



# SPACE

St. Petersburg Astronomy Club **Examiner**

November 2023

Editor – Guy Earle

The St. Petersburg Astronomy Club has been the center of family astronomy in the Tampa Bay Area since 1927. Our 400 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.

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## Astronomy Image of the Month

**SH2-170** - the little rosette & abell 85 in H00 by **Jamie Kenas**



## December Preview

In the December issue, we'll look at the first uses of the 20" Teeter telescope donated by SPAC member Howard Ritter and his family after his passing. Recently, we used this amazing telescope with a PVS-14 nightvision eyepiece for some truly remarkable results. I was hoping to write this up for November, but it had to be delayed.



## 2024 SPAC Officer Elections

Please, congratulate the 2024 SPAC officers which will be representing the club this coming year, and extending our thanks to Brad Perryman and Paul Kramer for their prior leadership.

President -- Mike Partain

Vice President -- Guy Earle

Secretary -- Shirley Vuille

Treasurer -- Jim Hunter

2023 Director--Steven Gaber

2022 Director -- Kyle Brinkman

2024 Director -- Jack Fritz

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## November General Meeting

This month's general meeting is on Thursday, Nov. 16th at **7:30 PM**. The meeting will be *in person* at St. Petersburg College, Gibbs Campus, 6405 5<sup>th</sup> Avenue North, Natural Science Building, Classroom 236, 2nd floor, and **also virtual**. This month's re-scheduled presentation is about **Annual Eclipse Observations** by SPAC member, Michael Davis



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 be November 10<sup>th</sup>-12<sup>th</sup> at [Withlacoochee River Park](#) east of Dade City.



## New SPAC Members

We would like to welcome Brad & Jamie Ashbrook, Susan Melton, Dominick Zaucha & Diana Encalada, and Steve Robbins to our family of members.

## Examiner Staff

<b>Editor</b>	<a href="#">Guy Earle</a>	813 785-1972
<b>Space News</b>	<a href="#">Steve Robbins</a>	386 736-9123
<b>Field Reporter</b>	<a href="#">Kelly Anderson</a>	813 672-2751
<b>Mirror Lab</b>	<a href="#">Ralph Craig</a>	727 384-2086

## OBS Commemorative T-shirt

The **OBS t-shirts** are available to order until January 7<sup>th</sup>, and will be distributed at the star party. You can click [HERE](#) to order from Custom Ink in various colors, sizes, and styles.

### SPAC OBS 2024 Event Apparel Order Site

Welcome to our 2024 OBS Event Apparel Order Site. Please check the sizing guide and order accordingly. I generally order one size larger to be safe. The last day to order event apparel is January 7th, 2024.

Doug | [Contact](#)

Hanes Beefy-T Crewneck T-shirt – Orange



Hanes Beefy-T Crewneck T-shirt – Deep Royal





## SPAC New Moon Weekend

Withlacoochee River Park

October 13-15, 2023

By Intrepid Field Reporter

As we were eagerly looking forward to the October New Moon Weekend, a short version of the Florida Autumn was in the forecast bringing clear skies and cool to chilly temperatures. Finally, a break from the steaming cloudy nights we'd suffered through all Summer!

Before that short burst of Autumn got here we had to transit through some "interesting" weather. On Wednesday, October 11<sup>th</sup>, a cold front was rapidly approaching bringing widely scattered thunderstorms and gusty winds. In the early morning hours of the 12<sup>th</sup> two EF-2 tornadoes struck not very far from our Dark Site at Withlacoochee River Park. One came ashore in Crystal River, the other in Clearwater Beach. Both caused heavy damage but fortunately no deaths or serious injuries were reported.



KELLY ANDERSON



1 Heart Nebula by Joe Canzoneri

Friday was still cloudy but skies cleared during the wee hours Saturday morning. An added attraction for this New Moon weekend was the partial solar eclipse on Saturday. While not as impressive as totality, we did get a sideways look at the annular that, at our location, had about 40% coverage. Dimmed the light a bit and fun to (safely!) watch.

Temperatures were comfortable with a light breeze to cool our fevered brows. Overnight it was a bit chilly requiring long sleeves and light jackets. At least for most of us ... a few hardy souls eschewed heavier outerwear.

Several folks had arrived on Thursday, but a crowd gathered on Saturday on the strength of the cool and clear forecast.

Guy Earl and Jack Fritz joined us for day, while Chris Ruback, Elizabeth & Roy Wood, Bob & Rita Mizel, Joe Canzoneri, Rich Tobin, Joe & Pam Faubion, Fred & Diane Friedman, Mark & Sharon Bruns, Peter McLean and your IFR stayed for the weekend. Bob Stelmock joined us on Sunday for a few days. About half the crowd left on Sunday, and the rest of us pressed on, taking advantage of the clear skies and the best seeing in months.

My apologies if I missed anyone.



3Andromeda Galaxy by Joe Canzoneri



2Lobster Claw Nebula by Joe Canzoneri

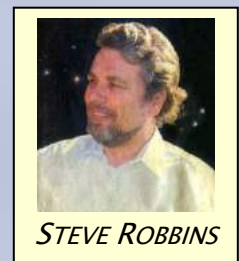
Tuesday morning temps were somewhere in the low 50's, maybe a dip into the upper 40's, requiring me to wear gloves to take down my equipment. I didn't complain a bit.

