



OBSERVER

March 2023

*Bringing Stars to the eyes of Tulsa
since 1937 Editor - John Land*



The Jellyfish Nebula IC 443 by Don Sailing

The [Jellyfish nebula](#) located 1500 light years away in Gemini is a supernova remnant with a star forming nebula as a background. It exploded between 3000 and 30,000 years ago. The star in the image is Proxima Centauri. The western member of the two stars in Gemini's right foot.

The Jellyfish nebula is right in the middle of the Milky Way's spiral arms and therefore is full of stars that are much brighter than it. To get the nebula to show good detail, the rich starfield ended up drowning out the nebula. I separated the stars and the nebula and processed them separately, allowing me to tone down the stars before recombining them.

Image was taken in my backyard with a Takahashi FC100D scope on an iOptron HEM27 mount back last December 17. I took a total of 106 images each 3 minutes long. The Camera was a ZWO ASI 2600MC. I stacked them with DeepSkyStacker and did the rest of the processing with PixInsight (and Russell Croman's StarXTerminator in PixInsight).

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Astronomy Club Events Check our website AstroTulsa.com events section for updates

Astronomy Club Meeting - Friday Feb 3 - 7:00 PM - IN PERSON club meetings.

At Jenks High School planetarium 105 E B Jenks OK - Guests Welcome

Our featured program will be member **Byron Labadie** will be sharing his experiences visiting a number of leading astronomical facilities in Chile. Byron along with 8 other cohorts were chosen to be part of Astronomy in Chile Educators Ambassador Program to Santiago, Chile.

We will also enjoy a Full dome planetarium show – *Big Astronomy - People, Places, Discoveries*

Also **Observing Chair Brad Young** will also present a PowerPoint explaining the **Saros cycle**.

The Saros cycle is used to predict Solar Eclipses with similar patterns.

See more complete program description on page 3

Observatory Stargazing Nights

Astronomy Club Meeting - Friday March 3 - 7:00 PM - IN PERSON club meetings.

At Jenks High School planetarium 105 E B Jenks OK - Guests Welcome

We have a great program - See Details below

Saturday Mar 11 6:00 to 10:00 PM **Guest and Members Night** –
Guest requested to RSVP - Gates Open near sunset

 **Sunday March 12 Daylight Savings Time Begins** 

Friday Mar 17 7:00 PM **Members Only night**
Open to members and their immediate family

Saturday March 18 will be our **annual Messier Marathon** where participants try to observe as many of the 110 Messier catalogue objects possible in a single night.

Specific details later in newsletter **SAVE THE DATE** Open to our members

Saturday April 1 Observatory Work date – Clean up Brush – Classroom and other projects

Astronomy Club Meeting - Friday April 14 - 7:00 PM - IN PERSON club meetings.

At Jenks High School planetarium 105 E B Jenks OK - Guests Welcome

Saturday April 15 7:30 PM **Guest and Members Night** –
Guest requested to RSVP - Gates Open near sunset

Friday April 21 7:30 PM **Members Only night**
Open to members and their immediate family

Save the Dates - our club is hosting the MidStates Regional Astronomy Convention

Guests from the Five State region will be joining us

June 9 – 10 – 11

Registration details will be coming soon

Astronomy Club Meeting - Friday March 3 - 7:00 PM



Member Byron Labadie will be sharing his experiences visiting a number of leading astronomical facilities in Chile. Byron along with 8 other cohorts were chosen to be part of Astronomy in Chile Educators Ambassador Program to Santiago, Chile during the southern hemisphere summer Dec 9-20, 2022. They visited various telescopes at Cerro Tololo Interamerican Observatory, Cerro Pachon', home to Gemini South telescope, the Southern Astrophysical Research telescope, and the now under construction Vera Ruben observatory. Following tours of the telescopes and meeting all of the people who make astronomical research

possible, the team flew north to the 12,000 ft high Altiplano Plateau of the Atacama Desert to visit the 66-dish radio telescope array at ALMA, along with a tour of the morphological and geological features found in the high Atacama. Afterward we will enjoy a **Full dome planetarium show – Big Astronomy - People, Places, Discoveries**

Also **Observing Chair Brad Young** will also present a PowerPoint explaining the **Saros** cycle. The Saros cycle is used to predict Solar Eclipses with similar patterns. The Astronomical League has chosen Brad to create a new Solar Eclipse Observing Program. The upcoming eclipses in Oct 2023 and April 2024 will be the first covered by this new program. In addition to observing these spectacles, participants will engage in activities geared to a deeper knowledge of how studying solar and lunar motions led to the discovery of the cyclic, predictable nature of eclipses.



See our new [Telescopes & Astro Equipment Sales](#) Page

Our club frequently gets inquiries from members or the public who have astronomical equipment they would like to sell. I am trying an experiment to create a page that can be updated occasionally as new offers come in. If you have items to sell, send a picture, contact information and information to Tulsaastrobiz@gmail.com If you have a particular item, you are looking for you might try our page. This page is intended for equipment that can be acquired in or near the Tulsa area.

President's Message John Land



February has been a busy month for our club. We had a good turn out for our Feb 25th Telescope Workshop at the Tulsa Air and Space Museum. More than a dozen of our club members helped new telescope owners learn how to set up their telescope to begin observng. I'll have more pictures in the April news.

I would like to say a special thank you to the members of our MSRAL planning team. Due to health issues I had to step aside for awhile recovering from surgery. The Team has valiantly moved forward putting in much effort and time to complete the plans to open registration in early March. They have arranged for the catering of an excellent banquet for our keynote speaker. Mapped out a plan for scheduling of the presentations during the meeting, prepared, reviewed and submitted a budget, arranged for group rates at two nearby hotels for our out of town guests, and procured our keynote speaker as well as a few others. Mike Blaylock is working deligently on a website for the convention guests to learn about our plans and area attractions for our out of town guests.

There will be much more to do in coming days putting together registration packets and all the other details for a successful event to welcome both our local members and guests.

