



# OBSERVER

SEPTEMBER 2019

*Bringing Stars to the eyes of Tulsa since 1937*

*Editor – John Land*



## **The Club's dome telescope gets an upgrade !**

Above Skip Whitehurst. Adam Koloff and Jerry Cassidy pose with the newly installed Meade Ultrawedge on our 14-inch RCX 400 telescope. This extremely heavy-duty wedge provides a secure stable mounting platform with exceptional vibration damping and precise polar alignment. Converting the scope to an equatorial mounting format allows for smooth tracking of the stars as the Earth rotates without field rotation. This expands the possibilities of the scope from simple visual observing to opening opportunities for photographic imaging. The inserts show the planets Jupiter and Saturn taken at prime focus with a DSLR by Skip Whitehurst on the evening of Weds Aug 28th.

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We are trying something new this summer. If an Observing Night scheduled for FRIDAY night has to be Cancelled due to weather, we will try again on Saturday if the weather improves. CHECK the Astrotulsa.com Website on Saturday afternoon to see if the observing grounds will be open.

*Astronomy Club Events* Details at <http://astrotulsa.com/Events.aspx>

<b>AUGUST</b>				
MEMBERS' NIGHT	New	FRI, AUG 2	8:30 PM	OBSERVATORY
<b>CLUB PICNIC (MEMBERS ONLY)</b>		<b>SAT, AUG 3</b>	<b>5:00 PM</b>	<b>OBSERVATORY</b>
SIDEWALK ASTRONOMY	1ST Q	SAT, AUG 10	7:30 PM	BASS PRO
PUBLIC NIGHT	3rd Q	FRI, AUG 23	7:30 PM	OBSERVATORY
MEMBERS' NIGHT	New	FRI, AUG 30	8:00 PM	OBSERVATORY
MEMBERS' BACKUP NIGH	New	SAT, AUG 31	8:00 PM	OBSERVATORY
<b>SEPTEMBER</b>				
GENERAL MEETING	1ST Q	FRI, SEP 6	7:00 PM	JENKS PLANETARIUM
SIDEWALK ASTRONOMY	1ST Q	SAT, SEP 7	6:45 PM	BASS PRO
PUBLIC NIGHT	3rd Q	FRI, SEP 20	7:00 PM	OBSERVATORY
<b>OKIE-TEX STAR PARTY</b>		<b>SEP 21-29</b>	see page 3	BLACK MESA
<b>AUTUMNAL EQUINOX</b>		<b>MON, SEP 23</b>	<b>2:50 AM CDT</b>	
MEMBERS' NIGHT	New	FRI, SEP 27	7:15 PM	OBSERVATORY
MEMBERS' BACKUP NIGH	New	SAT, SEP 28	7:15 PM	OBSERVATORY
<b>OCTOBER</b>				
GENERAL MEETING	1ST Q	FRI, OCT 4	7:00 PM	JENKS PLANETARIUM
SIDEWALK ASTRONOMY	1ST Q	SAT, OCT 5	6:30 PM	BASS PRO
PUBLIC NIGHT	3rd Q	SAT, OCT 19	6:15 PM	OBSERVATORY
MEMBERS' NIGHT	New	FRI, OCT 25	6:30 PM	OBSERVATORY
MEMBERS' NIGHT BACKUI	New	SAT, OCT 26	6:30 PM	OBSERVATORY

**NOTICE to ASTRONOMY magazine subscribers. - Treasurer's message from John Newton.**

For anyone who has submitted payment through the club to the Astronomy Magazine since the month of June, either to initiate or renew a subscription, I want to make you aware that the company has moved their processing center from Wisconsin to Texas. I am working with the magazine to get those subscriptions processed as quickly as possible. We apologize for any delay or inconvenience and appreciate your patience.

# PRESIDENT'S MESSAGE

BY TAMARA GREEN



We are in for a really nice month! September brings many nice things, including cooler weather, the return of Autumn, and [OKIE-TEX](#) !!!! Sept 21 thru Sept 29 For those new to the club Okie-Tex is an annual week-long "Star Party" under some of the darkest sky on the planet! Each fall over 300 astronomy enthusiasts gather at the tip of the Oklahoma Panhandle to observe, visit and soak in starlight! Owen and I hope to see you all there! I'm sure looking forward to it along with over 20 other Tulsa club members. Registration deadline for this year was Aug 31 but you can make plans for 2020.