Our next New Moon weekend will be November 10 – 12, where the hazard of heat stroke will probably not be a factor. Space heaters and

## So Plumb Bobs DON'T Hang Perfectly Vertical?

By Steve Robbins, Philosopher of Phaint Phuzzies

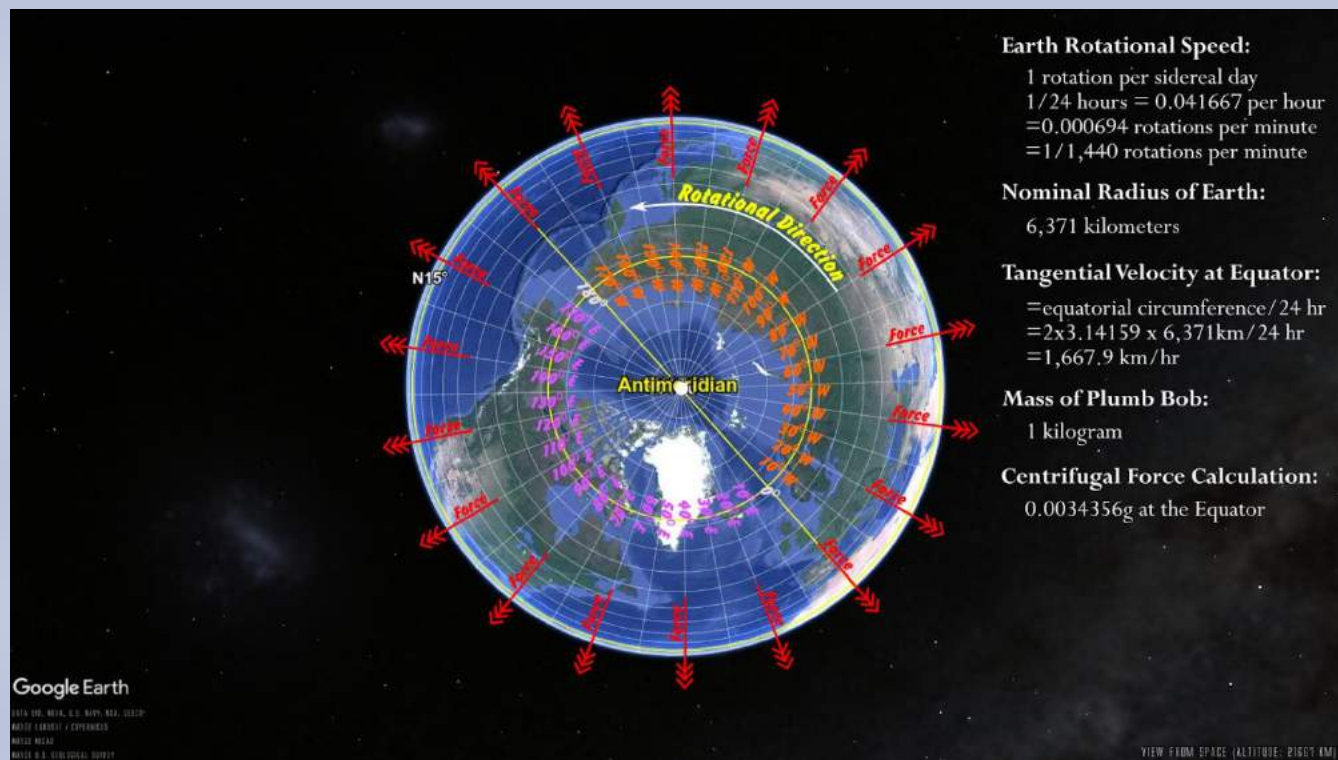
Sometimes, on the Internet, I engage with those reality-based persons who engage flat Earthers and help to counter their silliness. But once in a great while I run into a flat Earther who asks a really good question. So Flatopian Daniel Pratt brought up the point that no scientist has ever mentioned the deflection of a plumb bob caused by the centrifugal force of Earth rotating on its



STEVE ROBBINS

axis. That's a fair point. I certainly haven't ever seen anybody talk about that, EVER, whether from a flat Earther or scientist. And it deserves to be looked at.

We have to begin by determining what centrifugal force results from living on a spherical planet rotating once per sidereal day. So here's your diagram, looking down on Earth from astronomical north, straight above Earth's north pole:



A great place to do the calculations above is the [CalcTool website](#). Enter the numbers above for Earth radius, tangential velocity and mass of the plumb bob weight and you'll see this:

**CalcTool**

**Centrifugal Force Calculator**

Created by Lili Bloggs  
Last updated: Jun 22, 2022

Table of contents:

- Centrifugal force definition
- Centrifugal acceleration formula
- Centrifugal force formula
- Centrifugal force formula in rpm

Rotational motion is present in many real-life situations, such as the movement of centrifugal pumps, car engines, orbital period formula, or the tugs of amusement parks; for that reason, we created this centrifugal force calculator.

In the following section, we talk about:

- The definition of centrifugal force.
- The acceleration and centrifugal force formulas.
- The equation for centrifugal force calculation, with velocity in rpm instead of rad/s.

If you're dealing with tangential forces, our [angular displacement calculator](#) can be helpful. Then, you can use that displacement and the tangential force to find the work using [Circuits work calculators](#).

**Velocities**

You only need to add one type of velocity, either tangential or angular velocity.

Mass (M)

Radius (r)

Tangential velocity (v)

Angular velocity (ω)

**Force and acceleration**

Centrifugal force (F)

Centrifugal acceleration (a)

[Advanced mode](#) [Reset defaults](#) [Send this result](#)

You can use any units you like, imperial or metric. And you'll notice that on the bottom our result comes out in centrifugal force of acceleration on G force. That way you can use any units you like, multiply its nominal weight by the G force to determine the force exerted on the object.

