ASTRONOMY CLUB OF TULSA

OBSERVER

MAY 2025

Bringing Stars to the eyes of Tulsa since 1937

Editor – John Land

Member Liam Yanulis shares his image of
Lynd 1266 - Dark Nebula in Cepheus Nebula

The image of LDN 1266 covers an area of 96” by 96” – about 3x the size of the moon
This is a four-panel mosaic that took the better part of 4 months to complete

William Optics Zenithstar 73 telescope with an ASI533MC Pro camera and
a ZWO 2" UVIR cut filter on a Skywatcher HEQ5 mount

Join Us Friday May 9th @ 7:00 PM for our club meeting – Guests Welcome

Jenks High School Planetarium Located at 105 East B St, Jenks, OK

After May 9 - In Town club meetings will resume in September.

Our club president, Jonathan Fussel, will be speaking on -

Chemical Clues and Cosmic Contexts:
Prebiotic Networks and the Expanding Search for Life

His presentation will tie together research from meteorite chemistry, icy moon analog environments, and the latest discoveries from exoplanetary missions, including the recent potential biosignature detection on K2-18b. It will explore how prebiotic chemistry modeling helps inform our expanding cosmic context for habitability and guides our search for life in the universe.

Jonathan Fussell is an astrobiology researcher whose work sits at the intersection of chemistry, planetary science, and the search for life in the universe. His research began at the Blue Marble Space Institute of Science, where he contributed to a project analyzing meteorite data to trace the order of amino acid incorporation in early protein evolution. From there, his work expanded into the modeling of prebiotic chemical networks on Saturn's moon Enceladus. Working with Dr. Henderson Cleaves at Howard University and utilizing computational tools to simulate reaction pathways and explore potential biosignatures in subsurface ocean environments.

Jonathan is also a contributing member of NASA's Science Analysis Group #25, where he supports efforts to define, prioritize, and refine biosignature and techno signature detection strategies across planetary systems. His work explores how the smallest molecular patterns—whether in carbonaceous meteorites or complex reaction networks—may offer universal clues about the emergence of life, both in our solar system and beyond.

Liam Yanulis shares these during and after images of a supernova 11/21/24 & 02/24/25

Stargazing Nights and Observatory Nights

Our GUESTS & Members nights are open to anyone. We do ask guests to try to RSVP.
Large groups need to make separate arrangements.

Members Only Nights are Open to members and their family
Details, Times and Direction Maps are posted on our Website
https://www.astrotulsa.com/events

Guest and member Observatory nights

Come enjoy an evening of star gazing at our observatory located in darker rural skies.
See details and directions on our Website Events Page Guests are requested to RSVP

Friday May 16 - 7:50 PM Guest & Members Observatory Night
Friday June 13 - 8:10 PM Guest & Members Observatory Night
Friday July 18 - 8:10 PM Guest & Members Observatory Night.
Friday Aug 15 - 7:40 PM Guest & Members Observatory Night

Astronomy Club Members Nights

Our members are invited to come work on their observing goals, do some Astro imaging and share ideas.

Friday May 23 - 8:00 PM Members Observatory Night
Friday June 22 - 8:10 PM Members Observatory Night
Friday July 25 - 8:00 PM Members Observatory Night
Friday Aug 22 - 7:30 PM Members Observatory Night

If a Friday event must be cancelled due to weather, we will try on Saturday 30 minutes before sunset
- Always check the website for event updates

Special Free Public Events -
Saturday May 3 - 7:30 to 10:00 PM
Case Community Center Astronomy Night

Sand Springs Case Community Center
1050 W Wekiwa Rd, Sand Springs

Come help us celebrate International Astronomy
This is a come and go event.
No registration required.

Friday May 30 – Telescopes at Hunter Park
Telescopes will be set up for public viewing. Members & Guests are welcome to bring their own telescope so our experienced observers can help them learn observing skills.

Check Website later for future Details.

President's Message
Jonathan Fussell

As the spring semester draws to a close and we prepare for a brief summer pause of our monthly planetarium meetings, I want to take a moment to reflect on what an incredible season it's been for the Astronomy Club of Tulsa.

From weathering the winter chill in February to chasing Messier objects in March, each month has been packed with moments that reminded us why we look up. This spring saw everything from our Telescope Workshop at the Tulsa Air and Space Museum to public outreach nights, members nights, and guest night, and your passion continues to shine through, rain or shine every time.

I'm especially proud of the conversations we've started and the community we've built—not just among ourselves, but with the greater Tulsa area. Whether we're teaching families to use their first telescopes, chasing planetary alignments, or simply sharing a view of Saturn's rings, we're doing something that matters.

