The Classroom Astronomer Newsletter #13 - November 16, 2021

Eclipse Things to Do; Teachniques--Moon, Spectra; Using iTelescope, Part 1; Hubble's Nebulae; Earth's Eccentricity; Eclipse Subscription Special; 37.5% Black Friday Sale

Nov 16

Cover Photo - iTelescope in Spain

In This Issue:

- **Cover Photo -** ITelescope’s Spanish Observatories
- **Welcome to this Issue!** - Our New and Revamped Homepage!; The Moon’s Light is Reduced in Eclipse, and So is Our Subscription Rate for Then;
- **The November 19th Nearly Total, Longest Partial Lunar Eclipse - What Can You Do Educationally?**
- **Astronomical Teachniques -** IAU-Shaw: The Moon; What Can We See With Spectra?
- **Astronomy Remotely - (Cover Story)** Observing with iTelescope, Part 1

- **Connection to the Sky** - Hubble's Field Guide to Nebulae
- **The RAP Sheet – Research Abstracts for Practitioners -** How Eccentric Is the Orbit of the Earth, and Where Is the Sun?
- ***The Galactic Times Inbox Magazine #13* Highlights**
- **The Black Friday/End of Year/Holidays with 37.5% Discount Sale**

Welcome to this issue of *The Classroom Astronomer* Inbox Magazine!

In this issue, we continue with the wonderful Teachniques from the IAU--Shaw conference, just as the Astronomical Society of the Pacific's gears up.

Sky events for students—always a priority. These two weeks start with a very nearly total eclipse—use to measure Luna's distance and size—and end with three planets beginning an evening line-up. [If you're a Lite reader, see our Deeply Eclipsed Rate below, to see all!]

TCA's Astronomy Remotely column takes its first dive…into iTelescope.net.

And we test YOUR knowledge about Earth's orbit in a misconception article.

Meanwhile, the **homepage** for *The Classroom Astronomer* has been revamped and updated! There's an index to all (now) 13 Inbox Magazine Issues' contents by celestial object and educational subject area, and Tables of Contents. More special content will be added over time. Come explore ! http://www.classroomastronomer.com

Subscription and archive (for full subscribers only):
https://classroomastronomer.substack.com

We have an Eclipse on November 19th…on our Subscription Rate….as Well as on the Moon….

The Moon will be in umbral shadow, shining at a lower brightness for 3:29.0, so from November 16 through November 19, you can subscribe to *The Classroom Astronomer* for the Eclipse Rate of $32.90 *less* per year (i.e., $**22.10**, essentially, $0.92 or less per 14-19-page issue, or $1.84 per month). Click on the link three lines below, not the regular Subscription Button, to get the Eclipse Rate! When the Shadow goes away (November 19th), so does the Eclipse Rate…..

Click for the Eclipse Rate Here:
https://classroomastronomer.substack.com/eclipse

Publisher -- Dr. Larry Krumenaker

The November 19th Nearly Total, Longest Partial Lunar Eclipse - What Can You Do Educationally?