It's vitally important to determine the **direction** of the force. In this view of

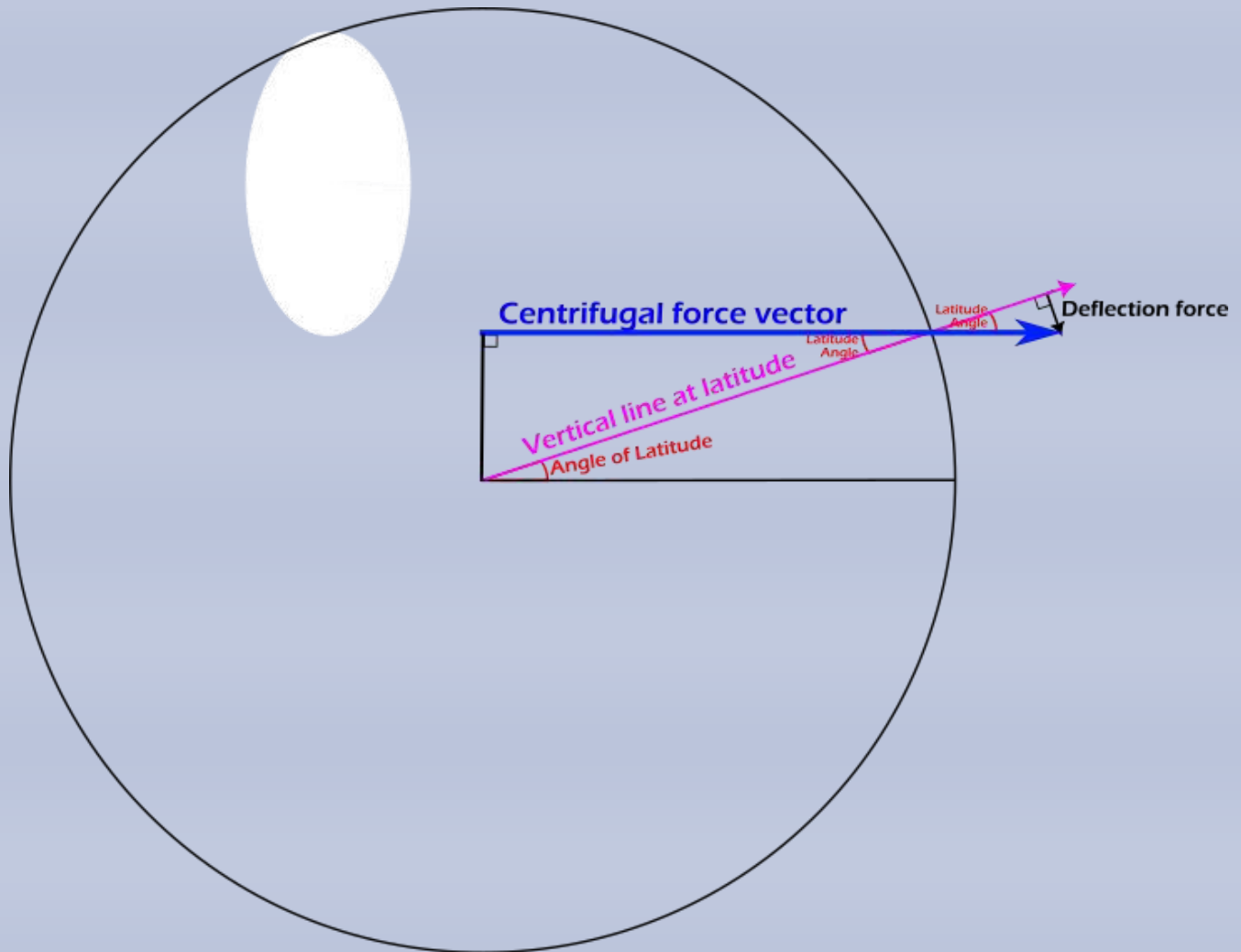
the equator, the force is outward from the rotational axis of Earth, at a right angle, perpendicular to that axis. We just calculated the force at the equator, so it's obvious that for any object on the equator, the centrifugal force is exactly in the up direction for that object. There is no force from any other direction, so the plumb bob would hang straight down at the equator.

Similarly, at either pole, the diameter of rotational motion is zero. That means there is zero force from centrifugal force and the plumb bob therefore hangs perfectly straight down. So the equator and poles are the only three latitudes on Earth where plumb bobs hang straight down.

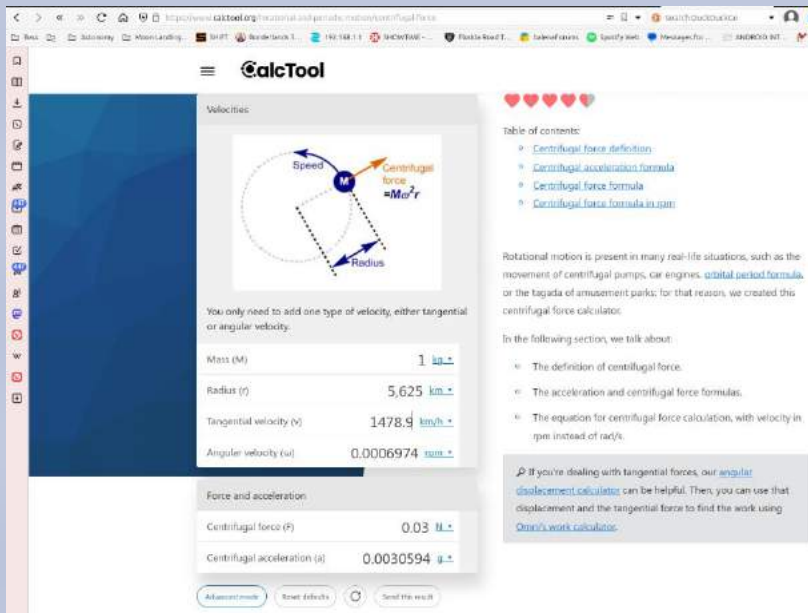
It may occur to you that you've never heard any of this at all. You probably are thinking **of course** plumb bobs hang straight down. And you are thinking there must be some reason you've never thought that they don't. Have patience.