Dana Swift, Skip Whitehurst, Don Bradford, Jack Reeder and James Taggart have been working on an inovative new system to rotate the observatory dome. It will feature a full circumference toothed gear along the rim with a drive drive gear to rotate the dome. Our Observatory manager James is asking members to comeout for and Observatory Workday. There will be many projects to get the grounds and building looking top shape before the convention. James is planning the first work day Saturday April 1st

Congratulations to Ben Staton for completing his Astronomical League Lunar observing cetificates. I'm sure he would encourage more of you to get started on one of the many observing [Astronomical League Certificates](#) available. It a greta way to develop your skills as well as learning about the many sights in the night sky.

Lastly I would like to thank Bob Lieser for his interesting book review. I would encourage others of you to share some of your recent astronomy related reading with our membership.

We have a busy Spring ahead of us. So roll up your sleeves and pitch in to help while making new friends. Its going to take many dedicated volunteers to pull all this together.

To volunteer contact astrotulsa.pres@gmail.com

Let us continue our 85+ years of

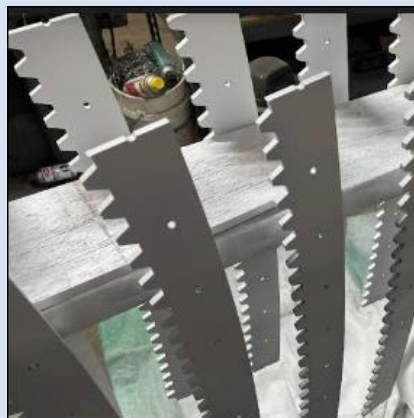
"Bringing Stars to the Eyes of Tulsa since 1937"

John Land - President



Ben Staton receiving his Lunar Observing Certificates and pin from observing chairman Brad Young. Ben completed both the binocular and telescope observing programs.

Below are images of the prototype model of the new dome drive system as well as the actual metal gears and drive



GOT A NEW TELESCOPE? Here are some sites to help you get started with you telescope.

Getting Started with Your New Telescope

<https://skyandtelescope.org/astronomy-news/getting-started-with-your-new-telescope-2/>

Astronomy for Beginners | Night Sky Facts, FAQs & Resources

<https://skyandtelescope.org/astronomy-information/>

What to Know Before Buying a Telescope

<https://skyandtelescope.org/astronomy-news/what-to-know-before-buying-a-telescope/>

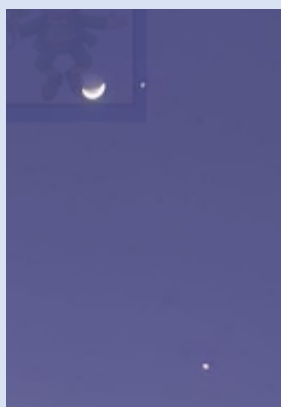


Click on these images
to links on the Internet



See [Website Observation Station](#) for a collection of [Interactive Sky Watching Tools](#)
Moon phases - Sun rise & Set - [Make your own custom interactive sky chart](#) and more
Great website for printable Finder Charts of Solar System objects <https://in-the-sky.org/>

March - Moon Phases - - Full Mar 7 - - 3rd Q Mar 14 - - New Mar 21 - - 1st Q Mar 28



March planets. March 1 opens with a close conjunction of the two brightest planets, **Jupiter and Venus**, passing within 1/2 degree of each other. Look for the pair in the western sky during evening twilight. In the following days they will trade places as they draw apart. Venus will continue to climb higher the western sky as Jupiter sinks ever lower toward the horizon. This picture was taken Feb 22 by Harriet Young from midtown Tulsa. The moon joins up with **Mars** on Feb 27. The pair will join up again Mar 27. During March Mars slips eastward from Taurus to the edge of Gemini. The last week of March the planet **Mercury** begins to appear near the western horizon in early twilight. Mercury and Jupiter pass within 1.3 degrees of each other. But you'll need a clear horizon and likely binoculars to them in the bright evening dusk a bare 5 degrees above the horizon. Mercury reaches its maximum evening elongation from the Sun on April 11 while on the same day Jupiter passes behind the Sun at superior conjunction. **Saturn** has moved to the predawn sky but won't emerge high enough for viewing until April.

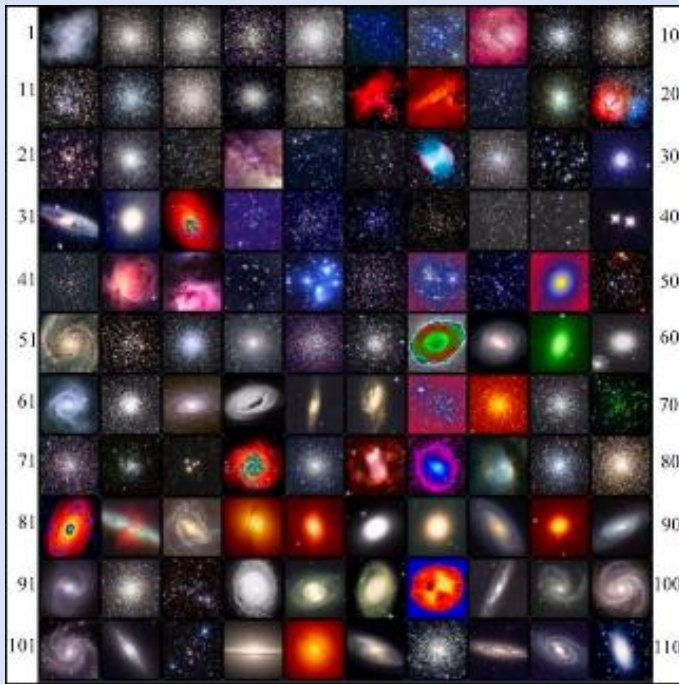


March 12 - Dastardly Daylight Savings returns robbing us of an evening hour of observing. Sunset will be 7:28 PM And once again rush hour and kids heading out for school buses will be doing so before sunrise at 7:38 AM If our foolish press and politicians don't wise up **next winter you won't see sunrise before 8:00 AM from November 17 to February 23** if we stay on Daylight time all year.