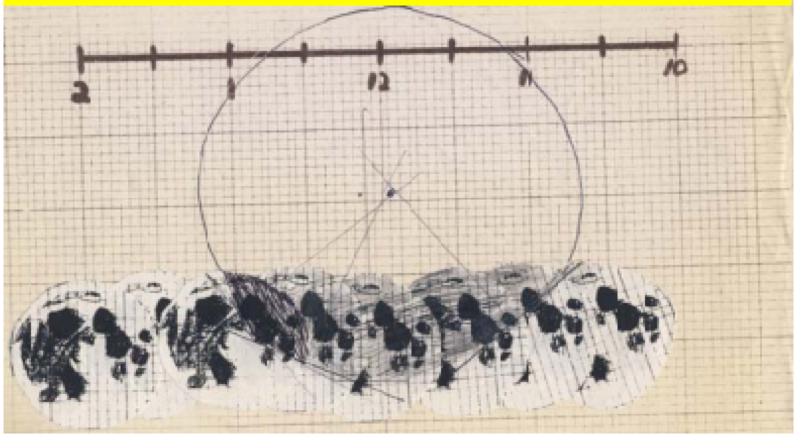
For the US East Coast, you can observe a totally post-midnight “all-nighter” lunar eclipse, going practically until dawn. For the West Coast and Pacific Rim, it begins on the 18th and goes past midnight. This eclipse gets *almost* but not quite into total eclipse territory, just 3% of the Moon not getting into the umbra—the totally no-sunlight central shadow of the Earth. That last bit gets some sun, in the thin, dusky penumbra, where if you were on the Moon, you’d see the Earth partially blocking ol’ Sol. Visually, you and your students just might find this to be a very interesting affair, with a bright white or bluish-white outer edge, and possibly coal black shadow on the opposite edge, with all sorts of gray-whitish-reddish variations slowly streaming across the Moon’s disk. It will just seem to take *forever* to happen, a minute shy of three and a half hours!

What can you do with a partial eclipse?

For one thing, in a normal central total lunar eclipse, that penumbra generally doesn’t get thick enough to be visible to the unaided eye until about 20 minutes before totality begins, and disappears 20 minutes after it ends. But with this glancing blow, could those first and last moments be farther from those moments? How sharp ARE your eyes? Give it a try and let *TCAN* know!

You can actually use total lunar eclipses to measure the Moon’s distance from Earth, and even its diameter! You can do so by either having two observers, preferably at opposite sides of the zone of eclipse visibility on Earth (not quite the same as opposite sides of the Earth), take a photograph at the same instant—you’ll both see the exact same eclipsed Moon because lunar eclipse phenomena doesn’t depend on your location like those of solar eclipses. You will, though, have slightly different starry backgrounds behind the Moon, a lunar parallax, and like surveyors, that angle can be used to get the Moon’s distance. Also, plotting the edge of the Earth’s shadow on the surface of Moon, and placing the plots on a piece of paper properly scaled give a passage record through the shadow, and THAT can give both size and distance information for our satellite.

Figure 2. Moon drawings showing umbra shading from a partial lunar eclipse, properly placed on a timeline, and the umbral circle estimated.



In the old *Classroom Astronomer* magazine, a series of articles on how to do this appeared, and while the particulars were for an eclipse over a decade ago, the procedure is still the same. The article is still online, and you can click on this link and download the four articles on what you can do with/in a lunar eclipse for free!
http://www.classroomastronomer.com/measurethemoon/

Astronomical Teachniques

Continuing our series of Teachniques from the Heidelberg IAU-Shaw astronomy education conference….

*** IAU-Shaw: The Moon**

The Sun and the Moon are the two most obvious astronomical objects, and most readily observable. Also the most tainted with numerous misconceptions (or alternative conceptions, and various other buzzwords educators use…whatever, they are wrong ideas). We’ve talked about the Sun. How can teachers teach about the Moon, and get the facts straight?

The most pervasive lunar misconception is the origin of its shapes and how they change over time—its phases. A common one is that the dark part of the phase is the shadow of the Earth on the Moon (never mind that this week that very same shadow causes a lunar eclipse on the 18-19th so how can it cause phases the rest of the time - SMH). It is common to teach Moon phases by having a ball, often of styrofoam, on a stick held in a student’s hand, the student’s head representing Earth, and a bare bulb somewhere in the otherwise darkened room representing the Sun. As the student moves the stick around their head, they presumably see how the ball goes from fully lit to fully dark and every fraction in between. Clearly this is imperfect since (a) there is often enough reflected light around the room to make the ‘unlit’ part of the ball bright enough to not be dark, and (b) misconceptions afterward still abound.