**Volunteers Needed!** Its always more fun to "Get in the Game" then just watch from the Sidelines. Our Annual Club Dinner is coming up Sat Nov. 2. We always appreciate help getting things organized. Our Tulsa Club along with the BASidewalk astronomers group hosting the **MidStates regional Astronomy convention June 12-14, 2020.** So keep those dates open on your calendars. We'll be hosting fellow astronomy clubs from a five-state region. We want to put our "best foot forward" There's lots of planning to do in advance. We will need lots of volunteers to help with that too! You don't have to be a board member to volunteer.

Contact Tamara Green or Jerry Cassity to volunteer.

## **Officer and Board Elections Friday Oct. 4**

The officers and board serve the club by planning meetings and events, maintaining the facilities, and doing all the things that make the club run smoothly. If you are wanting to help plan the future of our club, we invite you to come aboard.

The **requirements for holding an office or board position** are as follows: You must be a fully-paid ADULT member IN GOOD STANDING of the Astronomy Club of Tulsa for a MINIMUM of ONE YEAR. Fully-paid memberships include individuals who have paid the full membership rate or family members who have upgraded to full membership by paying the additional \$ 20 family rate. As an Officer and Board member you should be willing to devote the time and effort to serve the needs of the club. This includes attending General and Board Meetings as many as you can. Also, you would be expected to attend as many of our public viewing events as you can as well and helping at other planned club events.

If you are willing to serve as club officer or board position, please contact  
Tamara Green or John Newton by Sept 18th.

This year we have two open office positions. Secretary and Vice President. Tamara is running for President again and John Newton will serve again as treasurer. So far new candidates for Board are Dennis Berney and Michael Blaylock. Returning candidates are Richard Brady, Jerry Cassity, John Land  
James Taggart and Skip Whitehurst.

*Clear Skies, Tamara Green*

## The Annual Club picnic Sat Aug 3

Despite the uncertain weather and rain earlier in the day, a couple dozen of our club members along with family were able to enjoy an evening of eating and visiting.



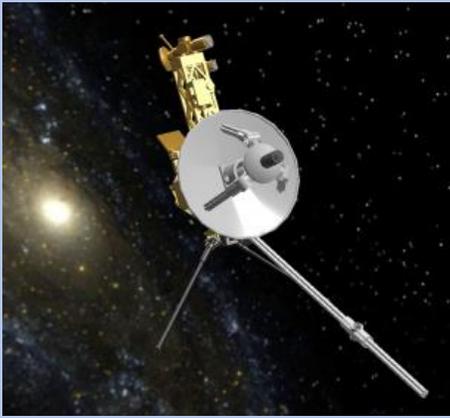
John Newton Cooked Hamburgers and Hot Dogs which we all eagerly devoured. Members brought along potluck sides and tasty desserts.



Many of us sought shelter from the sun in the shade of the observatory, While renewing old friendships and making new ones.



The Club's Swap meet had a nice selection but few takers



## Summer Theme of Celebrating Man-Space Programs – The Voyager Mission - by John Newton

The Voyager mission was originally set on providing a detailed perspective of this solar system's two largest gas-giants and their largest surrounding natural satellites and properties of Jupiter and Saturn. The Voyager program consisted of twin spacecrafts both launched by NASA. Voyager 2 launched first on August 20th, 1977, and Voyager 1 on a faster yet shorter trajectory soon after on September 5th, 1977. Voyager 1 reached Jupiter on March 5, 1979, and Saturn on November 12, 1980, followed by Voyager 2 to Jupiter on July 9, 1979,

and Saturn on August 25, 1981.

For the two-planet mission the spacecrafts were intended to last maybe five years. But as the mission went on achieving all its objectives, the scientist and engineers at the Jet Propulsion Laboratory in California realized they had a unique planetary alignment which occurs every 175 years providing them with the opportunity of extending the mission to Uranus and Neptune. Also, by using the "gravity assist" technique first demonstrated with NASA's Mariner 10 to Venus & Mercury mission in 1973-74, the flight time to Neptune was reduced from 30 years to 12.

However, as Voyager 1 approached Saturn its trajectory was designed to send it on a close flyby of its largest moon, Titan, an on behind Saturn's rings. This trajectory bent the spacecraft's path up out of the ecliptic plane out of the solar system to an angle of 35 degrees and as it continued outward bound at a rate of 320 million miles a year.