When we examine other latitudes, two things happen: since the radius of rotation diminishes, total centrifugal force diminishes, and since the Earth is a sphere, the angle of that force is no longer at right angles to the surface or a plane tangent to the sphere at a chosen location. Let's do math! We'll start out figuring the forces from the latitude of St Petersburg rounded to the nearest degree and then generalize to any latitude.





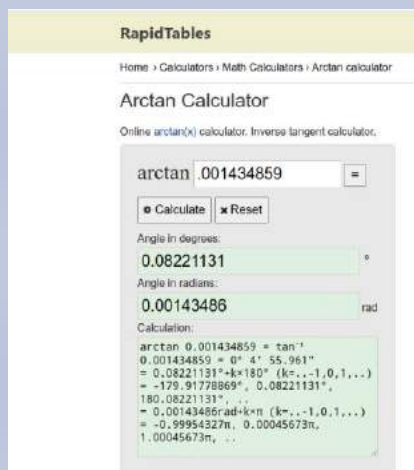
The rotational axis of Earth, north-south of course, forms one side of our force diagram. Then the total centrifugal force at right angles to the rotational axis forms the second side and the right angle that allows us to use trigonometry. Using a 2 dimensional slice of Earth, the point of contact between the curve and centrifugal force vector defines the moment arm of rotation where we can apply our formula and calculator. You can see that the G force at any latitude equals the cosine of the latitude in degrees times the G force at the equator. Or you can plug the numbers into the calculator again as below. Your angular velocity is unchanged at 0.0006974 RPM All you have to do is multiply the equatorial radius of Earth by the cosine of  $28^\circ$  and plug that number in. You'll find that all you really had to do is multiply the G force at the equator by the cosine of the latitude. Our centrifugal G force at  $28^\circ$  latitude is 0.0030594 G.



We're most of the way there. But look at the chart above. The centrifugal force of Earth's rotation isn't at right angles to the surface of the ground, but at right angles to the rotational axis! Looking at the chart above you can see that in the northern hemisphere, the direction of the centrifugal force vector and the ground is equal to the latitude. 28° at St. Petersburg!

We have another triangle formed by the total force vector, the angle between it and the vertical and a deflecting force, straight south in the northern hemisphere, straight north in the southern hemisphere, of the sine of the latitude times the G force of the total force vector.  $0.469 \times 0.0030594$  G is a deflecting G force toward the south of .00143G.


We'll draw a proportional triangle and calculate the angle. The height is our plumb bob weight of 1kg. The width, representing the deflecting force, is .00143kg. So we have a right angle between the vertical and the ground, with a triangle 1 high and .00143 at the bottom. Using trigonometry we can use the cosine function, the opposite side from the unknown angle divided by the adjacent vertical line.



So the arctangent of  $.00143/1 =$  our angle of deflection, trumpets please, 0.08221131 degrees. And now you know....the rest....of the story.

Although as you travel to higher latitudes, the angle difference between centrifugal force and the surface of the Earth increases, the moment arm from the rotational axis decreases to more than balance that out. Yes, plumb bobs are deflected from the vertical by the centrifugal force of Earth's rotation. No, you can't measure the difference with any normal tools used in construction.

## December Lunar Calendar

December 2023						
««	Sun	Mon	Tue	Wed	Thu	Fri
»»	Sat					
						1 
						2 
3 	4 	5 	6 	7 	8 	9 
10 	11 	12 	13 	14 	15 	16 
17 	18 	19 	20 	21 	22 	23 
24 	25 	26 	27 	28 	29 	30 
31 						

## Auroras in Iceland

My wife and I just returned from a week in Iceland, spending a few days initially in Reykjavik, then driving both northwest to Snaefellsnes and afterwards down along the southern coast road to the eastern town of Hofn. On the third day of the trip, we left Reykjavik and drove our rental car two hours north to the Snaefellsnes Peninsula and stayed at the appropriately named Hotel Snaefellsnes. It is a small, ranch style hotel at the convergence of route 54 and 56 with literally nothing else around except nature. Iceland is truly beautiful, with landscapes that are both stark and awe-inspiring. Mountains go nearly vertical into the landscape all around you, even



GUY EARLE



to the edge of the sea. I had a list of places that I wished to photograph on this trip, whereas my wife was really looking forward to seeing the northern lights. The weather was good when we first arrived, but by the third day it had become far cloudier and the wind that was tropical storm force in intensity. It was the kind of wind where it's hard to push a car door open and

worrying about it being ripped off the hinge if you weren't holding on to it. The purpose of staying at this lonely hotel was to see the Budir, the famous black church along the coast nearby, and the next day to head even further north to the arrowhead shaped mountain called Kirkjufell. All of these natural wonders were about a ½ hour drive from the hotel, but the hotel was, mercifully, isolated. It was peaceful, very peaceful. You had amazing mountains in one direction and flat vistas to the sea in the other, but as for other buildings or people there were none. The anti-social curmudgeon in me was very happy.