Museum educator Farprakay Jiarakoopt of the National Astronomical Research Institute of Thailand uses an exhibit of the Earth-Moon system that takes this one step further. Her model has the three objects - Sun, Earth, Moon — separate from the student so that he or she **observes them from *outside* of the system**, not as part of it. They can then see that the Earth's shadow clearly does NOT land on the Moon at any time other than during the Full Moon phase (and presumably she can show that that doesn't happen all the time otherwise we'd not have a Full Moon every month!). [Ed.—I suggest that you try this by making this a scaled model, with the Moon one-fourth the diameter of your Earth model and some 30 diameters away, with as distant a light as possible in your room. That shadow thing becomes MUCH clearer!]

Julie Bolduc-Duval of Canada's Discover the Universe program activities [Ed. - and one I find enormously useful when teaching teachers] is to be outside with a ball in hand when both the Sun and Moon are in the sky, i.e. between New and the Quarter phases, most often at or after Last Quarter. By **aiming the ball at the Moon**, you'll get the ball exactly the same phase as the Moon, and with your shadow clearly NOT overlapping the ball but on the ground somewhere, you can dispel that misconception dramatically.

Her method lends itself also to some math learning. Observe the Moon daily, preferably after New Moon, and both draw its shape against, perhaps, horizon landmarks (always at the same time or hour, to eliminate an unnecessary extra variable), and at the same time, use hands to point to Sun and Moon and measure the angle.

B. S. Shylaja of India has a whole **list of lunar observations, all without a telescope,** one can do! Of great immediate importance….use a sky map with good magnitudes for stars and measure how faint you can see on a Full Moon Night….before (or after) eclipse, and during mid-eclipse. During an eclipse, how long before and after can you detect the outer, duskier shadow, the penumbra. Other observations are to try and measure the tiny difference in Moon apparent size between perigee and apogee.

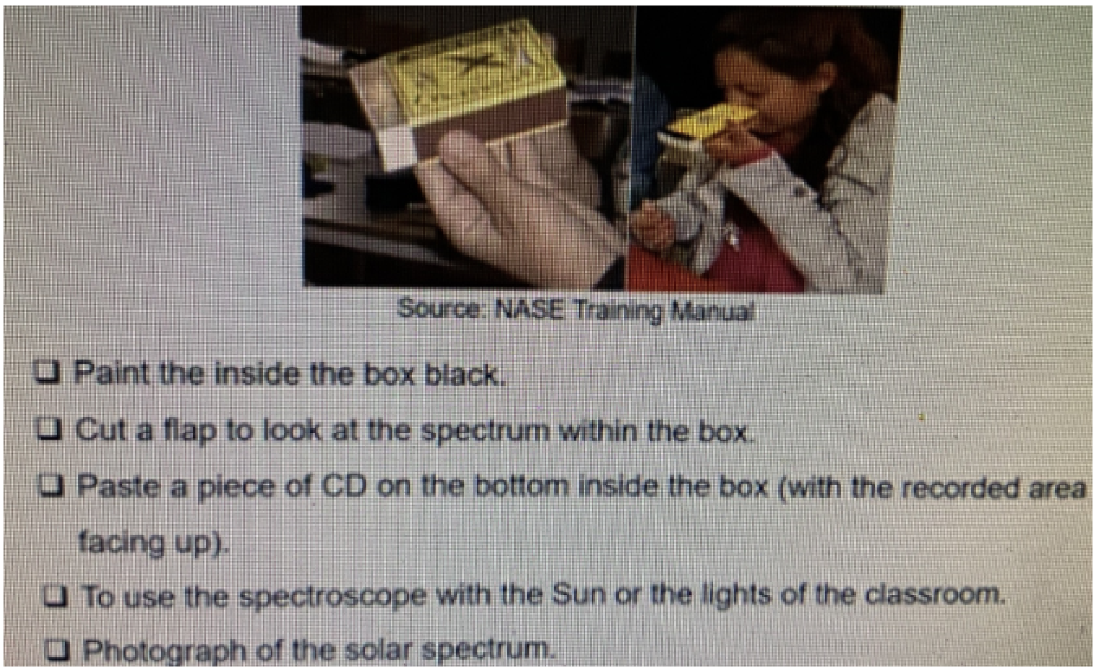
Over the year, record the first crescent moon's position and its orientation, to the horizon. That will be changed by its position along the ecliptic—the path of the Sun. Using sky almanacs (such as *The Galactic Times'* Moon-Gazing column), look for conjunctions with stars and planets and move along a student's knowledge of stellar identifications.

