SPACE

St. Petersburg Astronomy Club Examiner

August 2023 **Editor – Guy Earle**

The St. Petersburg Astronomy Club has been the center of family astronomy in the Tampa Bay Area since 1927. Our 391 adult members are dedicated to promoting and sharing the wonders and science of astronomy. We host a dark-sky star party each New Moon at Withlacoochee River Park, along with local star parties, telescope-making workshops, science lectures, astronomy lectures, educational outreach sessions and much more.

Inside this Issue:

Astronomy Image of the Month

The **Lagoon Nebula M8** in Sagittarius **by Jamie Kenas**

September Preview

In next month's issue, Guy Earle will discuss observing moons in the solar system beyond our own Moon, from those that you can see with a typical telescope to others which you can even photograph.

Also, SPAC member Steve Robbins, who contributes already "Space Exploration" and "Lunar Calendar," will be writing two additional articles for next month, one on the "Moon and Lunar Eclipses" and the other "Flat Earth Sparring."

August General Meeting

This month's general meeting is on Thursday, August 24th at **7:30 PM**. The meeting will be ***in person*** at St. Petersburg College, Gibbs Campus, 6405 5th Avenue North, Natural Science Building, Classroom 236, 2nd floor, and **also virtual**. This month's presentation is **Deep Sky Planner** by Phyllis Lang

To attend virtually with **Zoom,**
join from your computer, tablet or smartphone by clicking here.
You can also dial in using your phone.
United States: +1 (301) 715-8592
Meeting ID: 993-399-3311
Passcode: 999123

The club's **New Moon observing weekend** will by September 15th-17th at Withlacoochee River Park east of Dade City.

New SPAC Members

We would like to welcome Leslie Davis, Jones Gonzalez, Bell & James Jones, harry Haige, Gerry Graszi, Sara & Jose Hernandez, Traci McKenzie, Rishabh Tatiraju & Aditi Survase, Elizabeth Leib, and Kasey Rotunno & Fred Alphonse to our family of members.

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Review of TV14 Night Vision Eyepiece

Mike Partain

A few years ago, I stumbled across a nifty little secret that one day I hoped would expand my astronomical horizons, specifically, my love for visual astronomy with the mark one eyeball. Night vision astronomy has been around for the past two decades and has steadily grown as a niche in our hobby. This year I began my journey into this segment of our hobby with the purchase of a PVS-14 military grade night vision monocular. But before I begin, what is night vision astronomy? First of all, night vision equipment is technology which allows us humans to see in the dark and there are three main categories: Image Intensified Night Vision which uses tubes to amplify lowe levels of light, then there is Digital Night vision which uses digital cameras with CCD sensors to create an image on a screen and then lastly there is Thermal night vision which uses heat to create an image. Of the three technologies, only the intensified night vision and the digital night vision are useful for astronomy, unless you are Predator visiting our planet for sport.

For purposes of this article, I am going to focus in on the piece of equipment I purchased called a PVS-14. I ordered my tube in February to placate my angst for contracting Covid days before our annual OBS. It arrived in June just before my trip to the Cherry Springs Star Party in Pennsylvania. The PVS is a military grade night vision monocular that can be used on a gunsight or in tactical situations mounted to a soldier's helmet. The equipment is regulated by the International Traffic in

Arms Regulations which prohibits the unit from leaving the United States. The device is rugged and pretty straight forward. There is a image intensifier tube which collects and amplifies the light to the unit's eyepiece. The PVS-14 can be used hand held at low power for scanning the sky or at the telescope when it is attached to the eyepiece using adapters sold by Televue. The unit's objective lens is 26mm and there are magnification attachments which allow additional magnification when the unit is being held. The PVS-14 uses a single AA for power which will last the whole night and then some. One quick reminder, if you decide to delve into this segment of the hobby, do your research as the units go between $3,000 and $4,000. This may seem a lot, but just go ask an astro-photographer how long their camera mortgage is financed. The one I purchased was white phosphorus and is un-filmed. The white phosphorus version provides black and white views with no green hue seen with other types of units.

Now for the meat and potatoes. I was able to use my PVS-14 for the first time in the mountains of PA under a Bortle 2 class sky. The first two nights of the star party were, of course, cloudy much to my frustration. I ended up sitting out by the camper and found my first useful endeavor with my new toy. About an hour after dark, a bear made an appearance somewhere on the field. I sat in my chair and fired up the PVS-14 and proceeded to scan the field and tree line around my camper. Fortunately, I did not see the bear but WOW, I did see everything on the field, especially if there was any red lights nearby. I ended up scanning for over an hour which included looking up at the night sky through sucker holes. I was not disappointed and was mesmerized at what I could see in between the clouds.

The final night of the party was clear and I had my viewing list ready in hand. The PVS-14 excels in nebulae's, globular clusters and galaxies. My first targets were in Scorpius and Sagittarius (it was so nice to view these items and not sweat to death while fighting off mosquitos). I used my 16 inch dobsonian telescope and attached my PVS 14 afocally to a 31MM Televue Nagler which yielded a magnification of approximately 60x. I spent the first two hours fixed on the Swan, the Lagoon, the Trifid and the Eagle Nebulae in Serpens. The Eagle was my first target and I was amazed at the amount of detail I could see in the nebulae. The lines of the nebulae were sharp and distinct producing details I have never seen at the eyepiece. There was little guess work to seeing the "Eagle". The Swan was even more impressive with nebulosity extending well off the back of the Swan and past the field of view. It seemed to go on forever. The lines dividing the Trifid jumped out on in pronounced detail and the Lagoon was just everywhere. I ended up spending most of the night

using the nightvision equipment versus traditional observing. Galaxies were interesting as I was getting more structural details that I hadn't seen before. M-51 was a great example with distinct spiraling and the bridge as was the Needle Galaxy (NGC-4565) with a dark lane and bulge bigger than M-104. Globular clusters were not a disappointment M-13 revealed a small looking Eastern Orthodox cross at the center with thousands upon thousands of stars. Towards the end of my viewing session I began to see a haze develop in the sky. It was smoke from the Canadian wildfires and for most it signaled the end of observing as we lost detail. This was not the case for me as the PVS-14 seemed to cut through the haze and provided me with stellar views up until 3:45 AM when my legs gave out on me and I headed to bed.

It took me two years to save up for my unit after Elrod graciously allowed me to take a peak with his PVS-14 at one of our Withlacoochee star parties. I can honestly say, it was well worth both the wait and the expense. For me, this piece of equipment has already revolutionized how I view at the telescope and rekindled a new fervor for visual observing unlike anything before. Next time you see me at the Withlacoochee, come over for a view and if you one of those hermit astrophotographers, don't blame me if you suddenly find yourself buying something new.

Flats and Darks

A brief history of an amateur astronomer's progression

By Wayne Frey

Back in the fifties, when a person looked up they saw stars, the moon and very bright stars. Street lights were mounted lower and usually consisted of a 50 watt bulb with an inverted V shaped shield. The light went down forming a circle around the pole it was mounted on. Outside of this cone of light it was dark. Being a curious hyper active person, I wanted to learn more about the stars, especially the brighter ones. Our family watched Sputnik fly over from our front yard. It was the first man made object to orbit the earth so the rest of space was filled with just stars, planets and the moon or so I thought at the time.

A few months later, a friend & I were walking around the neighborhood after dark and spotted a man leaning over the hood of his car holding a brass telescope like the pirates in the movies had. We stopped and asked him what he was looking at? He replied, "the moon" to which we said "we can see the moon also." "Not like this" he said and then he let us look through his little brass telescope. WOW! We could not believe what we saw on the surface of the moon. Vast dark areas some surrounded by mountain peaks and many holes (craters). This speared me on to learn more so I purchase a moon map and a book of constellations (H. A. Rey THE STARS). It was not long before I realized those very bright stars were not stars but planets. I memorized their names and attempted to identify them but without any visual aids (binoculars or telescope) they remained very bright stars.

Remember I stated I am a hyper active person thus I was distracted from astronomy for years by life. Cars, girls, high school then military service. After that it was work but I was drawn back to the night sky every time I looked up. I finally obtained a pair of 8 X 50 binoculars and the rabbit hole opened up. The planets became planets instead of very bright stars. The Messier list and the moon map became my holy grail as I learned to star hope to the object. Messier's list is full of wonders to behold but many were just faint fuzzy cotton ball floating in the night sky.

I developed a case of aperture fever and soon had a 90 mm refactor on an equatorial mount that was very difficult to star hope with so I would lay it over and use it as an alt/az. Messier's list (catalog) was publish around 1760. Little had changed in the night sky over 200 years but some of his objects

were still small faint fuzzies. I found an astronomy club in the next town that had a domed observatory in the corner of a farm field, very dark there and only two miles out of town. They had a 12" telescope inside. I joined the club and got checked out on the operation of the observatory before receiving a key to it. I spent many clear nights out there observing the moon, planets and Messier objects, some of which were still faint fuzzies.

We traveled around the country for several years after retiring and decided to settle in FL. It was then I purchased a 10" reflector on a Dobsonian mount. By now the messier list was getting old so I found the NGC / IC catalog and started observing those objects. These catalogs were published in 1888 by J. L. E. Dreyer from the observations of William & Caroline Herschel with two supplements in 1895 & 1908 now know as the IC catalog. The objects still had not changed much in 100 years but these objects were farther out thus smaller and dimmer. I need help finding them and soon replaced the 10" with another 10" only this one had electronic setting circles and a hand pad with 10,000 objects.