The success of Voyager 1 at Titan opened the way for Voyager 2 explore beyond Saturn to Uranus in Jan 86 and Neptune in Aug 89. To explore Neptune's large moon Triton it had to make a steep dive of 48 degrees below the ecliptic plane and to continue outward at 290 million miles per year. The two Voyagers gave us our first closeup views of the four giant gas planets. Discovering 48 moons, tantalizing images of volcanoes and geysers on some of them. And showing that all four outer planets have unique ring systems of rings and magnetic fields those planets possess.

Each spacecraft was equipped with 10 equally matching instruments onboard to continually measure ultraviolet sources among the stars, and the fields and particles instruments aboard the Voyagers will continue to search for the boundary between the Sun's influence and interstellar space. As it does today and since its launch exactly 42 years ago, the Voyagers are expected to return valuable data for two or three more decades with its remaining operating instruments. Communications will be maintained until the Voyagers' nuclear power sources can no longer supply enough electrical energy to power critical subsystems.

This article alone only highlights the milestones of the mission but does not do it justice. There is simply just too much information that was learned as the mission continues to explore the outer boundaries of the sun's heliosphere today. I strongly recommend looking at their current status, or if you want to read more about the Voyager spacecrafts, visit

<https://voyager.jpl.nasa.gov/mission/status/>. From this link, you can also experience the mission through an Interactive 3D app on the website by clicking "[VIEW VOYAGER](#)" about midway down the page. Enjoy

## *Chasing Asteroid Shadows in the Desert.*

By Skip Whitehurst

**Why we drove 3,000 miles and spent a night in the desert for half a second of slightly darker darkness.**

In the early morning of July 29<sup>th</sup>, 2019, the asteroid 3200 Phaethon passed between Earth and a 7<sup>th</sup>-magnitude star in Auriga, momentarily occulting (blocking light from) that star along a narrow band crossing the US from southwestern Missouri to the Central Coast of California and on out into the Pacific Ocean.

Phaethon is a small object, but interesting because it has characteristics of both an asteroid and a comet, which is rare. It is also the parent body of the Geminid meteor shower that occurs each year in December. Because of its unusual nature, it is the primary target for the JAXA (Japanese space agency) DESTINY+ mission scheduled to launch in 2022 and intercept and take samples and measurements from Phaethon in 2025. Also because of its unusual nature, its albedo ( the reflectivity of its surface ) is not well established, so its size was only approximately known, estimated to be in the 4.5 to 6.5-km diameter range. Because its orbit is affected by non-gravitational forces like outgassing, its orbit is not as accurately known as would be liked.

A well-designed occultation timing campaign is where a “picket line” of stations are set up across the predicted path at different distances from the center line to record the exact time and duration of the occultation. This defines chords through the shadow caused by the occulting body blocking starlight, and can constrain its possible size, and, if there are enough stations spread across the width of its shadow, provide a 2-D projection of its shape. With information about the size and location of the shadow at a given moment along with precise celestial coordinates of the star, the location of the asteroid can be determined, which can be compared to predictions and used to refine its orbit, which improves future predictions.

For an object as small as Phaethon, it's necessary for the stations to be closely spaced across the predicted path so it can't slip between any two stations and escape detection, and closely spaced chords are necessary to best determine its size and shape. Unfortunately, since its orbit was not well determined, the prediction of the occultation path had a lot of uncertainty. This meant that the picket line had to stretch a long enough distance on both sides of the predicted center line to ensure that it doesn't pass north or south of the ends of the line. The combination of close spacing and long extent means there must be a lot of stations, which means a lot of equipment and manpower. For this effort, a total of 66 stations spaced 680 meters apart across the path were proposed.

Fortunately, the equipment and skills needed to collect useful occultation data are reasonably accessible, and this is a branch of the hobby where amateurs can and do make a significant contribution to science, so a fair number of people are actively involved. A call went out for observers with suitable equipment and expertise who were willing to travel to the southwestern US, and volunteers from the region willing to learn, and others willing to loan equipment for the volunteers to use.

From Tulsa, ACT member John Moore has an ever-growing collection of cameras, timing equipment, small computers for recording, batteries, small telescopes, and mounts for just this purpose, some of which can be set up and left unattended to automatically record the event. He proposed to drive to southern Nevada and set up as many as 10 stations. Since I had been dabbling in occultation timing for a couple of years and am retired, I volunteered to join in, share the driving, help with logistics and wrangling the gear, and operate some of it.