(Thanks 😞 I've had my Daylight Savings Time Rant 😞 Feel much better !)

The **Spring Equinox occurs about 4:00 PM CDT on March 20** when the Sun crosses the Celestial Equator in the constellation of Pisces. However, March 17 is the date that Sunrise and Sunset are exactly 12 hours apart. **Easter falls on April 9th** since it is the First Sunday following the Full moon on April 5th.

Comet ZTF (C/2022 E3) is still hanging around in the region of Orion. Slipping out to the far regions of the solar system it has faded to 10th magnitude but still detectable to larger scopes and imaging. Astrophotographer Miguel Claro recorded the action in this 4K video from the Dark Sky® Alqueva observatory in Cumeada, Portugal showing the many changes of the comet throughout the month of January 2023 Enjoy his nearly two-minute video at the [Feb 15, 2023 on SpaceWeather.com](#)



Are you up for the challenge of the Messier Marathon March

Each spring 100's of amateur astronomers are drawn into the darkness in a quest to observe all 110 objects in Charles Messier's Catalogue of Deep Sky Treasures. They turn their telescopes eagerly toward the vast denizens of Virgo cluster galaxies. Staving off drowsiness with numerous cups of coffee they welcome the Summer Milky Way as it rises in the east after midnight. Then desperately fight onward to catch the Autumn sky and the Andromeda Galaxy before it is swallowed up by the dawning Sun. Hold on there! I must be suffering from excessive starlight exposure.

Seriously, the Messier Marathon is a night that club members get together to encourage each other to find as many of the Messier Objects as they can in a single night. Whether you find a few dozen or nearly 100 it's an experience all will enjoy.

The first 10 days in March are great time to get started and hone your observing skills. Choose a couple of the charts in the links below and try to locate all the objects on that chart. Many of them can be found from suburban skies. Turn off those fancy GoTo features and find them yourself using the star charts. Our [April 2021 Newsletter](#) has a good article explaining how to find the Field of View in your telescope eyepieces. They "Star Hop" from a know star to locate your desired object. Just manually use your controls to move the scope until you find the Deep Sky object. Take a bit of time to look at it. Maybe even make a sketch of it. If you've never done the [Messier Certificate program](#) this is good time to start. Print Off Charts 3,4 & 5 in the link below and see how many you can find.

FOR OUR MEMBERS - THERE WILL BE A SIGN UP FOR THE MESSIER MARATHON LATER IN MARCH.

Messier Marathon Packet - Made in 2016 - its good in 2023 as well

<https://okmcd.com/pub/MessierMarathonCharts.pdf>

Printable PDF charts or ones that can be stored on a computer.

7 pages of Log sheets to check off your progress arranged by sequence and Suggested times for conducting your search.

17 pages of detailed charts showing the location of each object. Identified by sequence number.

Excellent Explanation and strategy for planning your observation Sequence

- Note- The resources at the end can now be found online.

<http://www.richardbell.net/marathon.html>

Single Page printout of the Sequence search list

http://www.richardbell.net/files/messier_list.pdf

Three Page Log sheets -

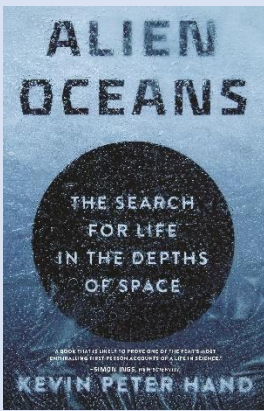
<http://www.astunit.com/tonkinsastro/messier/messmara.pdf>

For observers using different instruments during the night - this one has columns to identify which instrument

Messier Marathon 2023

<http://www.messier.seds.org/xtra/marathon/mm2023.html>

Notes specifically for 2023



Book review by Bob Lieser

Alien Oceans: The Search for Life in the Depths of Spaces,

by Kevin Peter Hand Published April 7, 2020 by Princeton University Press
ISBN: 9780691179513 (ISBN10: 069117951)

Kevin Peter Hand, is an astrobiologist at NASA's Jet Propulsion Laboratory. The book is about oceans on other worlds, in our solar system and beyond, and what life might exist there. It's a clever title, since the word "depths" can refer to deep space and deep oceans elsewhere in space. The pandemic was dragging into its second year, and I had been binge-watching science fiction films, like *The Europa Report*, a fictional about astronauts discovering life on Europa, and *2010: Odyssey Two*, also about life on Europa. I wanted to learn more about the scientific possibility of marine life elsewhere in the universe, so I ordered this book on Amazon.

Alien Oceans has three parts - development of life in Earth's oceans, possible other locations of oceans and ocean life elsewhere in the Solar System and theorizing about what alien ocean life might be like.

In speculating about the development of life in alien oceans, Hand points to the example of Earth's oceans and the extreme environments where life has developed. Specifically, hydrothermal vents on the ocean floor, known as "black smokers," host many kinds of life. These creatures never experience sunlight, and instead derive energy from the heat of the black smokers.

He focuses on the moons of Jupiter, Saturn, and Neptune as the most likely candidates - respectively, Europa, Enceladus, and Triton. In each case, the moon of a gas giant planet has an icy surface, beneath which is a water ocean, with a rocky core beneath the ocean. The oceans of these Jovian satellites would experience little direct sunlight due to the distance from the Sun and the ice cover. They are subjected to tremendous gravitational tidal forces from the planets they orbit, which causes geothermal and volcanic activity in the moons' ocean floor. This volcanic activity could create similar black smokers on the ocean floors of Europa, Enceladus, and Triton. Black smokers have been known to reach heights of up to 180 feet on Earth and might grow even taller on lower-gravity moons.