Looking ahead, I'm excited to share that our Fall semester will be our most ambitious yet. We'll be joined by some stellar guest speakers, including Dr. Graham Lau, astrobiologist and science communicator, as well as members of the SETI Institute. These meetings will bring in fresh perspectives from the frontiers of space science and will offer incredible opportunities for learning, collaboration, and inspiration.

Thank you all for making this club such a special community. Whether you've attended every meeting or just one, your presence, curiosity, and contributions matter. Let's take this summer to rest, recalibrate our scopes—and come back ready to dream even bigger.

Until then, keep looking up.

Clear skies,

Astronomy Club of Tulsa

"Bringing Stars to the Eyes of Tulsa since 1937"

Jonathan Fussell - President

2025 ASTRONOMY CONFERENCES and STAR PARTIES

Are you looking for a way to combine a bit of vacation time and enjoy learning more about astronomy? A regional of national astronomy conference may be just the thing for you. You can make friends with likeminded astronomy enthusiast and also get to hear some interesting presentations on a variety of topics. The door prize give aways are also an extra little bonus.

2025 MidStates Regional Astronomy Conference June 13 to 15

The 2025 MSRAL Conference will be on the Little Rock University of Arkansas campus. This year's host is the Central Arkansas Astronomical Society. Our Tulsa club hosted the June 2023 MSRAL Conference. They already have an impressive lineup of 15 speakers and activities posted on their website. The Friday evening "*Pisces Fry*" meal is going to be held at their River Ridge Observatory along with some observing. The Saturday and Sunday presentations and workshops will be on the U of AR campus.
I corresponded with their treasurer who told me registration and lodging information will be posted to the website soon. https://msral2025.caasastro.org/index.php

2025 National Astronomical League convention June 25 to 28

The ALCON 2025 will be located in the scenic Bryce Canyon National Park of Utah.
The convention is taking place during the new moon so guests can enjoy the incredible dark skies of Bryce Canyon. In addition to the dark skies Bryce Canyon is noted for its beautiful unique geological landscape features. They have a several notable speakers lined up as well as some interesting workshops. Several astronomy equipment vendors will likely have displays set up.
Check out the details at https://astrocon2025.org/ **Reservation space is limited.**
Most recent posting indicates 150 reservation slots still available

Okie-Tex Star Party Sept 19 – 27 https://www.okie-tex.com/index.php

Several of our Tulsa area astronomers enjoy going to the Okie-Tex Star Party in the autumn. Each year about 500 astronomers arrive from all over the nation for a week-long feast of starlight. Th Okie-Tex is held on a spacious observing area just west of the Black Mesa State Park at the far western end of the Oklahoma Panhandle. Its bortle 1 dark skies are acclaimed as some of the darkest on the planet. Each time I go I am overwhelmed by the late summer Milky Way flowing overhead like a river of stars engulfing the sky. You need to register and reserve your meal choices by August 31, 2025

Click on these images to links on the Internet

*** The CLEAR OUTSIDE icon above is a link to an extensive site showing cloud cover %, Seeing, Transparency, Moon Phase, Temp in ^{O} C and many other useful tools

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

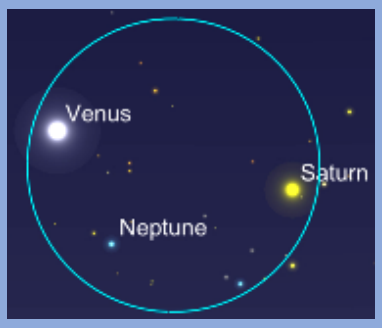
Getting Started with Your New Telescope
https://skyandtelescope.org/astronomy-news/getting-started-with-your-new-telescope-2/

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/

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/

MAY - Moon Phases - -
1st Q Sun May 4 - - Full Mon May 12 - - 3rd Q Tues May 20 - - New Mon May 26



Lunar conjunctions –

Evening Mars May 3 & 31 Jupiter May 28
Morning Saturn & Neptune May 22 Venus May 23

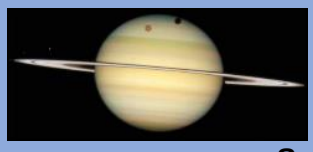
Triple morning dawn planet conjunction
Venus, Saturn & Neptune lie within a 5-degree binocular view on the mornings of May 1 thru 3

Saturn & Neptune draw even closer - lying within 1-degree from June 26 to July 19

Mercury can be seen hugging the eastern horizon before dawn the first half of May.
It was a greatest western elongation April 21 and will be superior conjunction May 29.
VENUS has become our bright morning star reaching maximum solar elongation May 31.
SATURN rises by 4:45 AM in early May and 3:00 AM by the end of May. Saturn's rings now appear almost edge on.