The community we settled in was not that dark and soon I found another astronomy club in central FL that had a dark sky site in Harmony, only an hours drive. They also had an observing program that offered a pin and certificate when completed. The internet is a wonderful thing at times. Through it I found an informal club who's dark sky site was in farm country near Dade city. I joined and volunteered there to gain access to the property on any clear night. It was only a45 minute drive in the country instead of through the suburbs to get to Harmony. I managed to finish up the Herschel 400 list and the second Herschel 400 list along with many others like double stars, carbon stars, planetary nebulas, globular clusters etc. Still searching for new things to look at, I was transported even further out in space to galaxies.

Again the further out the fainter and smaller the objects appear so another investment in a larger 15” fully motorized and computerized telescope. With this instrument I was able to reach out to catalogs from the 50s & 60s created by such famous astronomers as Abell, Arp. Hickson & Barnard. It was an all day and late night adventure loading up the scope in the van, transporting it to the dark sky site, unloading and setting it up then four or five hours of observing. Breakdown usually around 3 am for the hour drive home. Straight to bed so I could get up before the heat of the day to unload the equipment.

Our backyard was a Bortle 5 when we moved in to a new (to us) home eight years ago. Now due to growth it is a Bortle 6-7 depending on the humidity. I could no longer see galaxies or nebula thus every observing session had to be at a dark sky site. 140 years ago the professional astronomers started using photography to aid them in observing the heavens. I decided to try my hand in that endeavor by purchasing another telescope for imaging instead of visual. It was very challenging and even more time consuming than before. The results where rewarding in that you are able to see much more detail than visually and you have a record (image) of what you observed for later use.

After a year of astrophotography I switched to EAA (Etronically Assisted Astronomy). This was not as time consuming but not as detail revealing as astrophotography. This also involved a lot of preparation time but I could now observe from my backyard for the closer deep sky objects. Now when the inclination and time are right I still go to WRP dark sky site for those objects even further out. I still struggled with cords and computers at the telescope. It was very distracting until a new generation of EAA telescopes came onto the market.

Now I have one of them. It weights 20 pounds, is self contained with it's own wifi and controlled through an app on you phone or ipad. Only takes 15 minutes to set up but was very expensive. Cost about the same as my used 15” that is motorized and computerized but the images are far more detailed. The sensor cuts through a lot of light pollution and I am now doing most of my observing from the backyard again. I also get more observing time because I do not have to wait for astronomical twilight I can start just before nautical twilight. If a hole opens up in the clouds I can set up and be observing in minutes even if the clouds only give me an hour. I am now viewing objects from the ANNUALS OF THE DEEP SKY some of which are 2000 mly (million light years) away. Alas they are now the faint fuzzies I use to see visually and the faint fuzzies I use to see are now detailed objects.

I have not seen everything up there but I sure am giving it a try. So what opened the rabbit hole for you? Submit your story to the SPAC Newsletter.

in Gulfport

Bring your 'scope to this public outreach opportunity and set up at the corner of Beach Blvd. & 31st Avenue South.
Saturn will be up too!
Sunset 'til 10:00pm

***FREE** parking but get there early!*

This coincides with "Third Saturday IndieFaire" street market; lots of foot traffic!

moon.nasa.gov/observe
#ObserveTheMoon

for more info, contact Greg Simpson at fzwicky@aol.com

SPAC New Moon Weekend

Withlacoochee River Park

July 14-17, 2023

By Intrepid Field Reporter

KELLY ANDERSON

Summer continues unabated. We've been treated, as nearly we can tell, with the hottest global days for 100,000 years. The July New Moon Weekend was mostly hot (quelle surprise!) and mostly cloudy at night and thunderstorms by day, but that didn't deter a band of die-heart astronomers from enjoying the possibility of occasional stars here and there. Temperatures after sundown were actually quite pleasant and the mosquito patrol mostly stayed away.

On Thursday Joe Canzoneri rolled in around 9:00 am, and your Intrepid Field Reported arrived an hour later. Bob & Rita Mizel and Tim Harris joined us mid-afternoon, while Johnny White stopped by for a visit later on.

We all prepared our equipment in eager anticipation of what we came for, but by and large we were disappointed that the cloud gods refused to cooperate. We were surrounded by noisy and flashy cumulus nimbus clouds, but we did get a few breaks in the overcast and Joe was able to capture a couple of excellent images of nebulae, NGC 6888 (the Crescent) and NGC 7635 (the Bubble).

1Bubble Nebula by Joe Canzoneri

On Friday afternoon we greeted Rich Tobin and Pete McLean, followed later that evening by Mike Reese. Friday weather was pretty much a repeat, surrounding us with thunderstorms and dousing us with 20 minutes of moderate rain. Once again the cloud gods perversely teased us with the possibility of a few sucker holes, but closed them up before we could point our instruments.

Jack Fritz arrived for a visit on Saturday. Joe, Bob & Rita, and Tim stayed over Sunday night, but, sadly, had nothing of astronomical interest to report.

Still, it was good to be able to get out and enjoy the company of fellow cosmic enthusiast, not to mention the incredible Withlacoochee River Park.

2Crescent Nebula by Joe Canzoneri

Jack apologized for not doing a better job with the weather and promised to do better for the August edition of our Dark of the Moon festival of stars, scheduled for August 11 – 13, which coincides with the Perseid Meteor Shower.

A major meteor shower during a new moon! How can you resist that? Bring your lawn chairs and prepare to be amazed!

Space Exploration News

STEVE ROBBINS

There are two spacecraft on their way to attempted Moon landings right now, Chandrayaan-3 from India and Luna 25 from Russia. Chandrayaan-3 launched first on July 14 for an extended trip to the Moon. Using hyper-efficient small rocket motors, Chandrayaan-3 slowly enlarged its orbit around Earth until on August 5 it carried out a typically low energy trans-lunar injection to enter an extended Lunar orbit. Then with a reverse sequence of its Earth maneuvers, successive maneuvers will reduce the altitude of orbits and change the inclination so that Chandrayaan-3's Vikram lander can touch down near the Moon's south pole, scheduled for August 23.

Meanwhile, Russia joined the Moon landing party (remember, China is already there with Chang'e 5), launching Luna 25 August 11. Luna 25 is the first Russian launch to the Moon since 1976. Although a month behind the launch of Chandryaan-3, Luna 25 will be attempting a landing first, being on the more typical high energy path to lunar landing. At 1.6 tons, Luna 25 is about half as massive as India's lander. Luna 25's "most important task, to put it simply, is to sit where no one has sat," according to Maxim Litvak, a chief scientist for the mission from Russia's Space Research Institute. Its exact planned landing date is obscure, but Russia has announced that it will land before Chandryaan-3, near the south pole of the Moon.

Launched on July 1 and arriving on station two weeks later, ESA's groundbreaking Euclid probe is on station, joining JWST and Gaia at the Earth-Sun L2 Lagrange point. July 31, the first set of

test images was released to the public. Euclid is the extragalactic counterpoint to Gaia, where Gaia surveys 1.8 billion mostly Milky Way stars over a baseline of several years, cataloging stars' spectral characteristics, variability, magnitude and three dimensional motion and position, Euclid is doing the same thing for about two billion of individual galaxies, characterizing morphology, redshift, precise coordinates, using both visible light an infrared light. Euclid plans to survey about 30% of the sky to characterize the distribution and large scale interaction of billions of galaxies throughout the history of the universe, using a comprehensive computer simulator called the Euclid-Flagship simulation. This immense data set will put strict constraints on the cosmological theories in use today, probably resulting in some substantial adjustments. It will also yield great images for our astrophotographers to drool over!

Parker Solar Probe isn't getting much attention these days. But it launched five years ago on August 12, 2018 and has been living an Icarus existence painfully close to the star that warms our home. Paradoxically, as the Parker Solar Probe orbits closer to the Sun, it must increase its velocity. Orbital velocity in Earth's neighborhood is about 67,000 miles per hour at 93 million miles, but to get to its present periapsis of 4.5 million miles, PSP will use the latest of a series of Venus gravity assists to reach a NASA record speed of 394,742 miles per hour. That's almost Solar System galactic orbital speed of ~550,000 miles per hour! August 21, Parker Solar Probe will pass by Venus and temporarily interrupt its solar research with some measurements of the Venusian atmosphere and surface. It's ultimate speed of 430,000 miles per hour will take it to within 3.8 million miles of our Sun, only 4% of our 93 million mile distance.