Hand believes that Enceladus is the most likely candidate for ocean life. I learned that Enceladus has more water in its oceans than Earth does. There are photos of volcanic-style eruptions of liquid water stretching kilometers into space, taken by the Cassini spacecraft. The challenge for scientists is that the environments Hand describes are out of reach of human technology for the foreseeable future. Hand advocates for increased funding for exploration of Jovian satellites, and this book is intended to show that these places are better candidates for the search for extraterrestrial life than Mars. But any terrestrial probe sent to explore the subsurface oceans of these Jovian satellites would have to penetrate an icy crust several kilometers thick.

In a brief passage, he also writes about how rogue planets, drifting through interstellar space, could harbor life in subsurface oceans, either fueled by subsurface geological activity, or possibly dormant. Rogue planets' ocean ecosystems could be revived when they enter new solar systems and experience the gravitational and tidal forces of stars and planets.

Hand speculates on what ocean life might look like. The most likely form would be micro-organisms, similar to those found near black smokers on Earth. On Earth, shrimp, crabs, and tubeworms three feet long have also been discovered living near these vents. Could intelligent life be found on an ocean world? Hand cites the example of the octopus on Earth, which can use tools and has at least as much intelligence as a dog or cat and theorizes that similar creatures could develop in alien oceans. After watching the movie *My Octopus Teacher*, about a filmmaker's relationship with an octopus, it's not difficult to see how a species like this could evolve into intelligence.

How could an intelligent ocean-dwelling species develop without being able to see the sky or the stars? Here, Hand really gets philosophical, noting how much of human mythology, science, and technology comes from our visual observation of the stars. Intelligent ocean life might rely on sense other than sight, such as sound and echolocation. Beings living in an ice-covered ocean might develop a different kind of mythology, science, and technology, possibly based on the sounds of the ice creaking above them from tidal forces.

Alien Oceans is a good read, both educational and thought-provoking, and paints a picture of a universe potentially swimming with life.

Determining the Saros

By Brad Young

As you probably know, there is a New Moon every month*, where the Moon passes the Sun in our sky from morning to evening phases. So, why is there not a solar eclipse every month? The Moon is not in alignment with the ecliptic (the path the Sun appears to take), so the New Moon may pass north or south of the Sun. Because it is inclined to the ecliptic by 5° and the Sun and Moon only appear $1/2^\circ$ wide in our sky, often there is no eclipse.

*It may be helpful to start off with a list of what “months” are:

- Sidereal Month = period for Moon to return to same position compared to distant stars
- Synodic Month = interval of return to the same lunar phase
- Draconic month = period for the Moon to pass through the same node
- Anomalistic month = time required for perigee to perigee

Most of us think of a month as a synodic month, for example, full moon to full moon. For determining the Saros, the synodic and the draconic month are of greatest interest.

ECLIPSE SEASONS

Black hole sun, won't you come, and wash away the rain? – Chris Cornell

The moon appears to cross the “orbit” of the sun at two points – at the Moon’s ascending and descending nodes. New and Full Moons near these times – usually twice a year – may result in a lunar or solar eclipse. Lunar eclipses are wonderful sights, but can be seen from half the world when they occur. Solar eclipses, especially total ones, are much rarer for a specific location. Since astronomy began, we have tried to predict monumental events like solar eclipses. In fact, this is one of the quests that started astronomy, predicting eclipses, seasonal events, and the wandering planets.

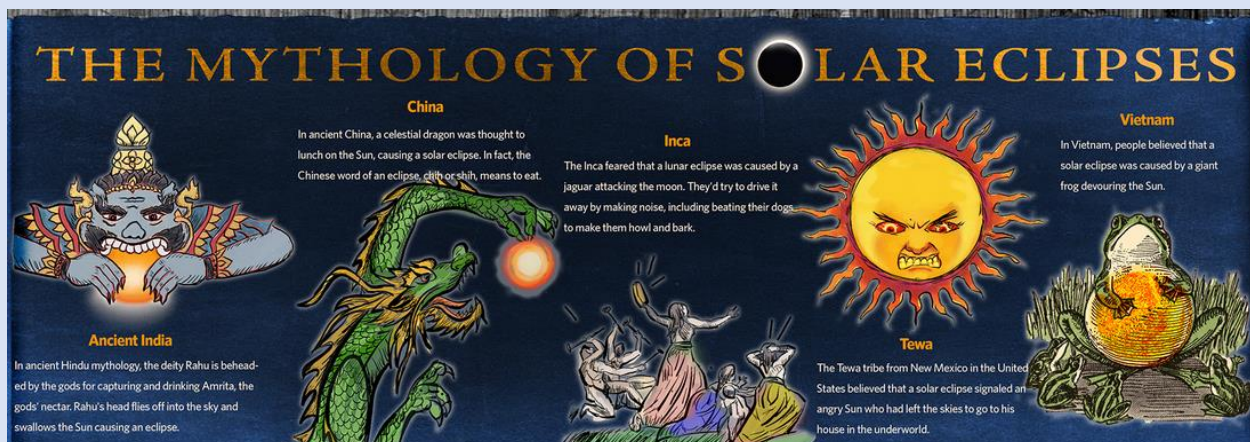


Total solar eclipses, along with comets and perhaps meteor storms, were upsetting events that people strived to know about ahead of time. A stone in Ireland may record an eclipse that took place on 30 November 3340 B.C., contemporaneous the beginning of writing. Ancient Chinese eclipse records are

accurate enough to allow us, millennia later, to calculate the slowing of Earth's spin and the rate at which the Moon is receding.