We had dropped our bags at the hotel about 2 o'clock that afternoon and got right back in the car to drive to the church. The sun was setting fast, as sunrise in early November is about 9 o'clock with sunset about 5, but that's a complete misnomer. The beautiful early morning "golden light" gets only slightly brighter, so by 11 o'clock you realize it's not increasing anymore. You get about three hours of that sunlight, then the sun begins to set. Having seen Budir, we returned just after dark and had a fabulous dinner—the best lamb shank I've ever had, ever. After dinner, we kept looking outside our hotel room at the sky for auroras. The aurora app said the chances were good, but the clouds and wind were making it seemingly impossible. Two hours later, a knock came on our door, the staff wishing to let us know that the auroras were indeed trying to break through the clouds. They knew which guests were hoping to see them and made sure we got the chance, an extraordinary act of good will and service.

This was our first-time seeing aurora, and I was struck how, to the eye, they look almost gray-green, like a somewhat bright cloud compared to the rest of the sky. But a quick 2-second photo with your cell phone is enough to determine if it is an aurora, as they show up bright green in the image. Guests were all around outside, looking up in both the NE and SW at two bright spots. They weren't fabulous, all-sky auroras like you see in photos, but they were awesome nonetheless. My wife was very happy. Seeing them with your own eyes is something quite special, as will be our memories of this whole trip.







# Astronomical Frames of Reference and Nodes

by Steve Robbins

A question came in earlier this year about my accuracy in the Astronomical Events Calendar when I say “the Moon will cross the celestial equator going northward at the Ascending Node.” The questioner was under the impression that the lunar nodes had to do with eclipses and they were with the ecliptic axis. That opens up a whole discussion on frames of reference, why we have them and how do we use them?



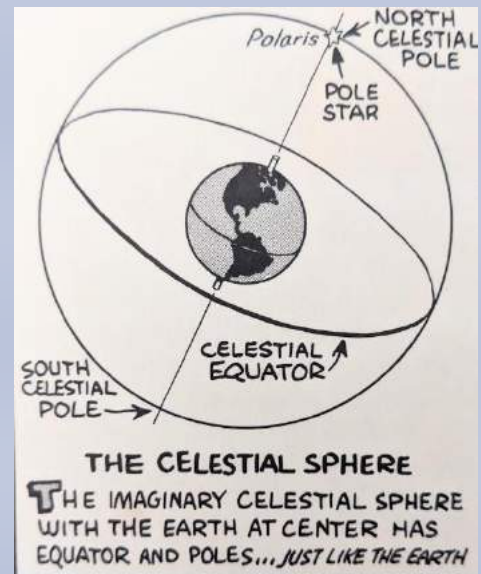
We're always talking about the same sky, with the same objects in them. Why do we need various frames of reference, which can be confused, to describe the sky? It all depends on function and tradition.

In ancient times there was no astronomical coordinate system. Stars were described by the constellation they were in and their position relative to the bright Greek letter stars within. Claudius Ptolemy instituted this method in about 150 AD. His catalog contains a consecutive number for the star, followed by the constellation name and a number designating the brightness of the star, 1 being the brightest. So the very first star in his catalog is designated “1 UMi 1 The star on the end of the tail,” the first star in Ptolemy's catalog in the constellation Ursa Minor, #1 brightest star in the constellation.

However, they were not dealing with nebulae. Ptolemy's catalog contained only five nebulous objects, of which only two were actually nebulous at all, the Beehive Cluster (Ptolemy 449 Cnc 1) and the Double Cluster (Ptolemy 191 Per 1). Of his stars listed, 855 Cen 21 is the globular cluster Omega Centauri and 559 Sco 14 appears to be open cluster NGC 6231. Just like Messier's catalog, it's interesting what Ptolemy saw and what he did not see.

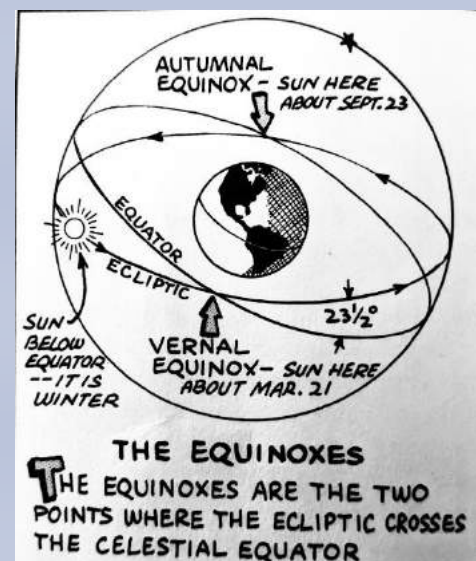
Obviously, Ptolemy's system was of marginal usefulness, especially when telescopes came into use and objects were not visible to the naked eye. The system chosen was to extend latitude lines and Earth's poles into the sky forming what astronomers call the Celestial Sphere. Since Earth

rotates, it would be pointless to extend longitude lines to the sky because that would mean stars would change positions with the time of day. Instead of that, astronomers chose the point where the sun crossed the Celestial Equator on the ascending node (the northern hemisphere vernal equinox, beginning of spring) as the zero right ascension coordinate. Then dividing the entire  $360^\circ$  of the sky into 24 hours, right ascension coordinates were established with each hour  $15^\circ$  apart, numbered counterclockwise around the North Celestial Pole. The North Celestial Pole was the point in the sky, about  $3/4^\circ$  from Polaris, which does not appear to move during the day. The illustration I use is from the incomparable **Mag 5 Star Atlas** published in 1974 by Edmund Scientific Company.