*** IAU-Shaw: What We See With Spectra**

One mainstay of physics, basic or astrophysics, is light. Light tells us…well, everything, astronomically. But that's where the two greatest modern astronomy mysteries were explored: what are the stars made of, and explaining the motions of the galaxies.

Light in physics or astronomy labs more often means spectra and the instruments of choice are diffraction grating-based. The triangular plastic spectroscope, where you aim one direction but look for the spectrum in another, is the students' bane. [Shameless plug: Some use Hermograph's Spectrum Viewers, with big viewing windows and gas tube spectra photographs to compare "unknowns".] Some folks get to use gratings in old square film holders. A few use glass prisms, long gone antiquated.

Deodatus Stanley of Tanzania spoke about his "Young Astronomer's Briefcase," eleven items that he has young students create and carry to make observations and measures. Among them was a **matchbox spectroscope.** Matchboxes are not so easy to come by but I found one, broke an unrecorded CD disk, and fitted it into said box, and observed the spectra of lights thru one end of the box. You can adjust the “slit” at the other end of the box, though I still would advise not to use it on the Sun visually. But the spectrum could be photographed! It takes a little play to find the right angle to look through the opposite end, and where exactly to place the reflecting diffraction CD disk to get a proper image, but it is definitely worth trying!

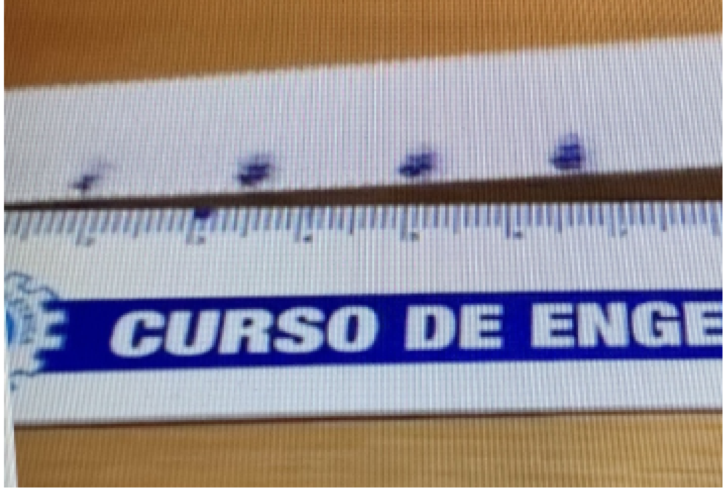


(courtesy Powerpoint of Deodatus Stanley)

What modern fluorescent and LED lights show are spectra with emission lines—colored lines overlaying on the general red to blue rainbow of colors, or glowing over no background at all. Few common lights (other than some Mercury vapor lights) show any absorption lines, where atoms have absorbed light out of the rainbow, such as stellar spectra have. But solving what the dark lines in stellar spectra were was one of the greatest achievements of astronomy.

A century ago, when Hubble and Humason found that that the absorption spectra of farther galaxies had their regular spectral absorption lines not only shifted to the red side of the spectrum, indicating they were moving away from Earth, but also they were even more shifted to the red than nearer galaxies. In other words, the further they are, the faster they moved away from us. This **Hubble expansion**, and why it seems we’re in the middle of this rush to escape from us, too, is a bit mind boggling still. But educator Beatriz Garcia showed a surprisingly easy way to show how both of these happen.