All over the world, different cultures reacted to solar eclipses in different ways:

- Native people in Colombia shouted to the heavens, promising to work hard and mend their ways.
- In Norse culture, an evil enchanter, Loki, was put into chains by the gods. Loki got revenge by creating wolflike giants, one of which swallowed the Sun—thereby causing an eclipse.
(Another of the giant wolves chased the Moon, trying to eat it.)
- Fear led Chippewa people to shoot flaming arrows into the sky to try to rekindle the Sun. Tribes in Peru did the same for a different reason; they hoped to scare off a beast that was attacking the Sun.
- In India, the demon spirit Rahu steals and consumes the nectar of immortality but is beheaded before he can swallow it. His immortal head flies into the heavens. The Sun and Moon had alerted the gods to his theft, so he takes revenge on them: When Rahu swallows an orb, we have an eclipse—but the orb returns to view because Rahu has no body!
- Similarly, in China, Mongolia, and Siberia, beheaded mythical characters chase and consume the Sun and Moon—and we experience eclipses.
- In Indonesia and Polynesia, Rahu consumes the Sun—but burns his tongue doing so and spits it out!
- In Armenia, a dragon swallowed the Sun and Moon.
- In Transylvanian folklore, an eclipse stems from the angry Sun turning away and covering herself with darkness, in response to men's bad behavior.
- In India, many believe that when an eclipse occurs a dragon is trying to seize the two orbs. People immerse themselves in rivers up to their neck, imploring the Sun and Moon to defend them against the dragon.

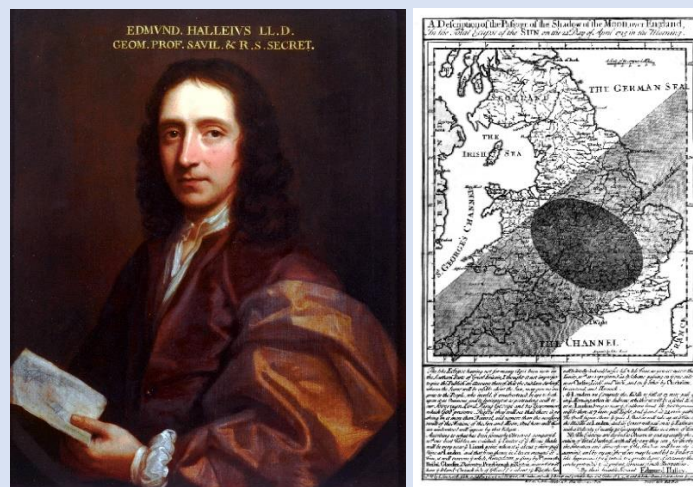


Meanwhile, attempts to predict a Total Solar Eclipse (TSE) met with mixed results. As amazing as sites like Chaco Canyon are, there is no evidence that people living in the SW US could predict eclipses. The Tewa of the Rio Grande dreaded the eclipse of the Sun. This may be because many Native Americans, such as the Dine, felt that “during the eclipse, we must always look down at the ground, cannot be looking up or outside.” These were real, sometimes terrifying events. Even today, some people commit violent acts against themselves or others during a TSE.

THE SAROS

*The modern astronomical usage of the word **SAROS** is attributed to Edmond Halley, who based it on the word **σάρωρ**, defined in the Suda as "a measure and a number among Chaldeans."*

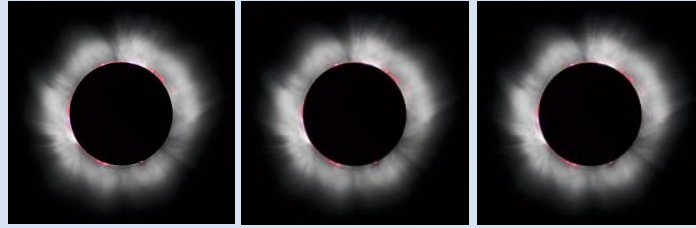
It is not known exactly when a scheme for predicting eclipses was developed, but it was almost certainly before about 575 BC. Chinese and Babylonians both independently knew of the Saros cycle. This is the cycle of the lunar nodes, as the pull of the Sun and Earth cause changes in moon's orbit known as perturbations. All the characteristics of the lunar orbit are perturbed, including the sidereal month (Moon returns to the same star field). But where the other features of its orbit affect the type of eclipse, the Saros cycle predicts when a similar eclipse may happen.



Modern studies of the Saros cycle began with Edmond Halley. He rediscovered Saros studying the Moon to determine longitude more accurately, which was the focus of astronomy in his day. He predicted a Total Solar Eclipse in London 1715 to within 4 minutes and 19 miles and crowdsourced reports of this TSE to correct errors in Moon's orbit. Considering the width of the path, or greatest extent of shadow of a TSE is 167 miles, that was no mean feat.

In his study, which lasted nearly 20 years, he determined the precession of the plane of the Moon's orbit. This included the Saros cycle that had been found by many ancient civilizations to be the period it takes the Moon's ascending node to move through 360° relative to the vernal equinox. The period is 223 lunar (synodic) months, or over 18 years. The direction of motion is westward, i.e., in the direction opposite to the Earth's orbit around the Sun, if seen from the celestial north. This is the reason that a draconic month or nodal period (the period the Moon takes to return to the same node in its orbit) is shorter than the synodic month. After one nodal precession period, the number of draconic months exceeds the number of synodic months by exactly one. The cycles line up, and, like a slot machine hitting, we are rewarded with an eclipse.

WINNER!



However, Saros is not an integer number of days, and the Earth rotates 120° to the point of the eclipse (1/3 of the way around the Earth, to the west). For instance, the eclipse of 2017 many of us saw will have a similar sister total solar eclipse on September 1-2, 2035, located in China and the Pacific. A Greek astronomical clock called the Antikythera (“turning of the wheel”) mechanism used epicyclic gearing to predict the dates of consecutive exelgmoses and is the root of our modern word.

It is important to note that this does not mean that eclipses occur only with spacings of several years. At any time, there are many interleaved Saros cycles in action: 39 at present. This is why we may have up to five solar eclipses per year, though many of those may be only slightly partial, or located in extreme reaches near the poles. It also explains why the American eclipses of 2017, 2023, and 2024 can occur close together.

DETERMINING SAROS

We will either find a way...or make one – Hannibal

By following a method carefully, over several months, you too can determine the Saros Cycle by simple means.

