of trial and error will clarify which of the screws should be advanced and retreated. Other directions can then also be easily identified. Our goal is to adjust tilt until HFR is the same in all three directions. The ASTAP analysis gives an additional verbose scale of the tilt ('mild', 'small', 'none') each referring to a range of tilt numbers. In my observations even 'mild' will not noticeably degrade an image. But it's nice to aim for tilt adjustment down to 'small' or 'none'. A reported 0% will likely be just a random chance, even seeing variations will introduce ca 2%-3% variation from image to image. The computation of the percentage is:

100.0 * (HFDworst - HFD best (for the four corners)) / HFDworst

The ASTAP window as shown in Fig. 5 allows two modes of visualization. There is the above 'triangle' shape and a 3x3 square matrix. Both utilize the measured HFR values from the image. The fit of the 3 points for the triangle and the 9 points for the matrix will have slightly different results. The function of the HFR values will be some arbitrary 3D surface and this is simplified to a single tilt angle and direction in the triangle shape and 3x3 distinct values in the matrix. I prefer the triangle visualization for interactive adjustments as I can identify the 3 adjustments screws with the triangle directions. The 3x3 matrix might be better suited for analysis of tilt stability over multiple observing nights. The data from ASTAP can be copied into a spread sheet and color coded for a quick visual reference of the tilt over time. That way I discovered that the Hyperstar imaging train showed some tilt creeping up and it will probably need a tilt check before the start of a new session just to verify it's still aligned and make small corrections as necessary.

For interactive adjustments at the start of an imaging session there is a helpful feature in ASTAP that monitors an incoming folder on the computer. Once a new image file is there it is loaded, analyzed and the new results shown on screen. The typical image capturing tools have some loop capability to take multiple images and store them, so that putting these two together we can interactively adjust the tilt of the system.

In my case I am using NINA (nighttime-imaging.eu) to capture 3-5 sec exposure images store them in a folder and then have ASTAP retrieve them for analysis.

We should always be critical of the measurements. There might be changing atmospheric conditions that distort the HFR report. Atmospheric refraction increases at lower altitudes and it is recommended to use an analysis target high up (above 60deg) in the sky.

Final results down to 0% tilt are possible. The last few percent of change refer to ca. 1/10 turn of the screws on the G. Neumann unit.

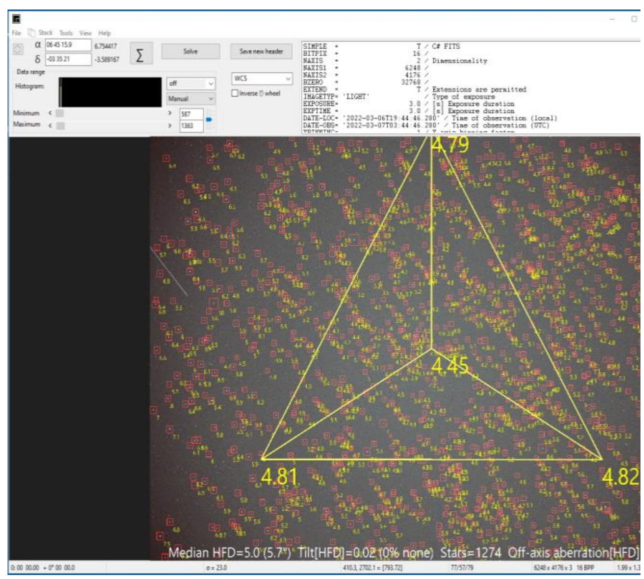

Fig. 6. Final tilt adjustment results

With the precision tilt adjustment units we can show good orthogonality of systems including, the F2 Hyperstar. It is easy to use and the closed loop between the image acquisition and analysis software enable quick turn around and convergence of tilt adjustment.

What's Up By Ken Sperber (adapted from S&T)

All times are Pacific Daylight Time

May

22	Sun	The last-quarter Moon is 5º below Saturn (Morning)
22	**Sun**	**Last-Quarter Moon (11:43am)**
24	Tue	Jupiter and Mars rise together in the east with the Moon 7º to their right (Morning)
25	Wed	Jupiter, Mars, and the Moon form a compact group as they rise together (Dawn)
27	Fri	The thin crescent Moon is 3.5º below left of Venus, low in the east-southeast (Dawn)
29	Sun	Jupiter and Mars, separated by 0.5º, rise in the east-southeast (Dawn)
30	**Mon**	**New Moon (4:30am)**

June

1	Wed	Jupiter and Mars, separated by only 2º, rise together in the east (Morning)
2	Thu	The crescent Moon, Castor and Pollux form a triangle above the WNW horizon (Dusk)
4	Sat	All 5 unaided-eye planets line up from low in the east to higher in the south, though Mercury will be a challenge to see (Dawn, see pp. 46 and 48, June S&T)
5	Sun	The crescent Moon and Regulus are separated by 4.5º as they sink in the WNW. Eta Leonis, at 3.4mag, will pass just north of the Moon (Evening, see p.49, June S&T)
7	**Tue**	**First-Quarter Moon (7:48am)**
9	Thu	The Moon is in Virgo, ~6º from Spica (Evening)
13	Mon	The Moon is in Scorpius, ~6º from Antares (Evening)
14	**Tue**	**Full Moon (4:52am)**
18	Sat	The Moon is ~6º below Saturn in the south. To the ENE, Mercury, Venus, and The Pleiades form a triangle (Dawn)
20	**Mon**	**Last-Quarter Moon (8:11pm)**
21	Tue	The Moon and Jupiter are separated by ~4º (Dawn)
22	Wed	The Moon is ~4.5º to the right of Mars. Jupiter is located to their upper right and Venus is in the east (Dawn)
24	Fri	All 5 unaided-eye planets line up from low in the ENE to higher in the south. The Moon sits between Venus and Mars (Dawn, see pp. 47-48, June S&T)
25	Sat	The Moon, Venus, and Mercury form a 20º line near the ENE horizon (Dawn)
26	Sun	The Moon is 2.5º from Venus, with Mercury to their lower left (Dawn)
27	Mon	The thin sliver of the Moon, just one day before new, is 3.5º left of Mercury (Dawn)
28	**Tue**	**New Moon (7:52pm)**