### **Road. Trip !!**

John was assigned 9 locations by the organizers, so he packed his van with 10 sets of telescope, mount, and storage tub with the rest of each station's equipment, and we left Tulsa at the crack of 9:45 AM Thursday morning, July 25, arriving at the Moapa Valley, on the north shore of Lake Mead the following afternoon. This gave us Friday and Saturday nights to practice preparing our unmanned stations so we could spend a minimum of time setting each one up on game night, and Saturday and Sunday to locate our assigned spots, find a suitable place to set up the equipment at each, and leave a reflective marker near the road so we could easily return to each when setting up and again when taking down.



Stations on or near US Highway 93 north of Las Vegas (at bottom). Green line is the predicted center line of the shadow, blue are north and south edges, and red lines are the 1-sigma (68% probability) line.

Green dots are positives. Red dots are misses.

### Pre-pointing

The technique that makes it practical to set up unmanned stations without exotic equipment is to point the telescope at the place in the sky where the occultation will occur at a time in the future, set up a recording system so that it starts and stops recording at the predetermined times, and then just leave it. The occultation community has produced software tools that allow you to do all that with relative ease, including a way to identify the star field now at the location in the sky where the event will take place sometime later – that location is always at the same declination as the occulted star, but the difference in sidereal time between now and the event time away in RA. With that information, star-hop until you find the star field that's now in the position where you want to point, lock everything down, set up the recorder, and move on.

### Deployment

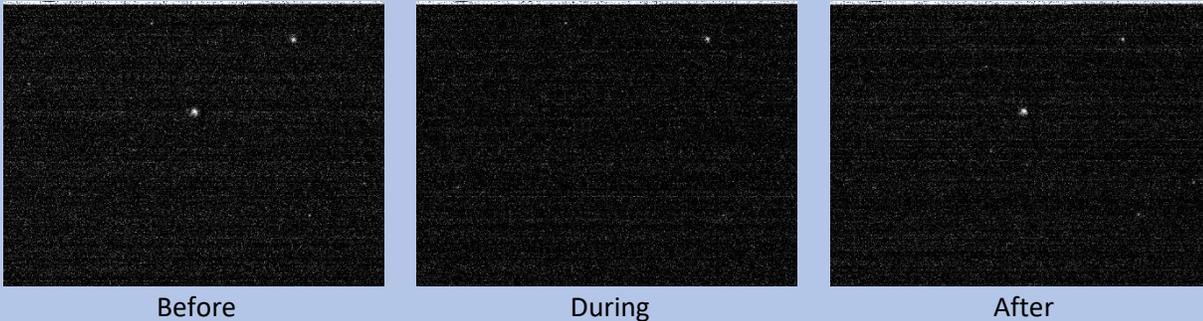
The event time of 4:20 AM Monday morning provided more than 7 hours of darkness to drive to, unload, set up, and pre-point our 9 stations. This sounds like a lot of time, but once we got going, each one took about 30 to 40 minutes to prepare and get to the next.

Before leaving Tulsa, John had organized the electronics that would be used for each of the stations in individual plastic bins, charged batteries, and configured all the computers to automatically start and stop recording video at the desired time. Then the bins, telescopes, and mounts and tripods were stowed in his van so they could be unloaded fairly quickly. Because the clocks in the small computers used for the unattended stations are not reliable after being unpowered for a while, we found a convenient place to stop in the vicinity of our first station as it was beginning to get dark on Sunday evening to start all of the computers, synch their clocks to GPS, and let them run on their battery. This way each would have valid time to control the recording start and stop. Once that final prep was complete, when we arrived at the first station it was dark enough to star-hop the telescope to the pre-point position. After connecting cables, verifying that the stick computer was getting time-stamped video signal, and tidying up, then we moved on to the next flagged position up the road. Rinse and repeat 6 more times. By the time we had deployed the last of the unattended stations, it was about three hours to show time. The last two station required a human operator to control the recording, so for those we each used a laptop computer to do the recording. The station I was operating was ready with about 2 hours to go, and John left to set up the last station a couple of miles away, which he finished doing with about an hour to spare. Perfect!

### Show time!

Once deployed and running, the only thing to do was watch the stars drift through the pre-pointed field of view, verify that those were the expected stars for that particular time, nosh on some snacks, watch some clouds slowly drifting in from the south, and hope they didn't arrive before event time. Despite daytime temperatures well above 110° F, it got cool enough as I was wiling away those two hours that I was glad I had brought a long-sleeve shirt and had it with me.