She used an elastic cloth with inked dots on it. Starting from an unstretched position, dot locations against a millimeter ruler were made. Then, stretching the elastic and re-measuring the new locations would show that the farther dots along the ruler would show greater distance changes, which could be graphed to show the linear Hubble expansion. [Ed. - What was not shown, but can be, is that you don’t need to use the end of the elastic as your origin, but can use ANY dot as your origin, showing that ANY galaxy, whether “our Milky Way” dot or any other “galaxy,” would see the same expansion—its ‘inhabitants’ would think THEY are the center of the expansion, too!]



In our next *TCAN*, we'll finish off our IAU-Shaw findings, with neat Teachniques on constellations, and the physics of Gravity and Galaxies.

Astronomy Remotely

Observing with iTelescope, Part 1

I always wanted my own research level telescope. Alas, a vagabond life in journalism and academia made that impossible. For yours truly, iTelescope.net may be as close as he could get.

iTelescope is designed to do research. There are 21 telescopes at the moment, in four countries (though most are split between Australia and the USA), ranging from small Celestrons and some refractors to 24-inch reflectors with every mechanical doodad you could wish for. While the majority of the technology is for various kinds of astrophotography, some scopes are rigged to do photometry (measuring brightness of stars) and some experimental spectroscopy is being attempted. In most cases, you reserve a time slot, you can set your targets from pre-selected ones (I wanna shot of M65) to you-pick-the-coordinates, the telescope picks the right settings and, if visible, gets your picture. In other cases, you can make manual changes to the settings yourself, and in some circumstances, you can take the time to, computer agreeing with you, point-and-shoot the scope as if you owned it.

Let's start at the beginning.

iTelescope began as a one-man, one-scope shop by Brad Moore in the early 2000s, which became Global Rent-a-Scope, one of the first services of its kind. There are today ~1000 active users, and tens of thousands of passive ones (getting newsletters, image sets, etc.), and these all range from the interested beginner to universities buying time for faculty and student research efforts. Scopes are at Siding Spring Observatory in Australia, in New Mexico, California, Spain and one wide field photographic scope in Chile. All are completely automated. While someone can be called in a real emergency, there are generally no 'night assistants' on duty like in national and many university observatories. If something doesn't work, the domes close down and send out an emergency email to support, and sometimes human observers do too, remotely.

To become a member of the iTelescope community takes two minutes. To get to be a user takes longer. iTelescope has no training program per se. On the website is a fairly lengthy set of commonly asked questions that can give you lots of information. You do need to watch some pre-recorded training webinars on how to use the facilities, and there is one monthly live webinar, on specialty topics by Dr. Christian Sasse, astronomer-in-charge of iTelescope. Each telescope has a web page of technical specs (and if you don't understand it, you need to probably learn about it first) so you can select the telescope that's right for your project.

Costs and Reservations

You need to have a payment plan for your usage time on any scope, which in turn needs to be reserved ahead of time, with an observing plan for the time.

Plans: There are two basic kinds of payment plans. The usual is a monthly subscription with multiple tier levels, and an education plan. The latter is only for university levels. So if you are a high school teacher who wants each student in his class to take a photo, they either all have to get a cheap plan or you have to pay for one with a lot of time available, and 'lend' it to students or have them look over your shoulder, or have them tell YOU what they want (Ed. —not recommended….).

Each monthly plan automatically renews, but points you don't use aren't lost (as Sasse said, unlike your cell phone plan…) but carries over to the next month. Oh, and these are (roughly) LUNAR months of 28 days (i.e. you'll pay 13 months in a year)….and range from 20 to 160 USD. Your Plan gets you:

1. a certain amount of reservation time for month, e.g. the Plan-40 gets you 8 hours of reservation time maximum.
2. Then…each dollar equals one point but each telescope uses a different amount of points per usage minute. An example: A certain Siding Spring Telescope uses 120 points per hour, or 2 points per minute of photography. So your Plan 40 will get you 20 minutes of photography on that scope and you're done for the month. Thus a 'cheaper' smaller telescope might get you further.