Night Lights: Aurora, Noctilucent Clouds, and the Zodiacal Light

By David Prosper

Have you spotted any "night lights"? These phenomena brighten dark skies with celestial light ranging from mild to dazzling: the subtle light pyramid of the zodiacal light, the eerie twilight glow of noctilucent clouds, and most famous of all, the wildly unpredictable and mesmerizing aurora.

Caption: A sampling of some of the various patterns created by aurora, as seen from Iceland in 2014. The top row photos were barely visible to the unaided eye and were exposed for 20-30 seconds; in contrast, the bottom row photos were exposed for just 4 seconds- and were clearly visible to the photographer, Wikimedia contributor Shnuffel2022. License and source: CC BY-SA 4.0 https://commons.wikimedia.org/wiki/File:Aurora_shapes.jpg

Aurora, often referred to as the northern lights (aurora borealis) or southern lights (aurora australis), can indeed be a wonderful sight, but the beautiful photos and videos shared online are often misleading. For most observers not near polar latitudes, auroral displays are relatively rare and faint, and without much structure, more gray than colorful, and show up much better in photos. However, geomagnetic storms can create auroras that dance and shift rapidly across the skies with several distinct colors and appear to observers much further away from the poles - on very rare occasions even down to the mid-latitudes of North America! Geomagnetic storms are caused when a magnetic storm on our Sun creates a massive explosion that flings a mass of particles away from its surface, known as a Coronal Mass Ejection (CME). If Earth is in the path of this CME, its particles interact with our planet's magnetic field and result in auroral displays high up in our ionosphere. As we enter our Sun's active period of its 11-year solar cycle, CMEs become more common and increase the chance for dazzling displays! If you have seen any aurora, you can report your sighting to the Aurorasaurus citizen science program at aurorasaurus.org

Have you ever seen wispy clouds glowing an eclectic blue after sunset, possibly towards your west or northwest? That wasn't your imagination; those luminescent clouds are noctilucent clouds (also called Polar Mesospheric Clouds (PMC)). They are thought to form when water vapor condenses around 'seeds' of dust from vaporized meteorites - along with other sources that include rocket launches and volcanic eruptions - around 50 miles high in the mesosphere. Their glow is caused by the Sun, whose light still shines at that altitude after sunset from the perspective of ground-based observers. Noctilucent clouds are increasing both in frequency and in how far south they are observed, a development that may be related to climate change. Keeping in mind that observers closer in latitude to the poles have a better chance of spotting them, your best opportunity to spot noctilucent clouds occurs from about half an hour to two hours after sunset during the summer months. NASA's AIM mission studies these clouds from its orbit high above the North Pole: go.nasa.gov/3uV3Yj1

Caption: Comet NEOWISE flies high above a batch of noctilucent clouds in this photo from Wikimedia contributor Brwynog. License and source CC BY-SA 4.0 https://commons.wikimedia.org/wiki/File:Comet_Neowise_and_noctilucent_clouds.jpg

You may have seen the zodiacal light without even realizing it; there is a reason it's nicknamed the "false dawn"! Viewers under dark skies have their best chance of spotting this pyramid of ghostly light a couple of hours after sunset around the spring equinox, or a couple of hours before dawn around the autumnal equinox. Unlike our previous two examples of night lights, observers closer to the equator are best positioned to view the zodiacal light! Long known to be reflected sunlight from interplanetary dust orbiting in the plane of our solar system, these fine particles were thought to originate from comets and asteroids. However, scientists from NASA's Juno mission recently published a fascinating study indicating a possible alternative origin: dust from Mars! Read more about their serendipitous discovery at: go.nasa.gov/3Onf3kN

Curious about the latest research into these night lights? Find news of NASA's latest discoveries at nasa.gov

This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, stargazing info and more.

Tri-Valley Stargazers
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www.trivalleystargazers.org

Tri-Valley Stargazers Membership Application

Contact information:

Name: ____ Phone: ______________________

Street Address: ____

City, State, Zip: ____

Email Address: ____

Status (select one): ______ New member ______ Renewing or returning member

Membership category (select one): Membership term is for one calendar year, January through December.

_____ Student member ($10). Must be a full-time high-school or college student.

_____ Regular member ($30).

Hidden Hill Observatory Access (optional): Must be 18 or older.

_____ One-time key deposit ($20). This is a refundable deposit for a key to H2O. New key holders must first hear an orientation lecture and sign a usage agreement form before using the observing site.

_____ Annual access fee ($10). You must also be a key holder to access the site.

Donation (optional):

______ Tax-deductible contribution to Tri-Valley Stargazers

Total enclosed: $ ___________________

Member agrees to hold Tri-Valley Stargazers, and any cooperating organizations or landowners, harmless from all claims of liability for any injury or loss sustained at a TVS function. TVS will not share information with anyone except as detailed in our Privacy Policy (http://www.trivalleystargazers.org/privacy.shtml).

Mail this completed form along with a check to: Tri-Valley Stargazers, P.O. Box 2476, Livermore, CA 94551.