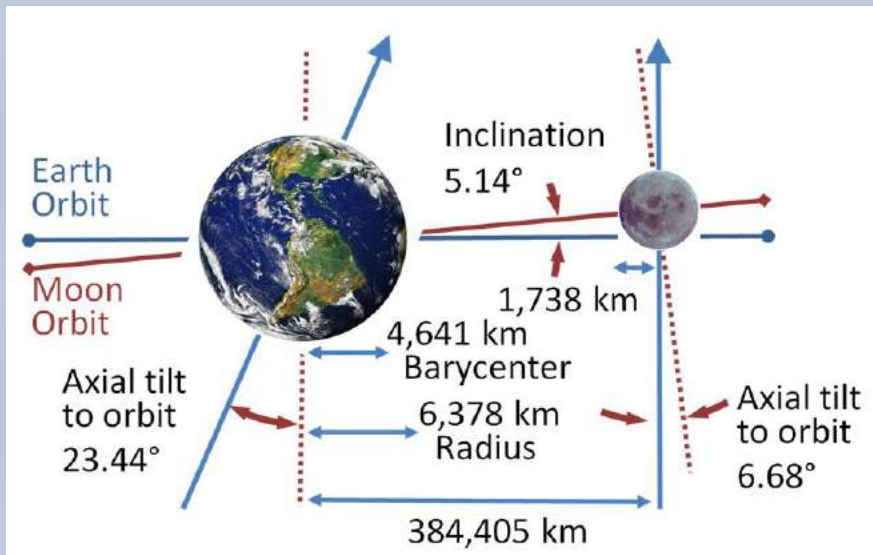


Now you can install setting circles on a telescope and find that phaint phuzzy you read about. Simply extending and modifying Earth's coordinate system to the sky allowed you to find objects not visible to the naked eye or a spotting telescope. But there is a very slight problem with this coordinate system. The basis for the whole system, the vernal equinox, moves every year, changing both right ascension and declination of objects to change over time. In fact, the celestial sphere rotates a whole  $360^\circ$  every 26,000 years. That is why every 50 years, astronomical charts and catalogs change to a new epoch. Presently we use Epoch 2000, but in 2025 we will begin using Epoch 2050 and all our coordinates will change a small amount. You will still be able to use Epoch 2000 coordinates to find objects, but if you were to find coordinates from 1850 you would have to do a translation based on the distance between the vernal equinox of 1850 and today.

A complication arises when we track solar system objects. When we track the path of the Sun through the sky over the course of a year, we're actually tracking the plane of Earth's rotation around the Sun. So we have yet another frame of reference regarding the same Celestial Sphere. Since planets fairly strictly follow the line of the ecliptic plane across the sky, a separate system of solar system coordinates has been made, which we won't cover in detail here because it isn't of much use at the telescope. Now, if you are plotting the path of a spacecraft between Earth and Jupiter, the solar system coordinate system is vitally important. What is important to us is the  $23\frac{1}{2}^\circ$  angle between the plane of the ecliptic, the plane of Earth's orbit around the Sun, and

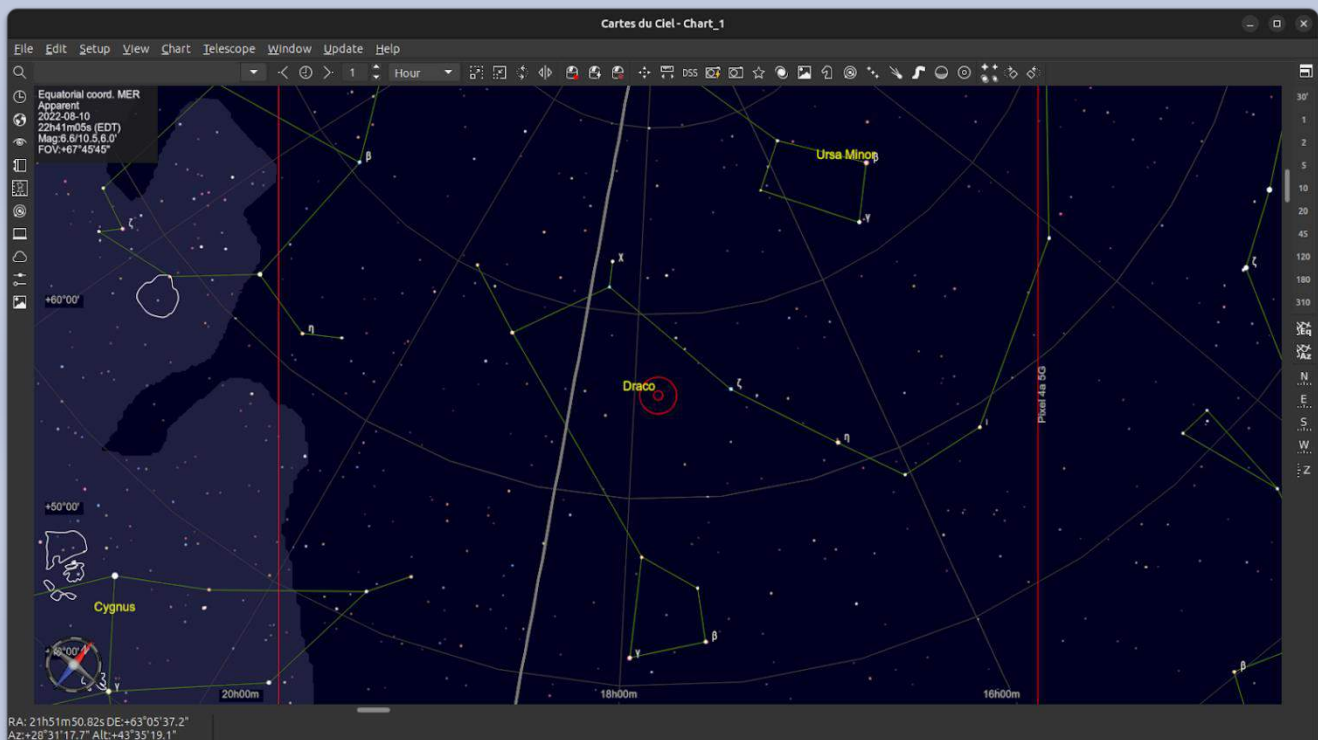


the Celestial Equator. And, like the Celestial Sphere's equatorial system, where the North Celestial Pole is at  $90^\circ$  north declination, the North Equatorial Pole, the axis of rotation of the solar system is in the constellation Draco at RA 18h 0m 0s, DE +66d 33m 38.55s.