You only pay for time you use to image, not to reserve the scope! But don't just sit the scope idly, or it assumes you've gone and logs you off. If your reserved night is cloudy (and you can see that with their all-sky cameras!), you don't lose a cent.

You also get discounts for nights with bright moons, though. Plan judiciously? Anyway you can change your plan every month, but the billing on your credit card goes on for infinity until you cancel your plan.

The Education Plan for institutions lasts for one year and costs 50% more than a standard.

Reservations: You use their Launchpad and Planner system, which will, of course, make sure your object(s) are visible during the time you want to observe, and in the latitude of your scope. It does not allow observing during daylight hours (no daytime Mercury or Venus, sorry), and it automatically opens the dome a certain time after sunset, closes it before sunrise, to keep the equipment operationally sound. During dark Moon time, bookings are naturally pretty solid, and you need at least 3-4 days advanced booking time. In bright Moon time, you can practically move in—hardly anybody's home.

When you take a photo, you do get an instant preview, and if not to your satisfaction, or clouds messed it up, you can get a refund for the time. If you like it, then you can get to the download site and download your FITS file.

Your what? Astrophotos come in a file format called FITS. You want a jpeg or gif? You'll have to convert the file. In fact, astrophotography is not a point-and-shoot hobby. This requires the right software (many free, though), and you may need what are called dark files and bias files to get the images right. Sometimes you may need to 'stack' multiple shots of the same image on top of each other to get one good long exposure. Don't understand? There are lots of tutorials online to learn all about this and more.

Discouraged? While yours truly has had lots of observing time in the past, [online confession here] observing remotely is a fairly new experience, and more complicated than his last observing runs in a heated dome with a night assistant and hot coffee. So in Part 2 of this article, hopefully in *TCAN* #14, I'll let you know about my trip through virtual Oz, through the tutorials and webinars, and taking my first measures. My two observing plans are (1) some straight photography like I would assign my students when I taught astronomy—get two photos of something that changed within a week, in my case, Neptune and its moons orbiting around it, and a comet, hopefully Comet Leonard—plus one pretty picture, and (2) some digital differential photometry of some long-overdue-for-study carbon and cool S-stars from my research days.

The RAP Sheet – Research Abstracts for Practitioners

What's in the scholarly astronomy education journals you can use NOW.

1. B. Rovšek (2021). **How Eccentric Is the Orbit of the Earth, and Where Is the Sun?,** *Physics Teacher, 59,* 438, September 2. https://doi.org/10.1119/10.0006123 .

Which of the following schematic illustrations corresponds most accurately to the real situation regarding the position of the Sun and the shape of the Earth's trajectory around the Sun, when viewed from top?