September Lunar Calendar

September 3, the Moon will cross the celestial equator going northward at the Ascending Node

September 4, Jupiter will be 3.3° south of the Moon

September 5, the Pleiades will be 1.2° north of the Moon

Third Quarter September 6

September 9, Pollux will be 1.5° north of the Moon

September 12, the Moon will be at Apogee: 406,289 km from Earth

September 12, Regulus will be 4.1° south of the Moon

New Moon September 14

September 16, Mars will be .7° south of the Moon. It will be occulted during daytime for us and not visible because the Moon will be on the opposite side of the globe

September 17, Spica will be 2.4° south of Moon

September 17, the Moon will cross the celestial equator going southward at the Descending Node

September 19 Neptune will be at opposition

September 21, Antares will be .9° south of the Moon

September 22, Mercury will be at greatest elongation from the Sun, 17.9° west

First Quarter September 22

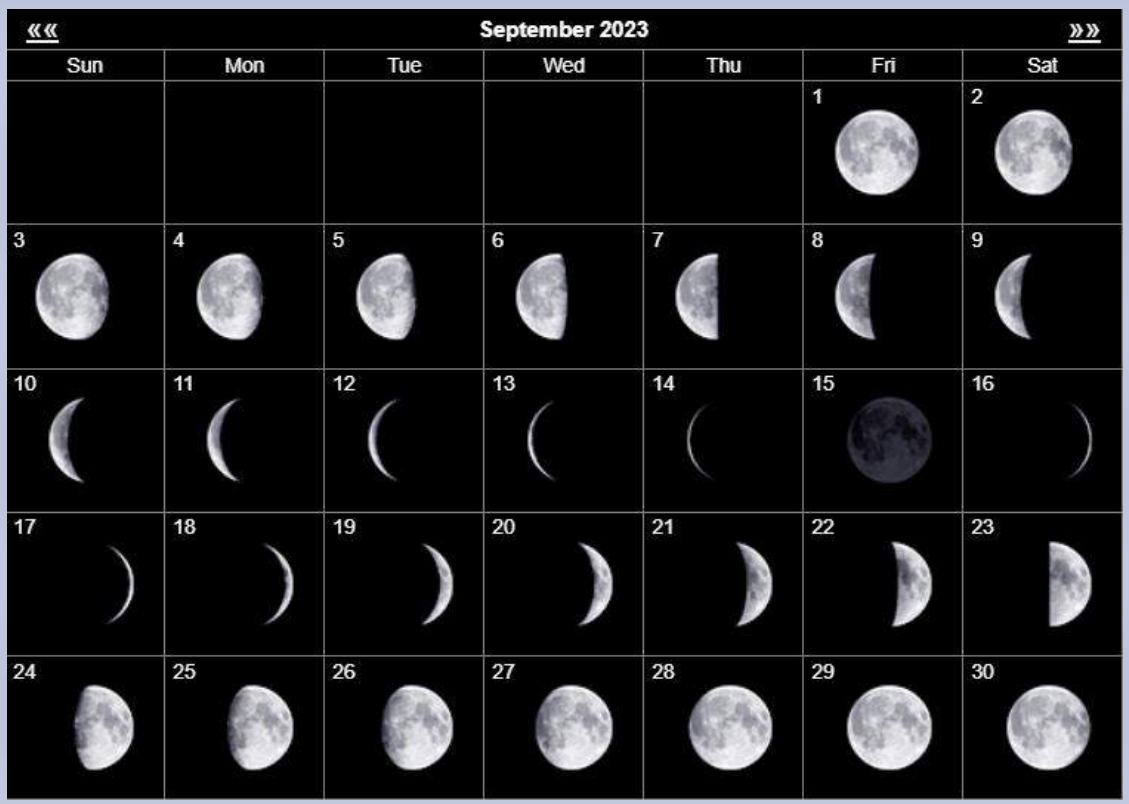
September 23 is the northern hemisphere Autumnal Equinox

September 26, Saturn will be 2.7° north of the Moon

September 27, the Moon will be at Perigee: 359,911 km from Earth

Full Moon, September 29, the Full Harvest Moon

Sept. 30, the Moon will cross the celestial equator going northward at the Ascending Node



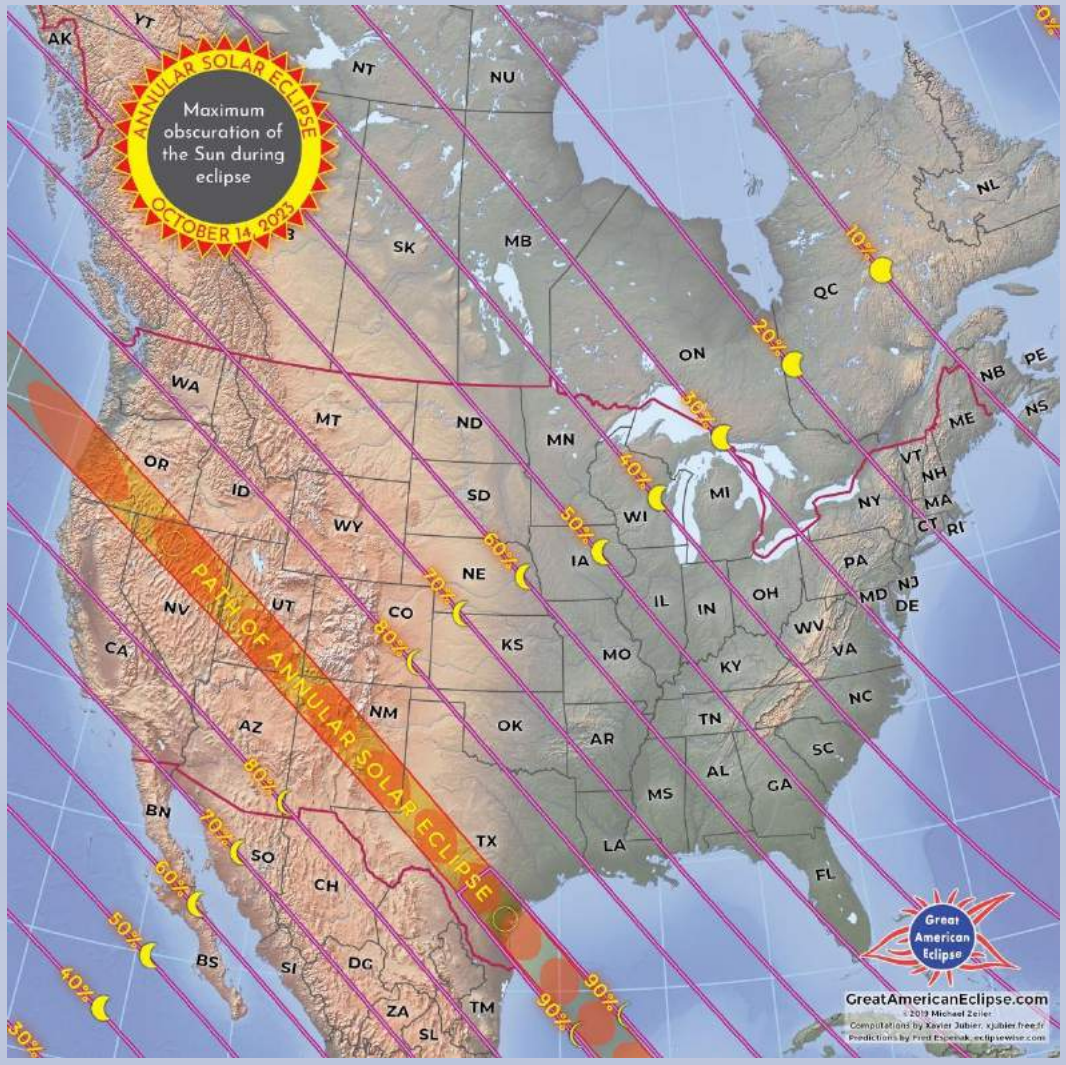
Upcoming Solar Eclipses

Guy Earle

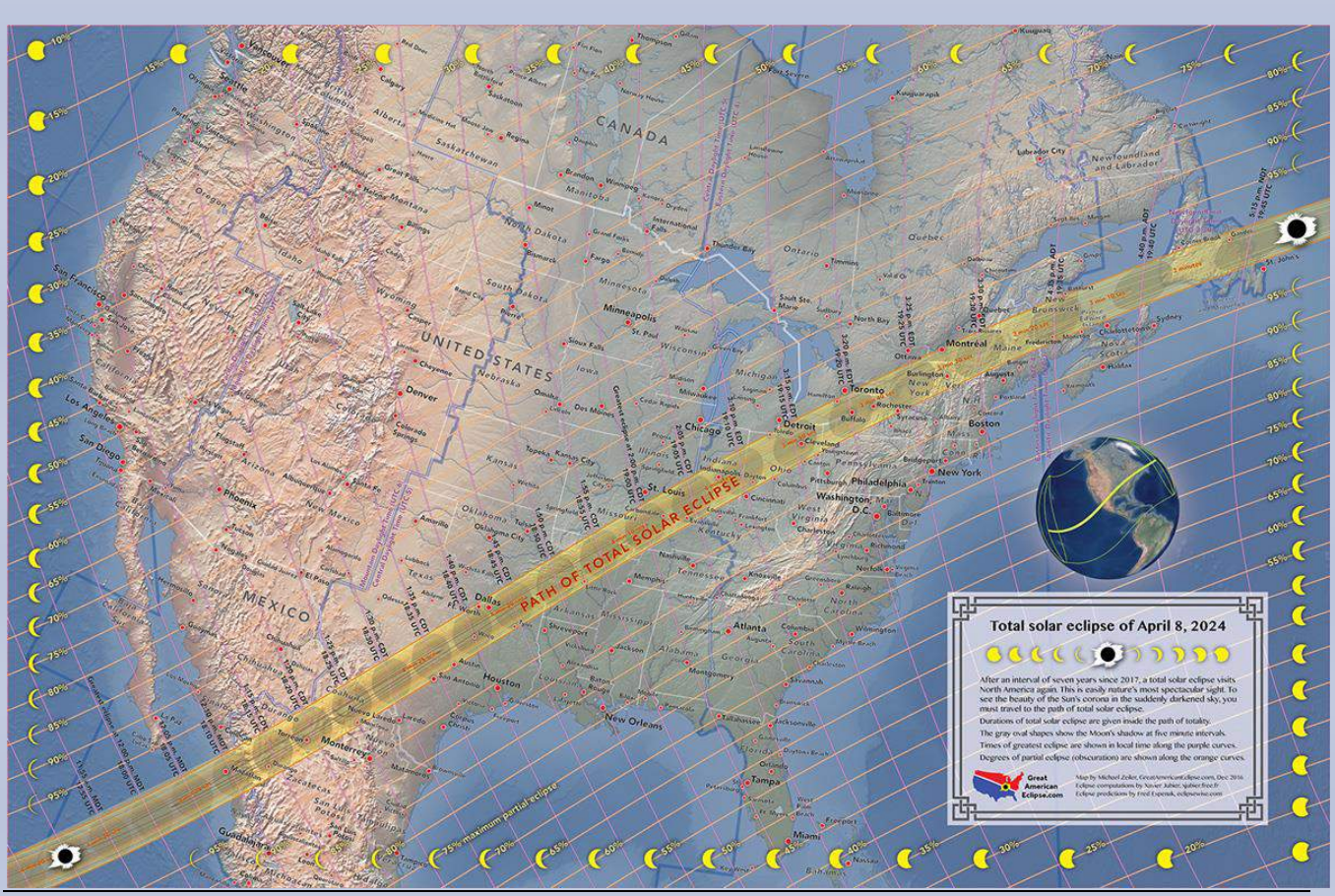
I have not seen a total solar eclipse myself, so if I don't see one of the TWO that are happening within the next year, then that's just criminal. It is rare for solar eclipses to hit the US, or it seems to be rare, but we will actually have one pass over many states in October, followed by yet another covering more of the US in April 2024. Here is some information, provided by NASA, on information and illustrations for the upcoming eclipses:

The Saturday, Oct. 14, 2023, the annular solar eclipse will cross North, Central, and South America. It will be visible in parts of the United States, Mexico, and many countries in South and Central America.

In the U.S., the annular solar eclipse begins in Oregon at 9:13 a.m. PDT and ends in Texas at 12:03 p.m. CDT.



The Monday, April 8, 2024, total solar eclipse will cross North America, passing over Mexico, the United States, and Canada. The total solar eclipse will begin over the South Pacific Ocean. Weather permitting, the first location in continental North America that will experience totality is Mexico's Pacific coast at around 11:07 a.m. PDT.



The path of the eclipse continues from Mexico, entering the United States in Texas, and traveling through Oklahoma, Arkansas, Missouri, Illinois, Kentucky, Indiana, Ohio, Pennsylvania, New York, Vermont, New Hampshire, and Maine. The eclipse will enter Canada in Southern Ontario, and continue through Quebec, New Brunswick, Prince Edward Island, and Cape Breton. The eclipse will exit continental North America on the Atlantic coast of Newfoundland, Canada, at 5:16 p.m. NDT.

I hope you have the chance to see the eclipse, as it's certainly a bucket-list item for me, as I've heard countless stories over the years of the incredible experience. Wherever you end up, I hope you share some stories and pictures with your fellow SPAC members.

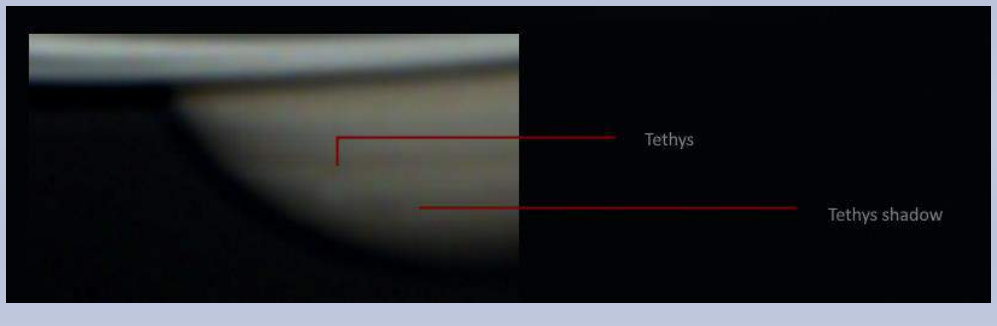
Saturn at Opposition

Guy Earle

On August 27th, Saturn will be at opposition, which I've described in previous Examiner editions in detail, but to summarize is the point when Saturn's orbit brings the ringed planet opposite the sun in our sky. This means that with Earth in between Saturn and the Sun, it is at its closest approach.

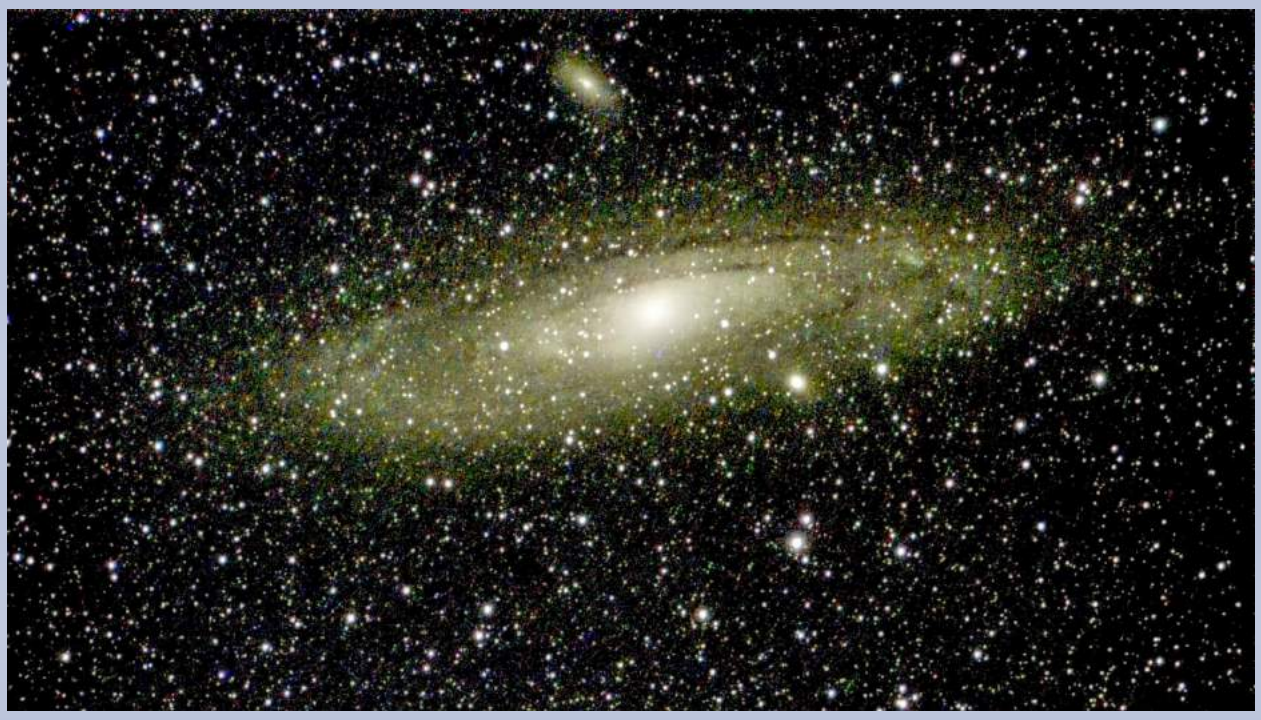
What does this mean for you? Saturn will therefore be at its largest to our telescopes and also the brightest (i.e. the ideal time to view or image it). The view right now is the ideal "perfect Saturn" image, with the rings slightly tilted. In fact, Saturn's rings tilt ever year a bit in on direction, eventually becoming edge-on, then progress to the other end of the tilt and back again. The same thing will happen in 2024-25: we will experience a "ring plane crossing." As Saturn goes around the sun, it periodically turns its rings edge-on to Earth—once every 14-to-15 years. Because the rings are so thin, they can actually disappear when viewed through a small telescope.

You can also see up to a half-dozen of Saturn's moons, especially Titan, which is the second largest moon in the solar system and the largest of Saturn's 145 moons. Yes, I said, "145." Something that I'm trying to achieve, as a planetary photographer, is to get a clear image of a Saturnian moon in transit. You can see and image the moons around Saturn, but they show up as little disks. It's far more difficult to image one when it goes in front of Saturn, mainly because they tend to blend into the planet's colors and their miniature size, being far, far smaller than even far away Neptune. Here's a photo I took just a few nights ago of Saturn and an attempt to image the moon Tethys previously.



SPAC Image Gallery

Here are some excellent astrophotography highlights from our fellow SPAC members. Anyone who would like to share his or her work, I encourage you to email the editor to submit for future newsletters or share them on our SPAC Facebook page.