Evening Planets JUPITER – this will be the last few weeks to view Jupiter and its moons in the evening sky. The reaches superior conjunction June 24 but will be difficult to find well before that.
MARS opens the month of May passing within 1-degree of the M 44 Beehive cluster in Cancer May 3rd & 4th The 1st quarter moon joins the view on May 3rd. Mars will continue as an evening star until Christmas time but will appear smaller and dimmer as each month passes.

Eta Aquarid Meteor shower peaks on the mornings of May 5th & 6th around 4:00 AM. These meteors are remnants of the famous 1P Halley's Comet On a good year they can produce 60 meteors per hour. Meteors traveling at 150,000 mph can leave long trails in the sky. Comet Halley has reached its aphelion point and is slowly making it way back to perihelion in 2062.



SATURN underwent Ring Plane crossing on March 23 but was too close to the sun to observe. For the next 15 years we will be viewing its southern hemisphere tilted toward Earth. For the next few months, it will be possible to see its large moon Titan and its shadow transit the disk of Saturn.
See the bottom of page 16 for details and a Table of Titan shadow transit dates.

Observing Chairman
Brad Young

Skills by Brad Young

Amateur Astronomers (per Google AI):

Amateur astronomy involves a range of skills, from basic observation and navigation to advanced imaging and data analysis. Beginners can start with learning the night sky, using binoculars or telescopes, and identifying constellations and celestial objects. More experienced amateur astronomers may develop skills in image processing, astrometry, and photometry. Additionally, "soft skills" are useful, including troubleshooting equipment and interpreting observations, taking the initiative to learn and observe, and patience in the face of challenges, such as cloudy nights.

As we acquire skills in our profession or hobbies over our lifetimes, these talents often become ever more specific and difficult to achieve. But it's important to remember that everything you've learned in your lifetime is continuously evolving, and it all began with the basics. My career in chemical engineering took the familiar path of disdain of the simple to "fit in" the most complex processes. You don't have to know everything about chemical engineering I think, to get the gist of what I mean, and I bet the same concepts apply to other job skills, from accounting to zoology.

One very simple idea in chemical engineering is that of a cooling water system. To begin with the design, you simulate sending enough cooling water to each heat exchanger to cool the fluid involved to the desired temperature. However, there are two imbalances that must be solved to have a real-world design. First is the energy imbalance, which is to say that although you may supply cooling water at a temperature to cool each exchanger, the exchanger hot side will have different fluids and different initial and final temperature requirements that may vary sizably over the different services demanded. A good way to begin fixing this is to look at the largest service of all and fix the return temperature at an initial set point. Let's say for instance you would have to supply 100 gallons a minute of cooling water at 80° Fahrenheit for the return temperature to be 100° F to effectively provide this utility service. The next thing to look at is the flow imbalance. You're not going to get perfect return temperatures across the entire network of cooling water exchangers, but you can count on an unchanging cooling water supply temperature. Here again if you size the piping and valves to provide the cooling water flow rate required with this change in temperature, everything else will equal out. You can manipulate flow rates here and there using valves that choke off water supply to the exchangers that don't need as much, so that they have an effective duty.

You could make the case that applying principles used in engineering may help you understand how variable stars work. Of course, there are many different types of variable stars, but in general, they change brightness due to some underlying changes in the star system, just as cooling water networks change their behavior due to individual variations in cooling requirements. As we watch the changes occur over time, we can get a sense of what causes them, and how the different reasons interact. The connection here is to see the whole system. A simple eclipsing binary star may have only one source of variability (the eclipse), but the more interesting variables have many parallel effects on their brightness over time.

Another unit operation that reminds me of some of my amateur astronomy projects is a steam system. Steam is another distributed utility just like cooling water, although it has many more ways to modify a process. Steam gives us the opportunity to change phases, in other words, to boil water and condense steam providing a much larger temperature difference and greater heat transfer. Think of how boiling is a quicker way to cook than a hot water bath. We also use steam to provide motive power in the expansion of water into steam. Here, a locomotive or electric power plant, where steam forces motion than turns machinery, are good examples. In a way (bear with me here) the work done by steam turbines is like the energy requirements of orbiting planets and moons, even asteroids. I don't mean the universe is a steampunk fantasy world; instead, that the change of potential energy held in steam to kinetic energy expressed as mechanical work is comparable to that of the potential of gravity causing kinetic orbital motion.