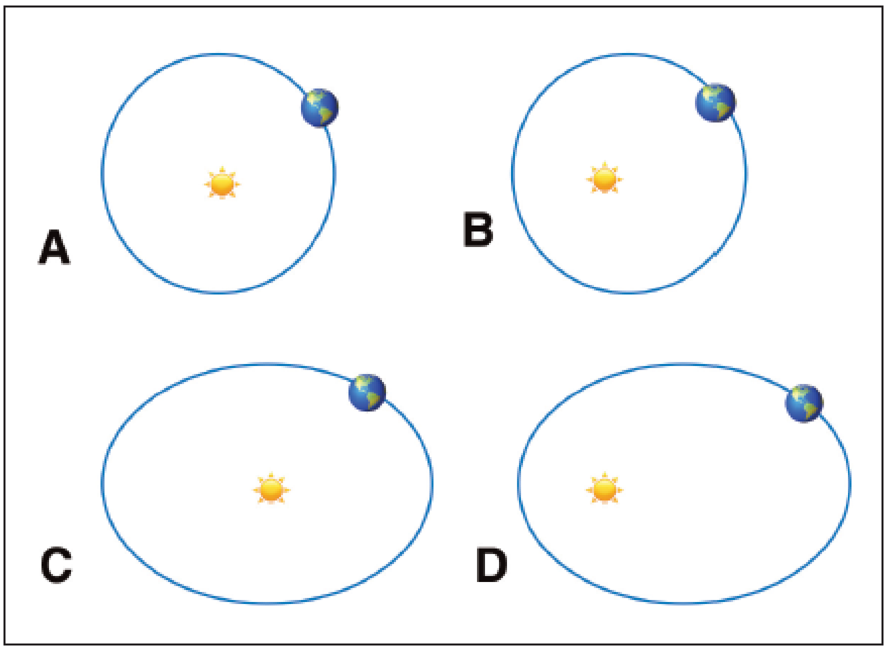


Fig. 1. Four combinations of trajectory and the Sun's position from the problem.

Always good to check one's own (mis)conceptions: which is the correct answer to the question entitling this article?

While your rattling your brain on that, Ms. Rovsek wondered while most college-level physics student-teachers chose C or D. The answer came to her that, despite years of teaching and all sorts of pedagogical efforts at misconception busting, students have been inundated for two decades with illustrations in books and on the Internet showing the Earth's orbit's eccentricity as rather extreme (to prove the point that it has some?), or to give a reference point to where the Earth is during its different seasons. In some cases, illustrators try to show both concepts, having a highly eccentric ellipse *and* an off-centered Sun, because in an ellipse the Sun will not be centered, right? The problem is, even the Earth's eccentric orbit is barely different from a circle, and she shows, even one ten times more eccentric hardly looks non-circular.

So when you are talking seasons, talk tilt. When you are talking ellipses, talk eccentric. When you are talking Earth's orbit, mention it does both, but it is hardly a National Enquirer *S H O C K I N G* display!

Oh, and the correct answer is A.

Connection to the Sky

Hubble's Field Guide to Nebulae

A four-minute plus video from NASA on the major types of nebulae in the sky, beautifully illustrated with Hubble images. The URL is https://www.youtube.com/watch?v=PYRDiR7peLw .

In Issue 13 of *The Galactic Times Inbox Magazine:*

Cover Photo — The Astronomy of Ophiuchus

- **Improved and Revamped Homepage: www.galactictimes.com !**
- **This Just In —***Are White Dwarfs Solar System Post-Mortems?*; *Knock, Knock. No, You Can't Come In.*
- **Sky Planning Calendar —**
  * **Moon-Gazing -** *The Longest Partial Eclipse;*
  * **Observing—Plan-et** — *Venus' Peak Show;*
  * **Border Crossings (Cover Story) —** *Special Report - Dr. Fauci's Sign*
- **Astronomy in Everyday Life** — *You Think?*

Subscribe to it here! It's Free!

The Black Friday/End of Year/Holidays with *Increased* Discount Sale.

Every year, Hermograph Press tries to clear its inventory shelves with an End of Year Etc. sale, in which a discount coupon nets you a discount off the sale. Sort of like Hermograph Roulette. With each issue of *The Galactic Times* and *The Classroom Astronomer*, the discount increases, but historically, the inventory goes down on some items so quickly that if you wait too long, there isn't left on an item you want to buy at a greater discount!

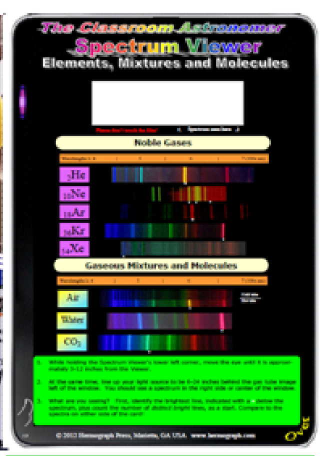
For this two weeks' run, the discount off any item in the Hermograph Store is"

37.5%

Use Code **EOY3,** good until November 30th, 2021.