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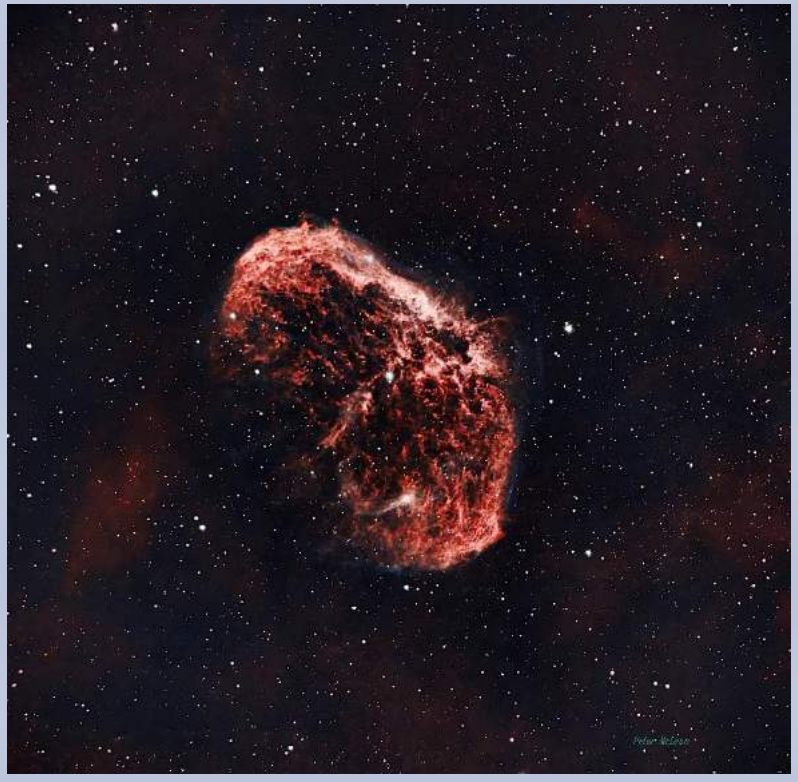
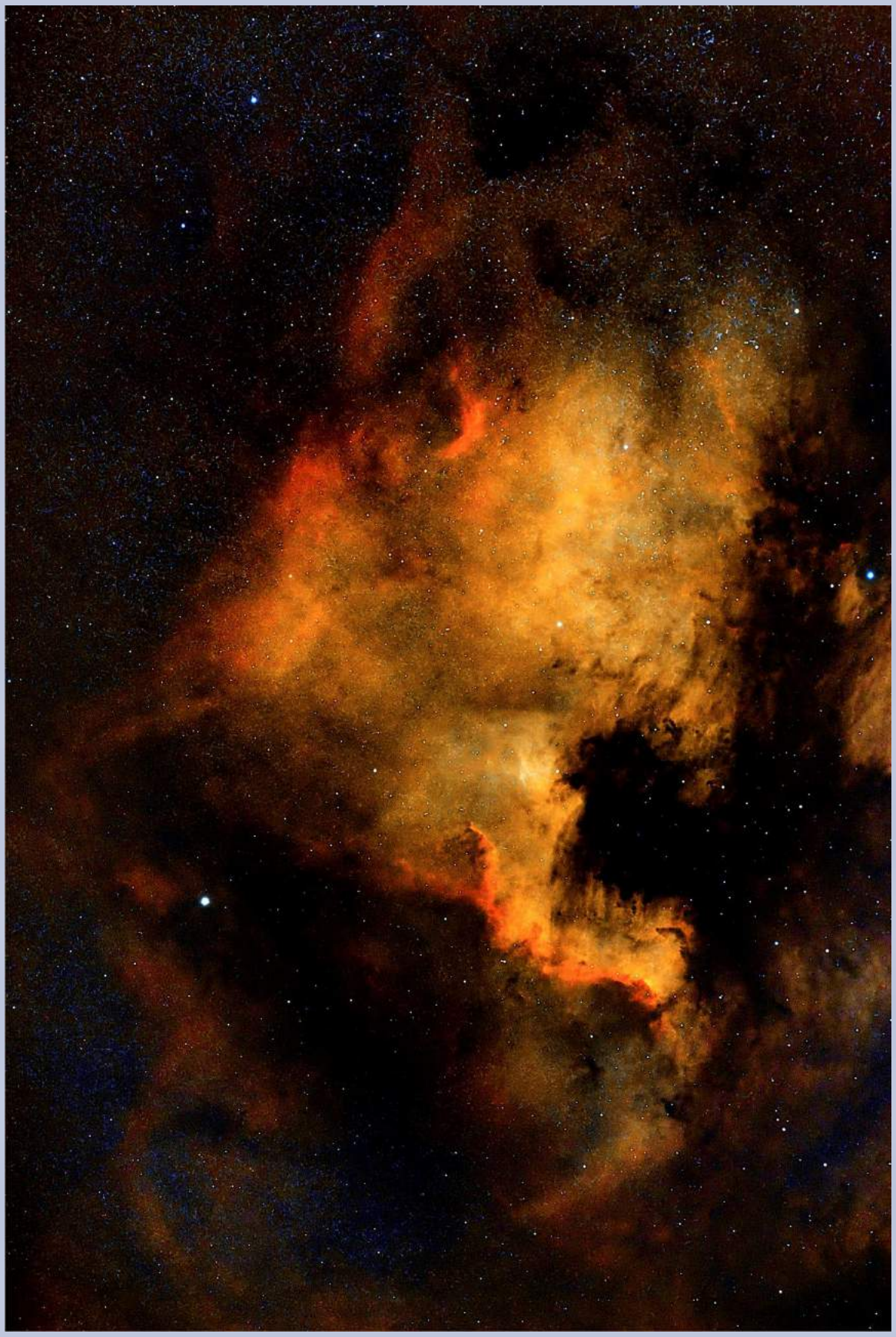
Above: **M31, The Andromeda Galaxy** w/Dwarf II **by Christian Rubach**
Below: **Saturn and the ring tilt** w/16" Dobsonian on eq platform & ASI290MC **by Guy Earle**

Above: **The Eagle Nebula** @ WRP **by Joe Canzoneri**
Below: **The Bubble Nebula by Peter McLean**



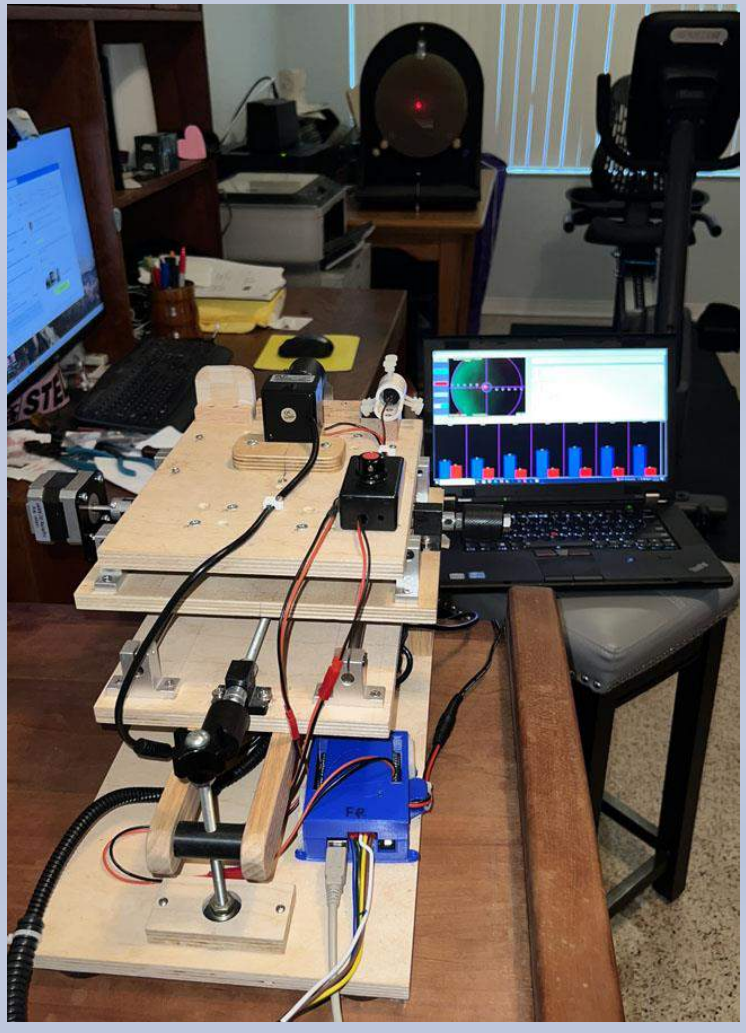
Following Page: **NGC 7000 The North American Nebula by Richard Tobin**



SPAC Mirror Lab: Robotic Foucault Tester 2.0

Allen Maroney

The Mirror Lab gang has been busy updating one of its central pieces of testing equipment, the Robotic (Robo) Foucault tester. First let's briefly go over the mirror making process and the testing tools that are used so show where the Foucault test fits in. Above is Robo Foucault ready to test a 11" mirror.



When you grind and polish a telescope mirror there needs to be a way to accurately measure your progress at each phase. The mirror goes through a progression of 'hogging out', grinding smoother, polishing and figuring. Explaining the process, a little should make it clear where the Robo Foucault comes in.

Hogging out (60 grit)

This is where the flat mirror is ground so that the center becomes deeper and the surface becomes curved up to the edge. This curve should be spherical with the depth of the sphere becoming the eventual focal length of the future telescope. A tile tool is used for this process.

Testing equipment used: the Sun, Sagitta Meter and/or a Spherometer

The Sun may be used for a rough focal length by wetting the mirror and focusing the Sun's light on a point where the smallest focus point is the focal length. Be careful not to catch anything on fire when doing this test.

The Sagitta Meter is a steel bar with a micrometer in its center that when placed across the mirror. The micrometer measures the depth of the center relative to the edge. We have a chart that converts that measurement into a focal length.

The Spherometer uses a metal disk with a micrometer mounted through its center and three small round feet equally spaced on the bottom of the disk near the edge. The Spherometer is able to check for the curve as well as how well the spherical curve is maintained across the face of the mirror.