These motions are quantified in the astrometry that we acquire of orbiting bodies through careful measurement of position in the sky and the time that position is taken. This part of astronomy has been going on for thousands of years, albeit with low precision for most of time. Positional studies are reasonably believed to be the primary founding principle of astrology, later to evolve into astronomy.

We also gather useful information that includes the brightness variations of planets, comets, asteroids, etc., as they orbit. Especially when coupled with the astrometric data, this photometry broadens our understanding even more. There are lots of reasons why these brightness changes occur, including:

1. the composition of the orbiting object, including surface markings or atmosphere
2. changes in the illuminating body – e.g., star shining on planet
3. the phase angle or lit portion of a solid body
4. effect of previously unknown exoplanet or asteroid moon transiting a star during an occultation
5. the degassing or ice sublimation activity of a comet depending on its age and composition.

You must think of many things when designing a steam system; it's not just mass or energy in and out you must consider (as with cooling water), there is also the effect of boiling and condensation used for work or heat. When investigating the positions and brightness of celestial orbiting objects, the same care is used to gather the data and provide plausible theories to why they act as seen. The scientific method applies across understanding how steam and planets work.

Per Google AI:

Chemical engineering *involves a blend of technical and soft skills. Technical skills include strong knowledge of chemistry, physics, math, and engineering principles, as well as proficiency in using simulation software and data analysis tools. Soft skills encompass communication, problem-solving, teamwork, and analytical thinking*.

I started this article after being frustrated by forgetting some simple steam system design ideas and how similar some errors are with engineering and astronomy. While writing this article, I found a rookie mistake that caused errors when I tried to image artificial satellites. Finding the errors led me to think about how always remembering to start from first principles, no matter what your career or hobby project may include, will give you the best chance for success over the long term.

By understanding the basis of astronomy instead of just telling a computer to “image M33 !”, you can add the pleasure of being able to provide outreach and answers. Our grandfather clock has a moon phase indicator. This is set by matching the date of the current lunation with the current day in an almanac. These simple little facts can not only help improve our daily experience of astronomy but can even open conversations with other hobbyists and people interested in astronomy. Not everyone is going to be ready or even interested in observing the infinitesimal fraction of starlight blocked out by an asteroid occultation. They might not have the training, afford the equipment, or even a remote access that will help them determine whether or not an exoplanet is in the Goldilocks zone, where life may be possible. But if you’re enjoying a beautiful conjunction of Venus and Jupiter on a lovely summer evening, I'll bet you can find something to talk about or even while not talking at all. And, if you can explain why that conjunction happened tonight, the orbits involved, and our viewpoint, it will spread knowledge and interest in our hobby and the universe we call home.

The New Smart Imaging Telescopes for amateurs. by John Land

Recently a trio of Smart Imaging telescopes have become available to enhance your joy of astronomy. Their prices range from $ 350 to $ 600 plus taxes and shipping. *Current tariffs may affect the final price* So for a price comparable to a modest telescope you enjoy capturing your own images of deep sky objects. Several of our astronomy club members are enjoying using them. They do amazing well even in bright urban skies using built in light pollution filters.

The telescopes link up with an App for your Smart phone or tablet via Bluetooth and their own Wi-Fi link. It takes only about 10 minutes to set them up and get them ready for imaging. Once you have selected you target from the app. The telescope moves to find your target by using AI type sky mapping and internal GPS. Once it finds the target it does some initial evaluation of the sky and begins taking multiple short exposures of 10 to 30 seconds. Then automatically stacks the photos. You can watch the images begin to emerge on your device. Once the photo is finished to your satisfaction you can apply an AI algorithm to remove some of the digital background noise and store the image on your device.

The Three Models are presently on the market. The SeeStar S50 and S30 telescopes by ZWO and the Dwarf 3 Smart Telescope. I won't pretend to cover all the details of each scope here but here is a good YouTube link comparing the scopes. There are many others online as well as well as the SeeStar Facebook page.

I have had my SeeStar S50 for a bit over a year. During that time, it has gone through several software updates and have greatly expanded its original capabilities. One was the addition of the Digital noise reduction. Another was a Framing Mosaic mode that allowed you to rotate and expand the imaging field to fit the object you are imaging. Using this mode significantly increases the exposure time as it takes several exposures and stiches them into one larger image. The latest is an option to mount the telescope in an Equatorial tracking orientation to track the sky better. A note of caution here. You will need to use some sort of extra weight on a tripod to lower its center of gravity and reduce the risk of your scope toppling over. A large bottle of water or sand tied to hang from the tripod center should work.