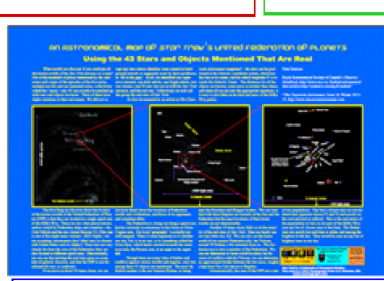
==Astronomy and Education Related Items==

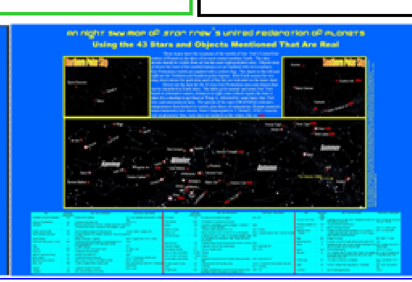
S, M, L, XL, and XXL



Two-sided spectrum viewer with over a dozen common gas tubes photographs.

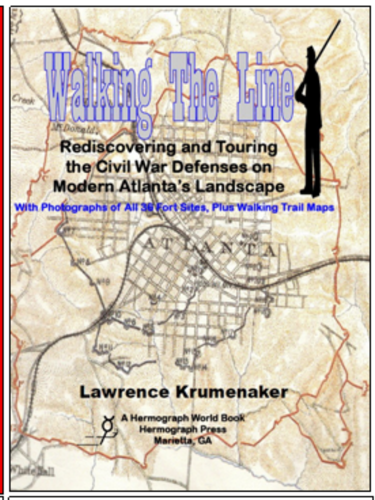
All 23 *TCA* Issues, singly, by volume, or all-together, downloadable PDFs.

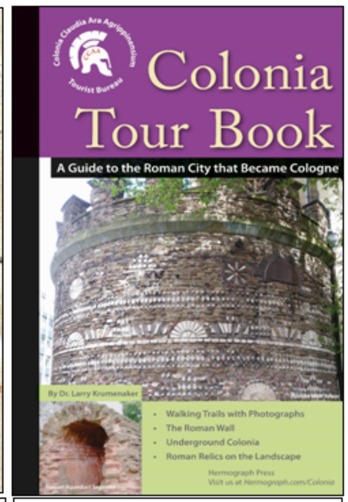




Two-sided Star Trek® mini-poster showing the locations of the real stars used in the franchise in the Milky Way and in Earth's skies!

==Historical Tourism Books==





Nine Days Traveling
Lafayette's 1825 Alabama Tour, Today's Historical Road Trip
Where did he go then? What would he—and you—see today?

Walking the Line
Rediscovering and Touring the Civil War Defenses on Modern Atlanta's Landscape
With a 2-page 2019 update!

Colonia Tour Book
A Guide to the Roman City that Became Cologne
Walking tours of the visible remains of the provincial capital.

Does not reduce shipping charges or applicable sales tax. Shipping, though, will be free for US orders over $60.

Subscriptions (fee-based) for *The Classroom Astronomer* can be made on the link below. Clicking on the FREE option will get you the *TCA Lite* Edition, in which some articles are available only to full subscribers or others are truncated. Details on other perks for these and Educator Supporter will be found when you click the link….

Subscribe now

Articles for *The Classroom Astronomer Newsletter* are welcome. Sponsorships and advertisers are welcome, too. Query us at Newsletter {at} classroomastronomer dot com.

Thanks for visiting our Universe! Stay safe in yours!

Questions, suggestions, comments? Email them to: Dr. Larry Krumenaker newsletter@classroomastronomer.com

Twitter: @ToTeachTheStars Facebook: Hermograph Press

This post is only for paid subscribers of The Classroom Astronomer Newsletter.

Like & Comment