Grinding smoother (80 grit-12 micron)

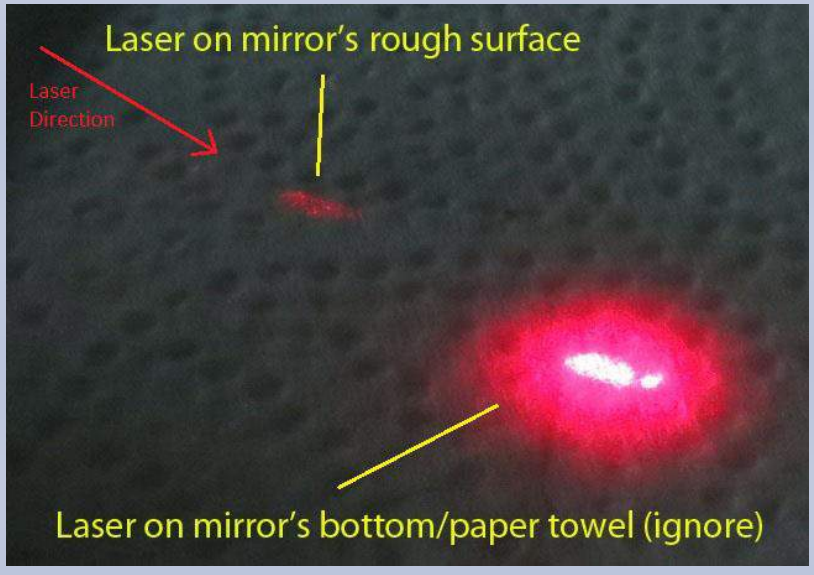
This phase continues to use the tile tool to progressively used finer grit levels to grind the surface down and remove the pits of the previous, larger grits.

Testing equipment used: the Sun, Sagitta Meter and/or a Spherometer

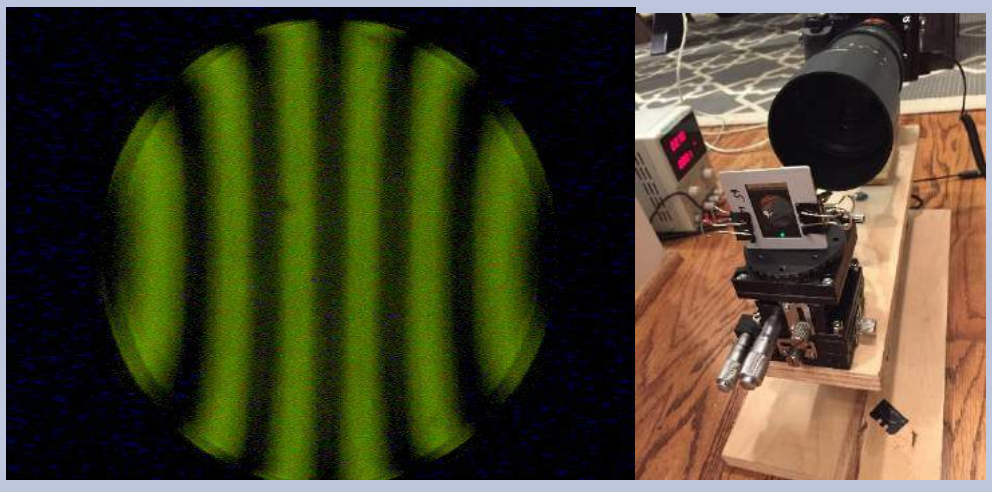
Polishing and Figuring (Cerium Oxide)

We now switch to a pine tar tool, also called a 'lap' or 'pitch lap', and start using Cerium Oxide as a polishing compound. After the mirror's surface looks shiny some testing may begin.

Testing equipment used: Laser, Ronchi screen, Foucault, Interferometer.



The Laser will show how polished the surface is. It is unforgiving and it won't lie to make you feel better. A mirror that isn't fully polished will redirect light into the black background making your telescope views have less contrast.



A Ronchi screen, very fine opaque lines on a clear background, may be places in front of the mirror and the resulting deviation from straight grid lines will show the deviation from a spherical surface.

The Foucault test uses light reflected off of the mirror at a distance of twice its focal length and a knife edge which cuts off the return beam to create shadows which can determine slight changes in its focal length for different zones across the mirror. These minor changes in focal length can be combined to create a plot of the surface of the mirror.

A knife edge and measuring device, often a micrometer, to accurately measure the distance from the knife to the mirror's surface using series of left and right sets of zones across the mirror (traditionally using a cardboard mask). Each left and right pair of zones gets its own measurement. Together they create an accurate measurement of the mirror's surface in the billionths of a meter across the strip of the surface where the zones were located. During figuring the spherical shape becomes a parabola by deepening the center of the sphere, which this also measures.

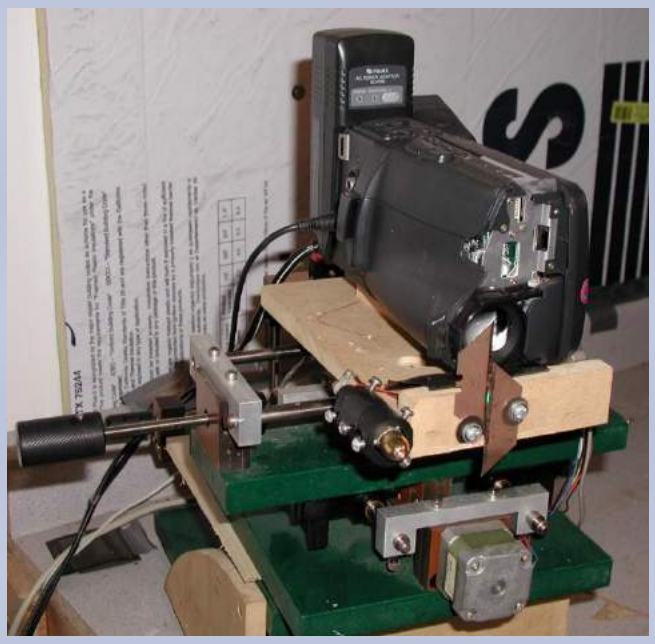
The Interferometer is a Foucault test on steroids. It measures the entire mirror surface at one time. It uses a laser, beam splitter, mirror, lens and a camera. We attempted to use this at the Mirror lab but the road traffic in front of the Science Center and the water treatment pumps caused too much vibration.

A Deeper dive into the Robo Foucault Tester

The traditional Foucault test uses a cardboard mask sized for the mirror being tested with zones cut out. This helps the person trying to match brightness values between two opposing zones stay focused only on the area needed. It also used a micrometer to measure the difference between the distance where different zones are measured.

James Lerch, an early member of the mirror lab, built a go-to bino scope using the Scope software and hardware plans from Mel Bartels web site. This controlled the stepper motors from the parallel port on a notebook PC. Making the matching 8" mirrors at the Mirror Lab required dozens of manual Foucault test. He had the idea to automate the Foucault process. A computer with the right software and a video camera for input on a Foucault test stand should be able to accurately measure the zones without the physical cardboard mask. Additionally, if the computer could accurately control motors, then it could move a Foucault test stand, test each zone and save the results and move to the next zone.

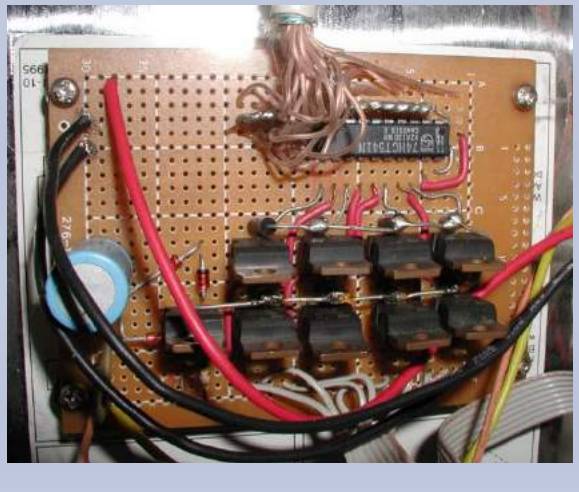
The motor control part was taken from the go-to bino telescope. The camera was a VHS-C that had a broken tape motor. It could feed into the computer with a video capture card. The hole was that there wasn't anything to tie the parts together. James armed with a Windows XP PC and a Visual Basic 6 compiler started writing RTAFT (Real Time Automated Foucault Test). RTAFT is the software and Robo Foucault is the entire package.

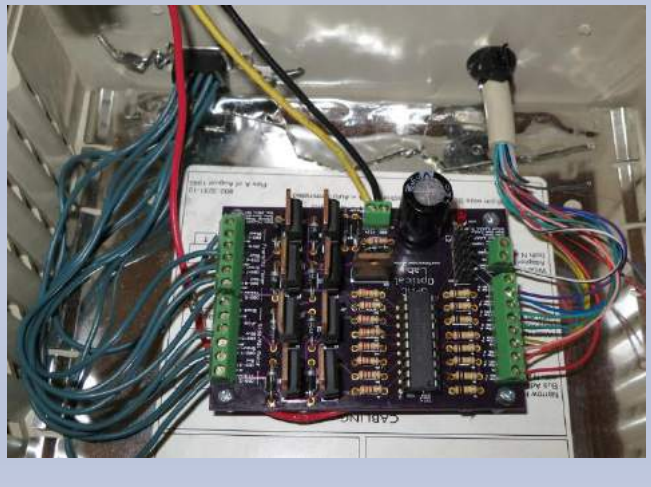


After creating the prototype Robo Foucault stand (above left) James was able to test the software and peer review the results online. Note the telescope hand controller still attached to the prototype. He was part of a test group that mailed a finished mirror around the country comparing their results. The RTAFT software not only accurately tested the mirror it did it much faster than testing it manually.