The standard image you see on your phone is a jpeg. They can also take Fitts, Tiff format images that have higher resolution and can be processed with external software. – the SeeStar has an AVI RAW option for the moon or sun. They also take MP4 videos or time lapse videos. I'll let you watch the YouTube videos to see the comparison and specs of the telescopes. Some Stats

Dwarf 3 – 35mm Aperture Fl 150mm FOV 2.9 x 1.7^{O} --- SeeStar S30mm Fl 150 1.2 by 2.13^{O}
Both of the above also have a smaller wide field view of scenic daytime images

SeeStarS50mm FL 250 FOV 0.7 by 1.3^{O}
Mosaic mode doubles FOV of S30 & S50 but requires significantly longer exposure times.

Examples of SeeStar S 50 images- top 6 images by John Land

Eclipse 4/8/24

Sunspots

Waxing Gibbous

M 42 2 min

M 31 & 32 11 min

Comet 2023 A3 5 Min

M 104 Sombrero Galaxy & M 51 Whirlpool galaxy
by Scott Bratt – 28 min

S 50 Expanded Mosaic mode - 46 min
- Horsehead & Flame nebula - John Land

Astrophotography has improved immensely since the days of using photographic film. Astronomers had to spend an hour or more carefully manually guiding their telescope to capture enough light to expose the film. At the end of the night, they had to develop the film to see if they actually got a good image. Then spend more time getting a good print.

Now with the advent of digital imaging assisted by computers they can watch the image appear on the screen of a digital device in real time as sensors are collecting the light. Images that would take an hour or more on film can be done in a few minutes. Later the image can be further enhanced with digital software. Making the detailed images we see on our cover page or online involve expensive telescopes and cameras. The telescopes need to be carefully polar aligned and guided with electronic assistance.

These new AI assisted telescopes allow the average amateur astronomer to make pleasing images without the steep learning curve. These new scopes track the sky in Alto-Azimuth mode taking short 10 to 20 second exposures. Then using internal software, they stack the data from each exposure by adding the data to the previous one. Granted they aren't super high resolution and can't be enlarged to make nice wall prints. If you are interested some of our members have some of the scopes, they would be glad to demonstrate.

Scott Bratt contributes these tips he has learned from using his smart scope.

Setup the SeeStar S50 and level as close to level as I can get it, usually 0.2 or less in the app. Next, depending on how high the humidity is, I might set the dew heater to on. To get a good auto focus I will select a bright object, either Jupiter or a star and verify that the targets are sharp and not fuzzy. I have noticed that when the dew heater is on the focus does not change but if off, it can slightly drift after about 20 minutes of use. I suspect the internal electronics are generating enough heat to cause the slight drift.

I will select my exposure time according to sky conditions and elevation of my target, poor conditions and below 30 degree or above 80 degrees azimuth I normally only use 10 second exposures. If between those elevations I will try 20 second exposure, and if getting good results and no dropped frames I will continue. If not, then I'll switch back to 10 second exposures. Also, when a target gets close to its apex it will begin to get more dropped frames due to field rotation. Obviously more time on target brings out more details and reduces apparent noise, but at 20 second exposure I am getting good result with 20 minutes, or about 100 frames.

When I am ready to stop and change targets or quit for the night, I will run the AI de-noise and save to my phone or tablet, then stop the imaging. A note on saving the FIT files or not, I have found that if I get a frame with an artifact, plane, satellite, or meteor, I can go find that frame, delete it, and re-stack and AI de-noise again to remove the object. Plus, you can stack externally and process in other software if you want. As far as image processing, I don't use anything besides the image editing tools available on my iPhone or iPad. Maybe someday in the future I'll join the Pixinsight crowd, but for now I'm content with what I'm getting. I hope this helps explain my process I used to capture great images.

Observations from John Land - I tried out the EQ mode a bit. One thing I noticed is that the power light changes to green when it is in EQ mode. When you select the EQ mode it asks to reset the scope Wi-Fi connection by pressing the small reset button under the corner of the base. Once it connects it rotates to determine its polar alignment. I mounted it on the EQ mount I use for my refractor. To get the right orientation I had to turn that mount around, so its north leg faced south allowing the mounting plate to face north at our 36-degree latitude. If you use a regular tripod, you will need an adjustable head device to tilt the telescope, so its axis points toward Polaris. Also, to ensure it doesn't topple over your need to counterweight it lower the center of gravity such as a gallon jug of water suspended below the tripod center. Unfortunately, by the time I had that all set up the sky clouded over. Arrrr ☹

Treasurer Report
Cathy Grounds

As of April 23, 2025, we have 170 members with 18 new members so far this year!
Please welcome our newest members Carl Jackson, Kevin Tighe and Case Wilkinson.