Earth has a moon, which is not orbiting perfectly in the plane of the planets. It's necessary to understand the angle between the lunar orbital path and the ecliptic and the places where the lunar path intersects with the ecliptic, because only when the Moon is at the point where the two paths cross, the ecliptic plane and the Moon's orbital plane, and that point is directly

between Earth and the Sun can we see an eclipse. The illustration is from [By Earth-image from NASA](#); arrangement by brews\_ohare – NASA. The Moon's orbital north pole is at RA 17h 47m 26.4s, DE +65d 38m 24s again, in the constellation Draco.





So, if the important node for determining the timing of eclipses is the node of the intersection of the Lunar Orbital Plane with the Ecliptic Plane, why does St Petersburg Astronomy Club's bulletin specify the node of the Lunar Orbital Plane with the Celestial Equator?

There are several reasons. The first is that our telescopes are aligned to the Equatorial axis because they are placed on the planet Earth. That makes alignment possible, and even fairly easy, especially if you are not doing photographic work. You set the right ascension axis of your mount to point at the North Celestial Pole, aligned with the rotational axis of Earth. You find a star, point the telescope at that star, look up the right ascension of that star and calibrate your right ascension readout to that number. If you have a clock driven mount, that's it for the night! Now you can instantly point your telescope at any object in the sky.

Could you align your telescope to solar system or lunar coordinates? Sure you could. But as Earth rotates, your axis of rotation would then be wrong. Every time you moved the telescope you would have to realign your axis of rotation to the North Ecliptic or the Lunar Orbital pole. And you can't find the coordinates in those two frames of reference anywhere, so even aligning these two ways would be nearly useless to your observing.

Therefore, when publishing the Moon's ascending and descending nodes in the Astronomical Calendar of our bulletin, I and everybody else, use the nodes between the Lunar orbit and the Celestial Equator, because that tells you where to look in the sky to find the Moon. Actually that's not too helpful. It tells you what might be obscured by the Moon. Further, the bulletin specifies whether the moon crosses headed toward its greatest northern (ascending node) or toward its greatest southern declination (descending node) two weeks after the node. In short, the path of the Moon is in equatorial coordinates because that is most useful to amateur astronomers.

There's nothing wrong with referring to the nodes of any two intersecting frames of reference, as long as you specify which two you are referring to. Our astronomical calendar always says "(date) the Moon will cross the Celestial Equator going (northward or southward) on the (ascending or descending) node. Nodes are crossing points. They can be between any two frames of reference. It's important to specify which two frames of reference are being used. There is no right or wrong in which frames of reference you use, only a question of how useful the information is to your particular audience.

## 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](#).

### ANNULAR ECLIPSE from UTAH

by [Gregory T. Shanos](#)

Just returned from Arizona/Utah where I was able to successfully video the entire Annular Eclipse of Oct. 14, 2023 from Goulding, Utah right next to Monument Valley. The skies were perfectly clear- zero clouds with excellent transparency and seeing. I used a SONY FDR-AX100 4K camcorder with a Sony 1.5× teleconverter. Tripod mounted on a Star Adventurer motorized equatorial tracker with a Thousand Oaks solar filter. Photo stills (8MP) from the video were taken to make this collage of second and third contact.



I took temperature and humidity readings every minute during the entire eclipse. First contact: 55.7°F (13.2°C) at 38% humidity. Second contact: 52.0°F (11.1°C) at 41% humidity. Third contact: 51.2°F (10.7°C) at 41% humidity. Fourth contact: 65.1°F (18.4°C) at 29% humidity

The video of annularity was uploaded to YouTube at: [https://youtu.be/r3v\\_zt5slSo](https://youtu.be/r3v_zt5slSo)

Above: Eclipse photos from Utah by Greg Shanos



Above: **Lions nebula** at wcp. 300sec x 10. 80mm refractor zwo 183 mc  
processed in gimp **by Joe Canzoneri**

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Below: **M15 Widefield** LRGB, Dates: 2023-11-04, OTA: William Optics GT-81  
WIFD, Mount: CEM 70, Camera: ZWO ASI 2600MM, Exposures: 120s x25 LRGB  
Filters: Antlia LRGB **by Jamie Kenas**



## For Sale

**Celestron CPC 8** for sale. Asking \$1,000. If interested, please contact **Jack Fritz** at [jack.fritz99@gmail.com](mailto:jack.fritz99@gmail.com)





## SPAC Business Meeting

Our next business meeting is **Wed., Dec. 6<sup>th</sup>, 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.