After the testing confirmed that the process would work James and Paul McNabb got together to create a more robust Foucault stand (above right) that could handle the rigors of Mirror Lab use. This stand has been used from 2003 sometimes making dozens of tests on Saturdays. You'll notice that there isn't an end date there. Ron Jones is still using this tester helping mirror grinders test their work in his hallway since we lost our mirror lab location.

As Robo ages parts have needed to be replaced. The camera, motors, alignment laser and computer have all died over the years. So-far the parallel port motor controller has not had a problem.





Above left is James original motor controller. We built a spare motor controller (above right) and tested it. That was fine for 2015 but now PCs, especially notebook PCs don't have parallel ports and a USB to parallel port adapter cannot be used.

It is time for Robo 2.0.

The goal was: *Get the RTAFT software running under Windows 10 and Windows 11. Remove the code parts that talk to the parallel port and replace them with communication to the USB port that is connected to a new off-the-shelf motor controller. Ideally, allow it to also use a USB video camera. Keep the new motor controller backwards compatible with the existing Foucault camera stand motors.*

I knew that Ralph Craig and Paul McNabb were independently working on a new Robo Foucault stands. We had been discussing using a small USB camera instead of a VHS camera with a USB capture hardware.

I wanted to replace the parallel port motor controller with something more modern and off-the-shelf. The goal was to use the same motors and motor wiring with the old parallel port and the new motor controllers. This would require some significant changes to the RTAFT software. Fortunately, James gave me a copy of the source code back in about 2005. I modified it slightly when we had to replace a dead XP PC with a Windows Vista PC and haven't looked at it since.

Above is the new motor controller stacked on the Arduino and connected to two stepper motors. This was a bench test before testing it with the robo Foucault tester stand.

In Mid July 2023 I blew the dust off of the Visual Basic 6 source code. To work with it I needed a Windows XP virtual PC which was running on my Windows 11 PC. Yep, it may only be changed on Windows XP, although the compiled program runs fine under Windows 10 and 11. Once I had my head wrapped around what James wrote I contacted Ralph and Paul and let them know what I was up to.

Ralph accepted the challenge and worked on finishing the Foucault test stand. A few weeks later we met at his house and set up the newly created Foucault stand and plugged it into the heavily modified code. The only thing reused during this initial test was a mirror with known Foucault test values.

We used a Windows 10 notebook PC and plugged the new USB camera into it as well as the USB Arduino motor controller. We set up the test, crossed out finders and started the test.

Both motors turned the wrong direction. Annoying, but since the software allowed us to reverse the motor direction it was an easy fix.

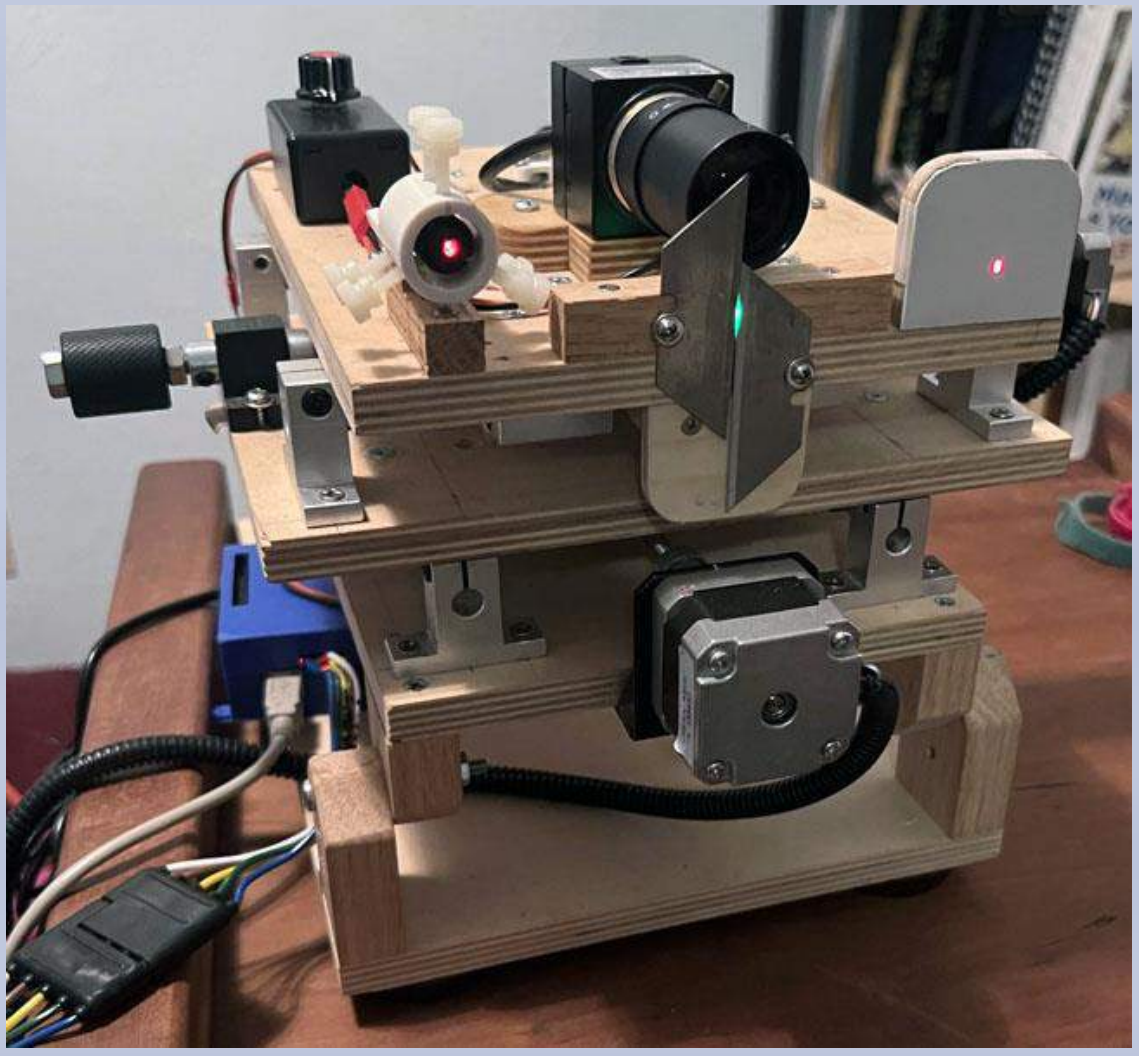
The test finished but the FigureXP program didn't open. This program is what displays the test results. After a little debugging and a tweak to the code (in another virtual Windows XP development PC) we had FigureXP opening. There were a few other tweaks that we wanted to the RTAFT code as well as the test stand.

A couple of weeks later and we met up again at Ron's house for round 2 of testing. In addition to testing the latest changes we could also retest the mirror with the classic Robo in Ron's hallway.

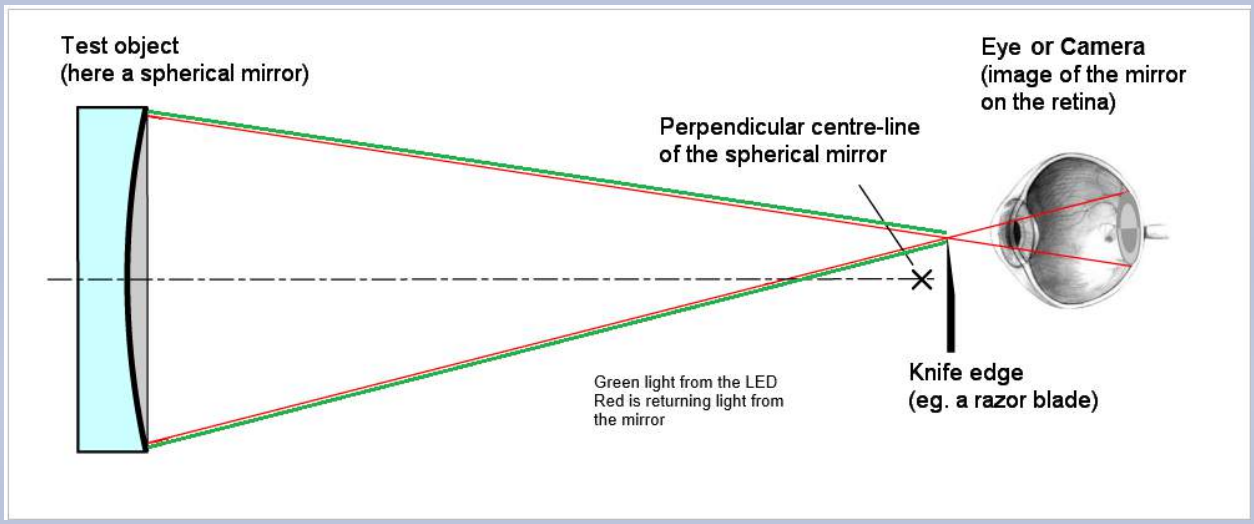
After we figured out that not only did the motors spin backwards but the numeric output was all negative numbers when it should have been positive. I'm seeing a theme here. We manually changed the numbers to positive and they matched the classic robo.

Round three of testing was back at Ralph's. The motors were spinning correctly and FigureXP opened with the correct, positive, values. We normally don't display the results using another program called Sixtests which is good because testing it failed also. That has since been corrected.