How do I know when to pay my dues? You will receive a notice by email that it is time to renew your membership. Look for it on or around the 1st of the month in which your membership expires. If you are not sure you are always welcome to check with the treasurer.

Accounts as of April 20th, 2025:
Checking: $ 4,368.30
Savings: $ 7,695.76
Investments: $37,116.17 (fluctuates with markets).

Don't forget these easy methods to join or renew your membership:
https://www.astrotulsa.com/join – see the "join" tab at the upper right

1. **PayPal (click "join/renew" on the website) and follow the prompts, there is small fee.**
   (You can use any major credit card - you don't need a PayPal account)
2. **Mail in a check or money order to Astronomy Club of Tulsa,**
   PO Box 470611, Tulsa, OK 74147.
3. **Direct your bank's bill pay service to send payment to our PO Box address above.**
4. **Pay cash at any club event or swipe a credit card (there is roughly a 3% service charge).**

As always if you have any questions or concerns or if your email, phone, or postal address has changed please email me at: AstroTulsa.Tres@gmail.com

Membership rates for 2024 - 2025 are as follows:
Adults: $ 50 per year includes Astronomical League Membership.
Sr Adult: $ 40 per year for those 65 or older, includes Astro League Membership.
Students: $ 40 per year includes Astronomical League Membership.
Additional Family membership: $ 30 with voting rights and Astro 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.

Magazine Subscriptions- You can see subscription info on the "Join" tab at www.astrotulsa.com. You can get a discount rate as an Astronomy Club member. You will need to do so directly using their web links below to make your subscription

To learn about Sky and Telescope magazine see their home page
Digital $ 37.05 Print & Digital $ 45.75 includes a $ 10 club discount
Use this **Sky & Telescope Subscription Link**

To learn about Astronomy magazine see their home page
Use this **Astronomy Subscription Link** **Digital $ 39.95 Print & Digital $ 49.95** no club discount

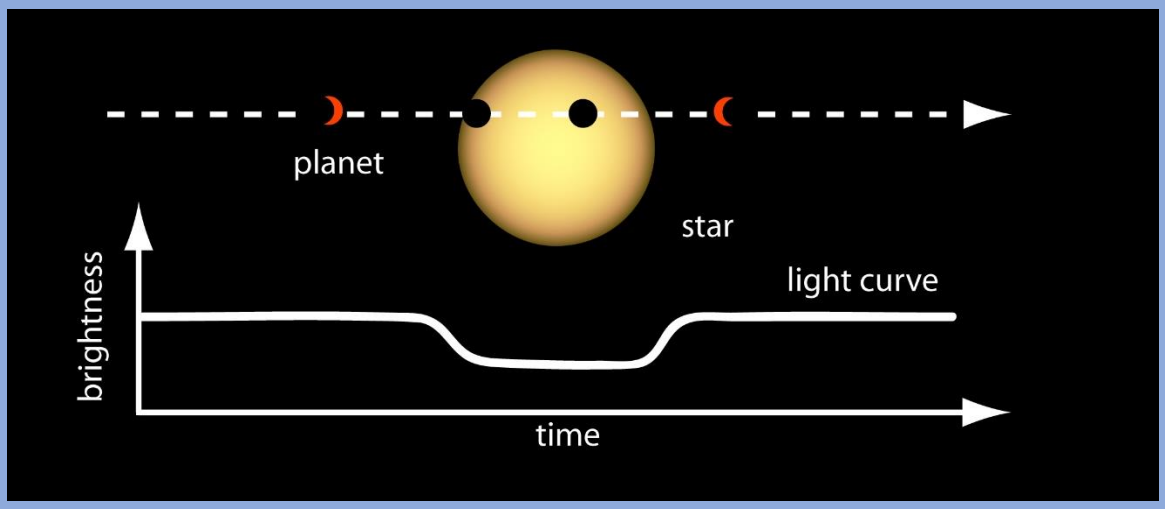
This article is distributed by NASA's Night Sky Network (NSN).
The NSN program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit go.nasa.gov/nightskynetwork to find local clubs, events, and more!

May's Night Sky Notes: How Do We Find Exoplanets?

By: Dave Prosper
Updated by: Kat Troche

Astronomers have been trying to discover evidence that worlds exist around stars other than our Sun since the 19th century. By the mid-1990s, technology finally caught up with the desire for discovery and led to the first discovery of a planet orbiting another sun-like star, **Pegasi 51b.** Why did it take so long to discover these distant worlds, and what techniques do astronomers use to find them?