Assumptions

- Assume Moon’s orbit is circular (this will remove effect of the anomalistic month)
- Assume the orbits of the Moon and Earth remain unchanged over the entire cycle of interest (no perturbations)
- Choose field stars and moon phases to make the calculation easier, e.g.:
 - Choose a bright star to check the sidereal month
 - Choose a phase around first quarter to get the synodic month
 - The difficult nodal crossing observations will be near New Moon, so start the project soon after a solar eclipse (even a poor one, or one you could not see) This will give you several months before the sun reaches the other nodal crossing, at the next eclipse season
- Don’t forget there are two nodes; eclipses occur at either one, but each should be considered separately for the calculation

Methodology

In recording the position of the moon, we will start near the positions of the last eclipses. So, if the last eclipse was a lunar one in Aries, concentrate on the Moon in Aries, and the mirror of it in Libra. One of these is the Ascending, the other the Descending node.

Method:

- Sketch or image moon, capturing a few stars in the field
- Record time to nearest minute
- Use those nearby stars and a star chart to find the Moon’s position
- Find position within $\pm 2^\circ$ (4 moon widths)
- Repeat for at least 6 months (more preferred)

Note that you should concentrate on getting positions around the node crossings; the sidereal month is not needed for the calculations; however, you may find calculating it to be an interesting exercise also.

Calculations:

From your careful records, you should easily notice the time required to return to the same field of stars (sidereal month - optional), back to the same phase as before (synodic month) and, less easily, the motion of the nodes over several months. Once you see the approximate motion, you can extrapolate to determine the time of entire circuit. There will be a solar eclipse of similar type as before at the point where the draconic month and synodic month line up. The period from the previous eclipse to this line up point is the Saros and is attended by another eclipse.

We can't say the next eclipse will be at the same location, as this is affected by rotating Earth. If the Saros cycle was exact in days, it would be located very close to the previous spot, but as it is not, the eclipse will occur at a location to the west. There is another cycle (the **Exeligmos**) which determines when you will see an eclipse at the same location, but that is a topic for another day. There is also the matter of the type of eclipse; it will be solar, but whether it is Total, Annular, or Partial is determined by the anomalistic cycle (the effect of the Moon's orbit being an ellipse, not a circle).

NUMBERING SAROS

The Saros Cycles are numbered, for instance the TSE on April 8, 2024, is in Saros 139. The system for numbering was developed by Dutch astronomer G. van den Bergh in the 19th century. The upcoming American Eclipse (the Sequel) on April 8, 2024 is #30 of Cycle 139.

Saros cycles usually start and end at the poles, usually with poor partial eclipses seen only by polar bears. #1 of Cycle 139 occurred on May 17, 1501, as a partial eclipse of the sun with 9% covered. The "Last of Us" moment for Cycle 139 will occur on July 3, 2763 at 6% covered for the penguins to watch as they stand on their eggs.

I find it interesting that #30 is an amazing total solar eclipse, its path through our state, to be seen by millions on my son's birthday, while the final hurrah of this Saros cycle is on my 797th birthday. I might not be there with the penguins, but I will be there with Gus next year, standing under the dark side of the Moon.

SAROS CYCLE 139



Suggested resource: [March 2023 Astronomy Club of Tulsa Presentation Observing Session 5](#)

There will be no doubt an avalanche of new books on the 2023 / 2024 solar eclipses, but here is a selected bibliography and the sources for this article:

BIBLIOGRAPHY:

SEEING THE ECLIPSE

General Scientific Guides:

The Under-Standing of Eclipses by Guy Ottewell

David Levy's guide to Eclipses, Transits, and Occultations by David Levy

Your Guide to the 2017 Total Solar Eclipse by Michael E. Bakich

Observational Recollections and Histories:

Eclipse – Voyage to Darkness and Light, David Levy

Eclipses, Past and Future, Samuel Jenkins Johnson

The Last Stargazers by Emily Levesque, Chapter 9

Sun Moon Earth by Tyler Nordgren

Eclipse - Journeys to the Dark Side of the Moon, Frank Close

Mask of the Sun – The Science, History, and Forgotten Lore of Eclipses, John Dvorak

Technical Papers and Websites:

Solar Eclipse 1970 Bulletin F [US Gov't document NS 1.2:So 4] (provides data and outcomes from several technical experiments at that eclipse)

<http://mega-what.com/glossary/LuniSolar.html>

<https://www.mreclipse.com/>

<https://solarsystem.nasa.gov/eclipses/home/>

SAROS

Prehistorical Astronomy in the Southwest, J. McKim Malville

The Stars in Their Courses, Sir James Jeans, p 30

Observational Astronomy for Amateurs by J.B. Sidgwick, p.58-61

Roads to Center Place: A Cultural Atlas of Chaco Canyon and the Anasazi, Kathryn Gabriel, p.96

Living the Sky: The Cosmos of the American Indian, Ray A. Williamson, p.189

How the World Works: Astronomy, Anne Rooney, p.110-115

Eclipse Prediction and the Length of the Saros in Babylonian Astronomy, Lis Brack-Bersen and John M. Steele

Astronomy Made Simple, Meir Degani, p.157

Astronomy, E.G. Ebbighausen, p.30

Your Handle on the Night Sky, Daniel Pope, p.113

Out of the Shadow of a Giant: Hooke, Halley, and the Birth of British Science, by John and Mary Gribbin, p 240-250

Scheduling the Heavens: The Story of Edmond Halley, Mary Fox, p.109

The American Eclipse, David Baron, p.12

<https://www.theguardian.com/science/1999/jul/15/eclipse.technology>

<https://www.behance.net/gallery/54643157/The-Mythology-of-Solar-Eclipses>

<https://www.smithsonianmag.com/blogs/national-museum-american-indian/2017/08/21/american-indian-beliefs-about-eclipse/>

<https://www.almanac.com/solar-eclipse-folklore-myths-and-superstitions>

<https://kaiserscience.wordpress.com/2021/07/13/lunar-precession-the-moons-wobble/>

Associate Treasurer Report

Mike Blaylock



As February 26, we had 192 members 11 New members for 2023

We welcome this month's newest members – William Clark, Jewel Simpson, Scott Shepperd, Sam Powell, Calib Leggett, Radis Spencer, and Jim Boyers. **Hello and welcome to ACT !**

Have you changed you Contact Information? Email, Phone, Postal Address ?