## Officers & Directors

President	<a href="#">Brad Perryman</a>	727 420-1957
Vice Pres.	<a href="#">Paul Krahmer</a>	727 535-5827
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Dark Sky Chair	<a href="#">Leeann Muszynski</a>	813-601-0986

*Click on the name to send email*

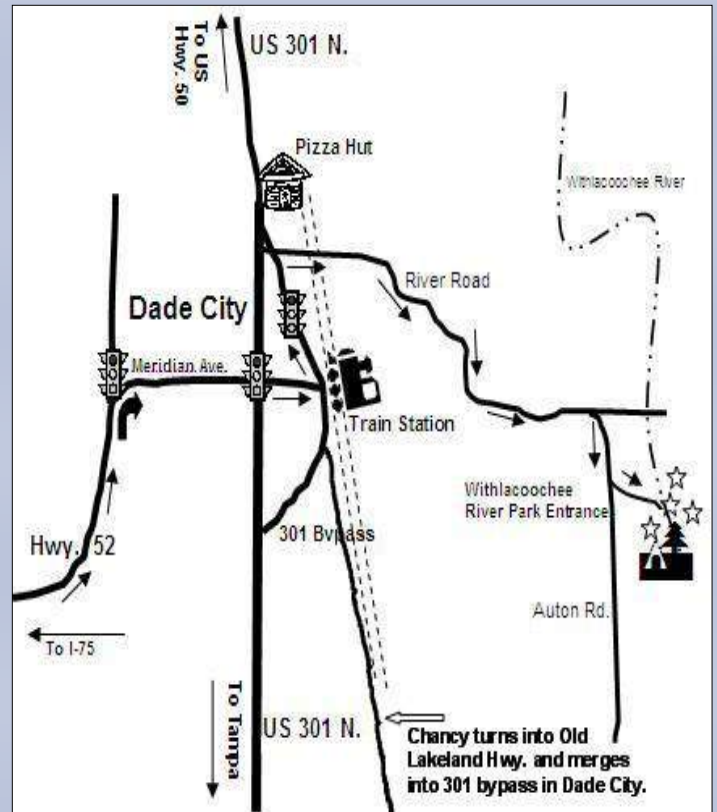
### Withlacoochee New Moon Weekends

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.



### **Withlacoochee River Park - Dade City, FL**

Detailed directions can be found at:

[www.StPeteAstronomyClub.org](http://www.StPeteAstronomyClub.org)



## St. Petersburg Astronomy Club

### Recognition of Patrons & Benefactors

Lakeisha & Stephen Black	Benefactor	Jan Anschuetz	Patron
David Brewer	Benefactor	Steven Balke	Patron
Walter Brinkman	Benefactor	Christopher Bankston	Patron
Dave & Deborah Catalano	Benefactor	Sean Bloch & Emiliy Kulokas	Patron
Stephanie Colon		Kyle Brinkman	Patron
& Ariel Grajales	Benefactor	Michael Callahan	Patron
Kimberly Dean	Benefactor	Ralph & Christine Craig	Patron
& Caroline Sherman		London & Leslie Crosby	Patron
Jack & Roni Fritz	Benefactor	Dan Denney	Patron
Michael Haworth & Melanie Otte	Benefactor	Peter & Jaclynn Dimmit	Patron
Valerie Hyman	Benefactor	Guy & Kelly Earle	Patron
Sai & Maggie Kakumanu	Benefactor	Joseph & Pamela Faubion	Patron
Jamie Kenas	Benefactor	Darla & Peter Flynn	Patron
David Knowlton	Benefactor	Steve & Cindy Fredlund	Patron
Laura & Roy Lanier	Benefactor	Steve Gaber & Karen Sell	Patron
Greg Legas	Benefactor	Richard & Mary Garner	Patron
Brenda Lorenz	Benefactor	Steve Gross & Julia Winston	Patron
Dave Lorenz	Benefactor	Ben Groves & Veronica Bynum	Patron
Tod Markin	Benefactor	Timothy & Mary Ann Harris	Patron
Kelly McGrew	Benefactor	Sharon Herman	Patron
Kevin & Karen Mulford	Benefactor	& Melissa Hughes	
Will & Jenni Nelson	Benefactor	Charlie & Linda Hoffman	Patron
David & Tara Pearson	Benefactor	Matt Hughes & Manuel Ordonez	Patron
Rath, Damon & Jean Futch	Benefactor	Bruce King	Patron
Howard Ritter	Benefactor	Matt Labadie & Jennifer Willman	Patron
Christian & Wendy Rubach	Benefactor	Bill Larsen	Patron
Jill & Robin Sumner	Benefactor	Joe & Shirley Litton	Patron
Andrew & Bonnie Watts	Benefactor	Steve & Jeri Maiaroto	Patron
*****		Allen Maroney & Tracee Elliott	Patron
Bill & Norma Amthor	Patron	Herb Monroe & Martha Stewart	Patron

David & Kathryn Musser	Patron
Leeann Muszynski	Patron
Robert Nadeau & Ali Wuchert	Patron
Bill & Kim Northup	Patron
Dominick Oppolo	Patron
Stephen Oros	Patron
Michael & Carli Partain	Patron
Brad & Lisa Perryman	Patron
Alan Polansky	Patron
David & Jenny Powell	Patron
Thomas & Andy Prince	Patron
John & Abbie Redmond	Patron
Gregory Satchwell	Patron
Nancy Schafer	Patron
Anthony Staiano	Patron
Jonathan Stewart	Patron
Tom & Michelle Sweet	Patron
Wally & Ramona Vazquez	Patron
Alexie Velez & Yanira Hernandez	Patron
Elizabeth Wood	Patron



## 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](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: \_\_\_\_\_

Email Address: \_\_\_\_\_

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.

Benefactor: ☐ \$100.00/YR. A Benefactor member is entitled to the above rights and privileges.

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.**