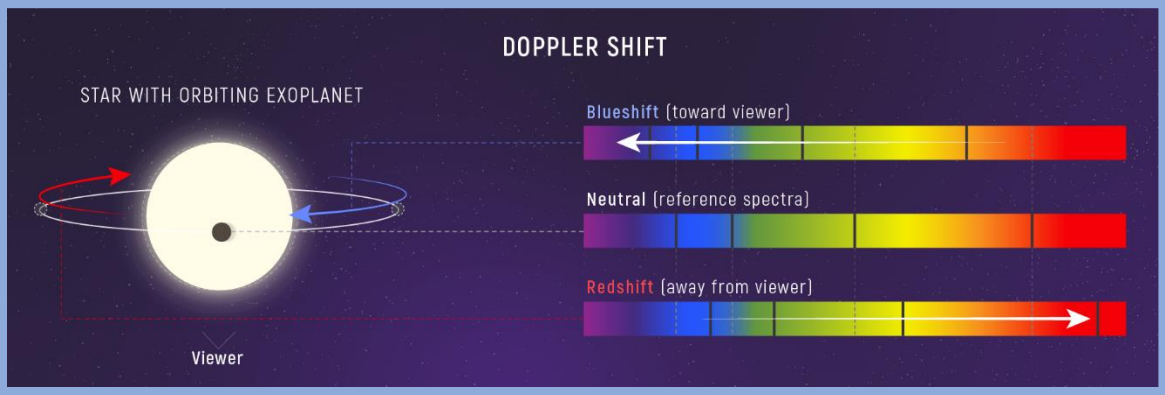
The Transit Method



A planet passing in front of its parent star creates a drop in the star's apparent brightness, called a transit. Exoplanet Watch participants can look for transits in data from ground-based telescopes, helping scientists refine measurements of the length of a planet's orbit around its star. Credit: NASA's Ames Research Center

One of the most famous exoplanet detection methods is the **transit method**, used by Kepler and other observatories. When a planet crosses in front of its host star, the light from the star dips slightly in brightness. Scientists can confirm a planet orbits its host star by repeatedly detecting these incredibly tiny dips in brightness using sensitive instruments. If you can imagine trying to detect the dip in light from a massive searchlight when an ant crosses in front of it, at a distance of tens of miles away, you can begin to see how difficult it can be to spot a planet from light-years away! Another drawback to the transit method is that the distant solar system must be at a favorable angle to our point of view here on Earth – if the distant system's angle is just slightly askew, there will be no transits. Even in our solar system, a transit is very rare. For example, there were two transits of Venus visible across our Sun from Earth in this century. But the next time Venus transits the Sun as seen from Earth will be in the year 2117 – more than a century from now, even though Venus will have completed nearly 150 orbits around the Sun by then !

The Wobble Method



As a planet orbits a star, the star wobbles. This causes a change in the appearance of the star's spectrum called Doppler shift. Because the change in wavelength is directly related to relative speed, astronomers can use Doppler shift to calculate exactly how fast an object is moving toward or away from us. Astronomers can also track the Doppler shift of a star over time to estimate the mass of the planet orbiting it. Credit: NASA, ESA, CSA, Leah Hustak (STScI)

Spotting the Doppler shift of a star's spectra was used to find Pegasi 51b, the first planet detected around a Sun-like star. This technique is called the **radial velocity or "wobble" method.** Astronomers split up the visible light emitted by a star into a rainbow. These spectra, and gaps between the normally smooth bands of light, help determine the elements that make up the star. However, if there is a planet orbiting the star, it causes the star to wobble ever so slightly back and forth. This will, in turn, cause the lines within the spectra to shift ever so slightly towards the blue and red ends of the spectrum as the star wobbles slightly away and towards us. This is caused by the **blue and red shifts** of the planet's light. By carefully measuring the amount of shift in the star's spectra, astronomers can determine the size of the object pulling on the host star and if the companion is indeed a planet. By tracking the variation in this periodic shift of the spectra, they can also determine the time it takes the planet to orbit its parent star.

Direct Imaging

Finally, exoplanets can be revealed by **directly imaging** them, such as this image of four planets found orbiting the star HR 8799! Space telescopes use instruments called **coronagraphs** to block the bright light from the host star and capture the dim light from planets. The Hubble Space Telescope has **captured images of giant planets orbiting a few nearby systems**, and the James Webb Space Telescope **has only improved on these observations** by uncovering more details, such as the colors and spectra of exoplanet atmospheres, temperatures, detecting potential exomoons, and even scanning atmospheres for potential biosignatures!