Please help us to maintain our records by sending an email to AstroTulsa.Tres@gmail.com

Accounts as of February 26, 2023

Checking: \$ 1,347.10

Savings: \$ 5,789.76

Investments: \$ 30,666.00 (Value tends to fluctuate with markets).

You can JOIN or RENEW memberships or magazine subscriptions ONLINE using ANY MAJOR CREDIT CARD.

The transactions are processed through PayPal but you Do Not need a PayPal account.

Fill out the registration form at <https://www.astrotulsa.com/join>

Click Submit and you will be given the choice of either MAILING in your dues with a check or paying online with most major credit cards. A modest processing fee is added to online transactions.

Membership rates for 2023 are as follows:

Adults: \$ 45 per year, includes Astronomical League Membership.

Sr. Adult: \$ 35 per year for those 65 or older, includes Astro League Membership.

Students: \$ 30 with League membership; Students: \$ 25 without League membership.

Additional Family membership: \$ 20 with voting rights and League membership.

\$ 15 with voting rights but without League Membership.

The regular membership allows all members in the family to participate in club events but only ONE Voting Membership and one Astronomical League membership.

Join Online – Add or renew magazine subscriptions. <https://www.astrotulsa.com/join>

MAGAZINE SUBSCRIPTION RATES and PROCESS has CHANGED !

You can get a discount rate as a Astronomy Club member. **However, you will need to do so directly using their discount rate web links.** Both Sky & Telescope and Astronomy have options for DIGITAL as well as PRINT subscriptions.

For club member's Discount subscription rates to [Sky and Telescope magazine](#) go to [this page](#)

For club member's Discount subscription rates to [Astronomy magazine](#) go to [this page](#)

Use the DISCOUNT RATE LINKS above instead of their regular subscription pages to MAKE or RENEW your subscription.

If you need assistance, contact our club treasurer at astrotulsa.tres@gmail.com

dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!



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

Spot the Morning and Evening Star: Observe Venus

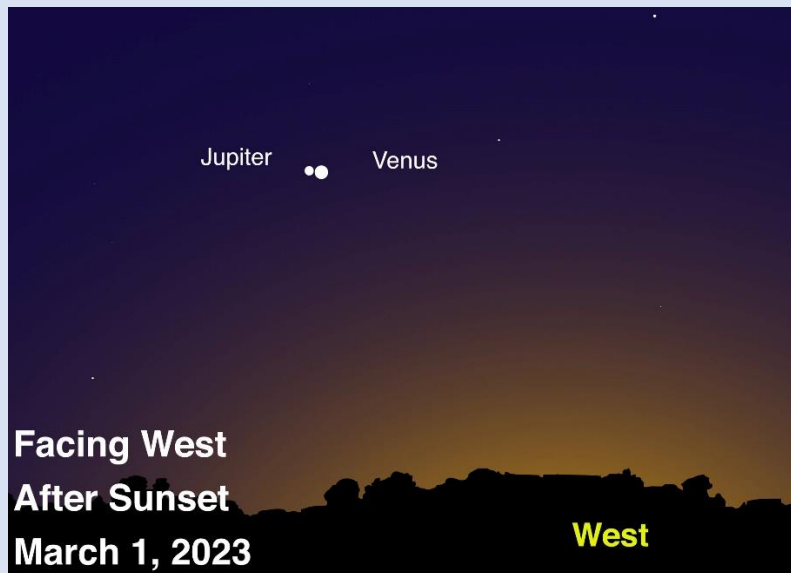
David Prosper

Venus is usually the brightest planet in our skies and is called “Earth’s Twin” due to its similar size to Earth and its rocky composition. However, Venus is a nightmare version of our planet, featuring a thick, crushing atmosphere of acidic clouds, greenhouse gasses, howling winds, and intense heat at its surface.

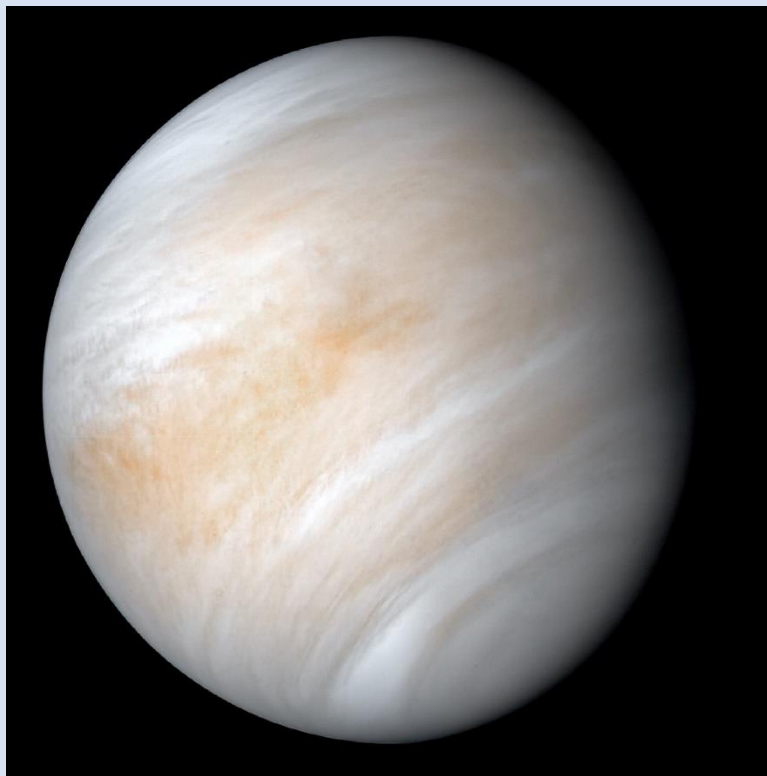
This rocky inner world’s orbit brings it closer to Earth than any of the other planets and is the second closest to the Sun after Mercury. Like Mercury, Venus orbits between our planet and the Sun, so Earth-based observers can observe Venus in the morning before sunrise, or in the evening after sunset – but never high in the sky in the middle of the evening, unlike the outer planets. Since Venus is so striking in its twilight appearances, the planet features heavily in sky mythologies worldwide. Venus’s bright morning and evening appearances are the origin for its dual nicknames: the Morning Star, and the Evening Star. Some ancient astronomers never made the connection and assumed the Evening Star and Morning Star were two unrelated objects! Observers can even spot Venus during the daytime, if the sky is very clear and the planet is bright enough. Venus also has phases, similar to the Moon and Mercury. Galileo’s observations of Venus’s phases helped turn the astronomy world upside down in the early 1600s, and you can see them yourself using a telescope or even a surprisingly low-power pair of binoculars. **Warning:** Please be very careful when observing Venus with a telescope in the early morning or daytime. Never allow the Sun to enter your instrument’s field of view, as you could be permanently blinded.