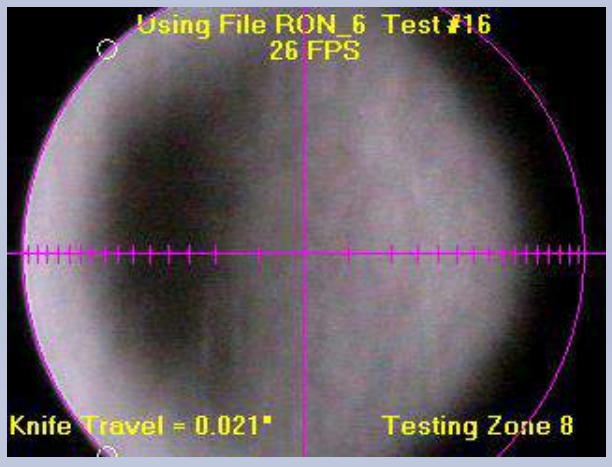
We have at least one more round of testing to go through. This will retest the core components, check the Sixtests output and try a second, less expensive, motor controller.



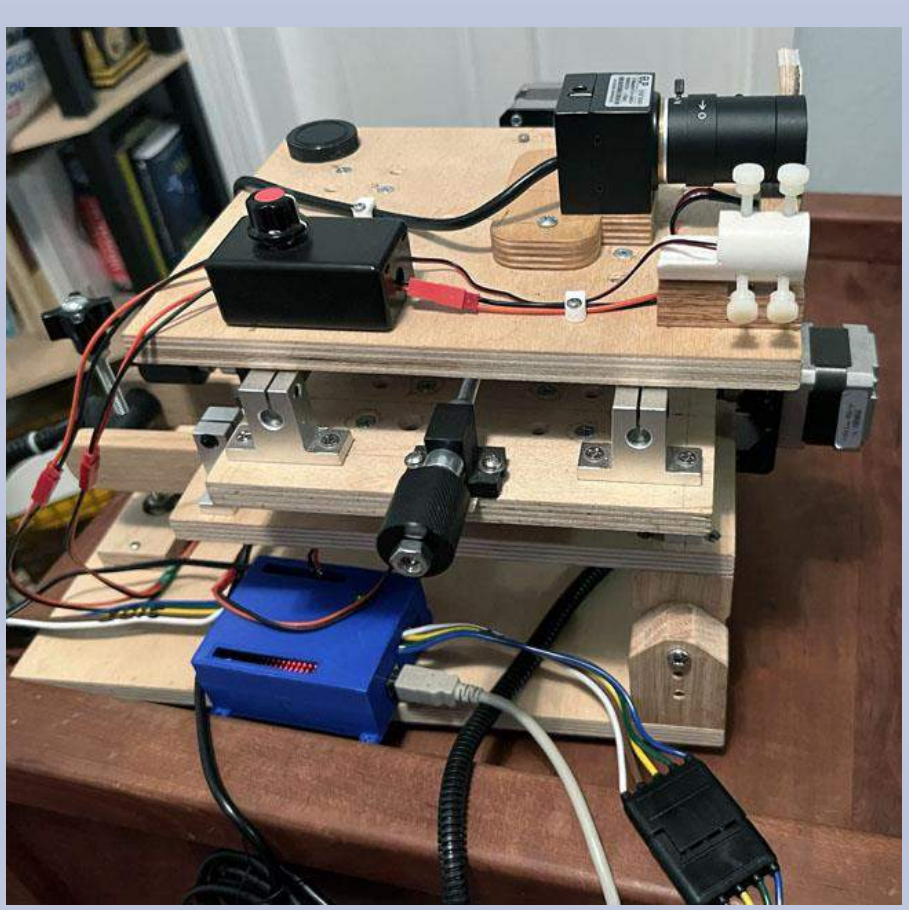
This is the front of the robo Foucault tester that Ralph built. The laser, in the upper left white tube, is bouncing off of the mirror (not shown) and returning as the red dot on the target board to the right of the camera. This is used for initial alignment. There is a green LED under the camera between the knife blades that is used to illuminate the mirror's surface. The light returning from the LED is blocked on half of the camera's lens by the upper knife. The front and right-side stepper motors control the position of the camera relative to the mirror's surface.



Above is a diagram of how the Foucault test creates the image. When seen in a camera or saved they are called a shadowgram such as the images below.



Above left is an image of what a 15 zone test looks like during a robo Foucault test. This test is currently on zone eight which is eight of the vertical tick marks out from the center on each side. Above right is a different mirror that is earlier in the polishing phase and you can see the rougher surface. It is only getting a six zone test for a quicker test to check its shape.



The USB camera and lens are in the upper right. The black box with the knob controls the brightness of the illumination LED. The blue box is the Arduino and motor controller. The 5-pin trailer connectors connect the motor controller to the motors.

The test stand was upgraded with a more uniform mirror illumination LED, Laser return target was added and protection was added to prevent us from cutting out fingers on the razor blades. And yes, there was a reason this was added.

The speed of Robo Foucault depends on the size of the mirror, f/ratio and the number of zones tested. An 11-inch mirror with the maximum of 15 zones tested will take about 10 minutes.

If you care to see the latest updates check out the USB Robo Foucault web page. We're working to make this technology available to other clubs and advanced individuals.

SPAC Business Meeting

Our next business meeting is **Wed., Sept. 13th, at 8:00 PM** via conference call; details upon request. All interested members are invited to attend. All club business decisions are made at the business meeting so as not to encumber the general meeting.

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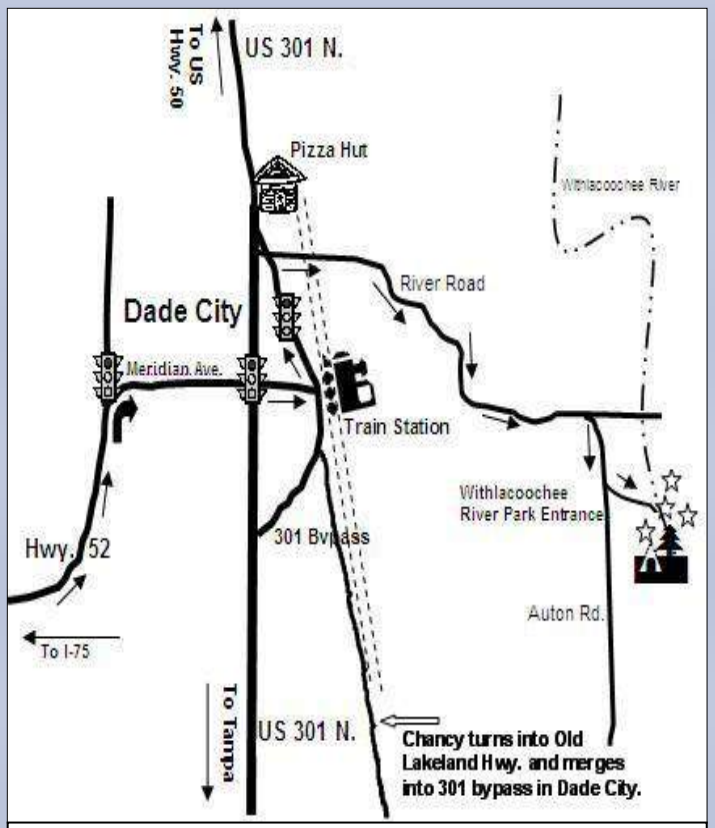
Click on the name to send email



Withlacoochee River Park – Dade City, FL
Detailed directions can be found at:
www.StPeteAstronomyClub.org

Withlacoochee New Moon Weekends

There's no need for reservations. However, the park closes at sundown, so you will need to arrive before then. The park rangers will give you the gate-code once you're inside the park. Please do not call for the gate code as they are not allowed to give it out over the phone.

Reservations are not necessary. Please print and display our Friends-Of-The-Park Pass on your dashboard.

Please join us! All astronomy enthusiasts are welcome. You do not need to be a club member to attend. Please refer to our Club Calendar for details and scheduled dates.

St. Petersburg Astronomy Club

Recognition of Patrons & Benefactors

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St. Petersburg Astronomy Club Membership Form

Membership in St. Petersburg Astronomy Club, Inc. (SPAC) is open to anyone, regardless of age, who is interested in astronomy. Benefits of membership include a monthly subscription to the SPAC Examiner newsletter, reduced camping rates and use of the club's bunkhouse at our dark sky site at Withlacoochee River Park, the ability to serve on the SPAC board and voting privileges. Dues are considered donations and are non-refundable. Membership options are available as listed below.

You are now able to choose how you wish to join or renew your membership:

- **Preferred On-line Website Option: New instructions as our website has been updated.**

Go to https://www.stpeteastronomyclub.org/Sign_In.php on the SPAC website where you can join, view and update your membership profile, provide payment, and **print your membership card**.

- **US Mail Option: Takes more time to process manually because we are all volunteers.**

Complete the attached membership form and send it along with your payment to:

Jim Hunter
17316 Oak Ledge Drive
Lutz, FL 33549.
(Checks should be made payable to SPAC, Inc.)

Adult 1: _____ Adult 2: _____

Street: _____

City, State, Zip: _____

Home Phone: _____ Cell Phone: _____

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Number of Children under 18: _____

Memberships:

Single: [ ] $ 30.00/YR. Includes one adult, minor children, the "SPACE" newsletter, and all the rights and privileges of membership.

Family: [ ] $ 35.00/YR. Includes two adults, minor children and the above rights and privileges.

Patron: [ ] $ 50.00/YR. A Patron member is entitled to the above rights and privileges.

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Student: [ ] FREE. SPAC offers free membership to full time high school and college students.
Expected date of graduation: _____

Total Submitted: $_____

Your SPAC Membership Card is required for reduced fees at the campground.