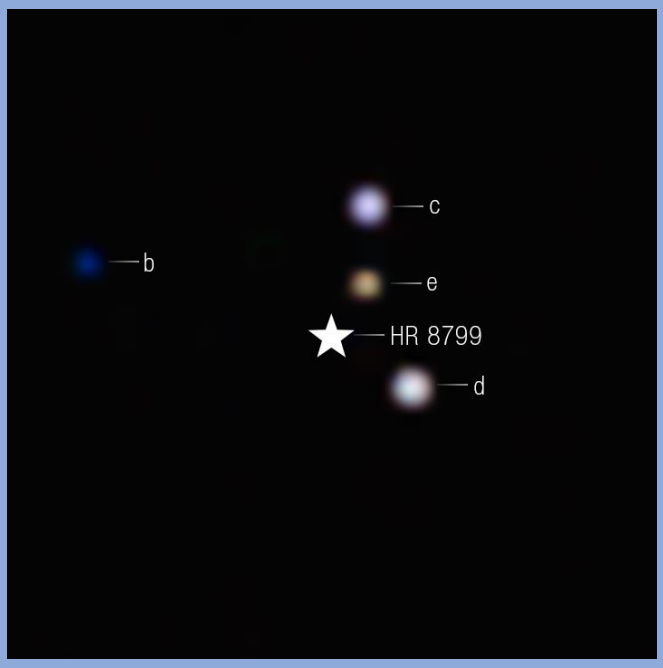
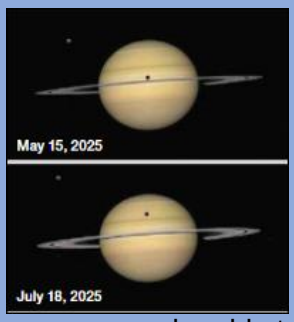


Image taken by the James Webb Space Telescope of four exoplanets orbiting HR 8799. Credit: NASA, ESA, CSA, STScI, Laurent Pueyo (STScI), William Balmer (JHU), Marshall Perrin (STScI)

You can find more information and activities on **NASA's Exoplanets** page, such as the **Eyes on Exoplanets** browser-based program, **The Exoplaneteers**, and some of the **latest exoplanet news.** Lastly, you can find more resources in our **News & Resources section**, including a **clever demo** on how astronomers use the wobble method to detect planets!

The future of exoplanet discovery is only just beginning, promising rich rewards in humanity's understanding of our place in the Universe, where we are from, and if there is life elsewhere in our cosmos.



Titan Shadow Transit time of Saturn – The **May 2025 Sky & Telescope** magazine has a nice article about observing shadow transits of its moon Titan on Saturn. This spring Saturn is an early morning planet, so you'll need a clear view toward the ESE horizon and begin observing by 5:00 AM before the dawn twilight. Later in the year Saturn will be higher in sky. The article says the shadow will be about 1" in size and suggests observing at 150x looking for a tiny speck on Saturn's disk. Imagers with large scopes may be able to catch both Titan & its shadow on the disk.
Your computer or phone app may assist in where to look and how high Saturn will be above the horizon.

Upcoming Titan Shadow Transits (UT)

Date	Start	Mid-transit	End
Apr 29	10:35	13:45	16:34
May 15	9:49	12:59	15:44
May 31	9:05	12:12	14:53
Jun 16	8:21	11:24	14:00
Jul 2	7:40	10:35	13:03
Jul 18	7:00	9:44	12:05
Aug 3	6:25	8:52	11:04
Aug 19	5:52	8:01	10:00
Sep 4	5:25	7:09	8:50
Sep 20	5:09	6:20	7:34
Oct 6	—	5:32*	—

*Full shadow on disk only at mid-transit

The **Shadow Transit times are given in UT** – Universal Time so you must **Subtract 5** hours to get our **CDT** time. So the shadow for the May 15 event will become visible on the edge of the planet a bit before 5:00 AM our time just as the dawn sky begins to brighten. Saturn will be 15 degrees up in the ESE sky. Sunrise is 6:16 AM. The July 18 transit finds Saturn 50 degrees up in the SE at mid-shadow transit time of 4:44 AM You may notice that the dates are about 16 days apart. Just remember if you miss the ones this year, it will 15 years before the next set of transits ! !

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 Guests – both individuals and families as well as our regular members. Several of our club members set up telescopes 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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PR AND OUTREACH – Open Position
GROUP DIRECTOR – Open Position

NIGHT SKY NETWORK – Jonathan Fussell

Enjoy at Planetarium Show at Jenks High School

JENKS PLANETARIUM

Jenks High School Campus
205 East B Street, Jenks

TICKETS are $7

See our Current Shows Schedule and ticket purchase links at
Shows and Ticket Link

Shows take place on Tuesday evenings or Saturday mornings
Must purchase tickets online in advance
Shows and Ticket Link