Venus’s other moniker of “Earth’s Twin” is a bit misleading. In terms of their surface temperatures and atmospheres, Venus and Earth are extremely different! The surface of Venus is warmer than that of Mercury, despite Mercury being many millions of miles closer to the Sun. While Mercury is still a scorching 800 degrees Fahrenheit (427 degrees Celsius), Venus is even hotter: 900 degrees Fahrenheit (482 degrees Celsius). The vast amount of carbon dioxide in the thick Venusian atmosphere acts as an insulating blanket that retains much of the Sun’s heat, creating the runaway greenhouse effect that dominates its present-day climate. The Venusian surface is a crushing 90 Earth atmospheres on top of its absurd temperatures. These extreme conditions mean that the mission life of any past Venusian robotic landers were measured in **hours** at best – and usually minutes! However, conditions in Venus’s upper atmosphere may be much more hospitable, with temperatures and pressures at 30 miles (50 km) above the surface that are much more Earth-like in temperature and pressure. Studies of the Venusian atmosphere, including seasonal appearances of dark streaks and faint signals of suggestive chemistry, intrigue researchers with the possibility that some sort of life may persist in its clouds. But far more evidence is needed to confirm such a claim, since non-biological factors like volcanism and other processes could also be the source for these signals.

Venus’s thick sulfuric acid clouds block direct visual observations of its surface from optical telescopes on Earth. Multiwavelength observations from space probes show evidence of active volcanoes and possibly some sort of plate tectonics, but follow-up missions will be needed to confirm the presence of active volcanism, plate tectonics, and any possible signs of life. In order to do so, NASA is sending two new missions to Venus by the end of this decade: the orbiter **VERITAS**, which will map the surface in high detail and study the chemistry of its rocks and volcanoes, and **DAVINCI+**, which will study its atmosphere and possible tectonic surface features via a “descent sphere” that will plunge into Venus’s clouds. Follow their development and discover more about Venus at solarsystem.nasa.gov/venus, and of course, continue your exploration of the universe at nasa.gov.



Venus and Jupiter continue to move closer together in the evening sky this month. Jupiter will continue its descent towards the horizon while Venus will continue to climb and will be visible in the evenings through mid-summer of 2023. It's a great year for Venus fans! *Image created with assistance from Stellarium*



The top layers of Venus's cloud pop in this contrast-enhanced image, reprocessed with modern techniques from Mariner 10 data. *Credit: NASA/JPL-Caltech*

Source: <https://solarsystem.nasa.gov/resources/2524/newly-processed-views-of-venus-from-mariner-10/>

You are invited to come join us to learn more about Astronomy and view the wonderful sights in the night sky.
Check the **EVENTS** section at <https://www.astrotulsa.com/>



During the school year our club holds a **Monthly General Club meetings** at **Jenks Public Schools Planetarium**
205 East B St, Jenks, OK
Located North of the intersection of 1st and B St

Meetings begin at 7:00 PM

When you enter the building lobby, take the elevator to the 3rd floor.

[Click for Google Map Link](#)



ASTRONOMY CLUB OBSERVATORY

Located on a hilltop about 25 miles SW of Tulsa
Features: classroom, restroom, dome with 14-inch telescope and an acre to set up your telescopes.

Weather permitting, we host two types of observing nights.

GUEST OBSERVING NIGHT – RSVP requested

This event is open to our Guest – both individuals and families as well as our regular members.

Several of our club members set up telescope for public

viewing.

* Groups need to make separate arrangements.

MEMBERS OBSERVING NIGHT usually on a Friday near new moon

Reserved for club members and their families to allow them to pursue observing projects.
The Observatory is **ONLY OPEN** for **SCHEDULED EVENTS**.

Check the **EVENTS** section at <https://www.astrotulsa.com/>

Follow our map directions **DO NOT USE GPS**

Two Options for travel to the observatory

MOSTLY PAVED ROADS – Hwy 75 to 201st St S – through Mounds OK

Most **DIRECT ROUTE** – Hwy 75 to 241st St S – some coarse gravel & dirt roads

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SIDEWALK ASTRONOMY – **Open Position**

PR AND OUTREACH – **Open Position**

GROUP DIRECTOR – **Open Position**

NIGHT SKY NETWORK – **Open Position**

WEBMASTER JENNIFER JONES

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JENKS PLANETARIUM



Jenks High School Campus
205 East B Street, Jenks

TICKETS are \$7

Purchase online at

jenkscommunityed.com

or call 918-298-0340

2023 [Go to Show Schedule](#)

Click the Date Column to sort them by show date

Most Shows take place on

Tuesday evenings from 7:00 PM to 8:00 PM
a few on Saturday

Do you have ideas for our club In Person or ZOOM Meetings?

Want to share an observing experience or astrophoto.
Know someone willing to be a Guest presenter?

We would also welcome YOU to do a short 5-10
minute section of interest or new equipment you'd
like to review.

Create a Cartoon on a Space Theme

Contact our Editor John Land

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