Time seemed to speed up as the moment approached, and it was a relief when the target star drifted into the field of view exactly when expected. After starting the recording two minutes before the predicted event time, I watched for the star to wink out for a moment, but it did not; it looked like I had a “miss”. After ending the recording a couple of minutes after the event, John sent a text message that he had a “positive”; the star was occulted for about **0.3 seconds !!**



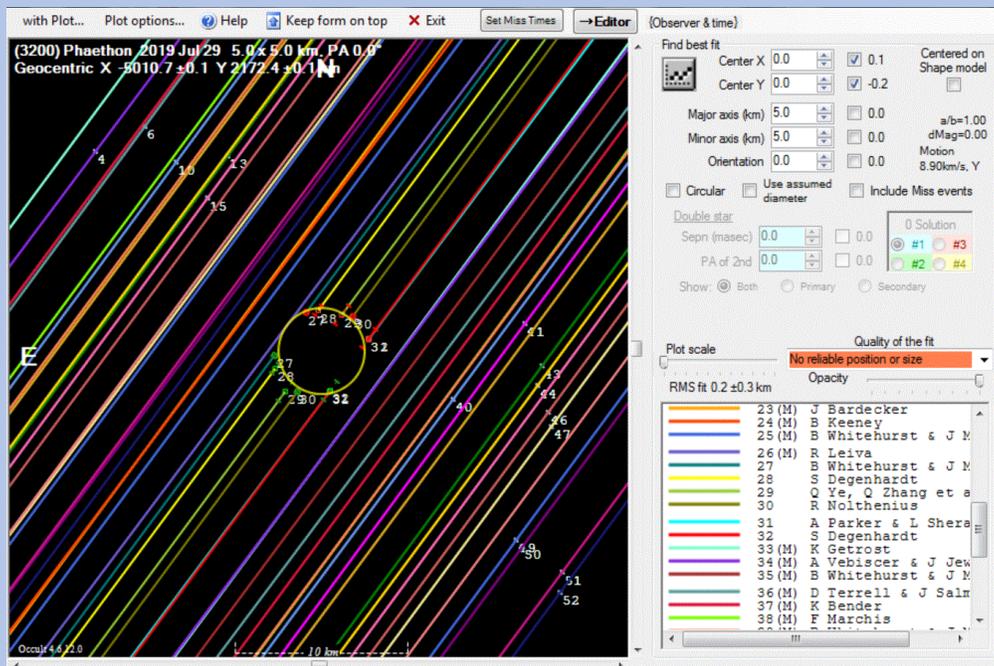
Even the misses are important, especially those closest to a positive, because that chord can provide an upper bound for the size of the body in that direction since you know where it isn't.

### Aftermath

After the recording was finished, both John and I disassembled and re-packed our equipment, then he picked me up, and we started up the line taking each station down. Without the reflective markers, it would have been difficult to locate those unattended stations. We stowed the equipment from each except for the computers, so the data could be harvested from them for analysis.

All nine of our stations collected data, which is pretty remarkable considering the number of things that could go wrong at each one. Later analysis of the recorded data showed that all were misses except the one that John operated. Given the small size of the body and the spacing between our stations, this was not unexpected, we just didn't know in advance which one (or maybe two) would actually be in the shadow track.

As of the latest reports, a total of 70 stations scattered from Colorado to California participated in the campaign, although not all of them collected data for various reasons. 6 positives were recorded, and it appears the path was about 1 or 2 km south of the last prediction, and the event was about one second off the predicted time.



“Sky View” showing all 52 chords (path of star behind the object) analyzed to date.



**16<sup>th</sup> Annual High Frontier Rocket Launches will be on Saturday, September 28 and Sunday, September 29, at the Pawhuska Airport.** The Tulsa Rocketry Club will be doing the rocket launch during the daytime, and our club members will be doing a star party that evening. They have a 20,000 Foot launch clearance from the FAA. There are activities for kids to build and launch rockets. We usually get there at 9:00 AM each day to watch the launch and do solar observing, then we eat dinner at Bad Brad's BBQ, then come back to the airport for the star party. The event ends on Sunday, September 30 in the afternoon, More at <http://tulsarocketry.org/high-frontier/>

### **Tulsa Rocketry's High Frontier Rocket Launch and Star Party - Sept 28-29 by Tony White**

On the weekend of September 28-29 2019 Tulsa Rocketry will host its 16<sup>th</sup> annual High Frontier rocket launch at Pawhuska Municipal Airport just west of Pawhuska of US Hwy 60. The Astronomy Club of Tulsa has been involved with this event since its inception, thanks to the efforts of Vince Moore and Tony White, who were members of both organizations at the time of its founding. The event is also sponsored by the Pawhuska Chamber of Commerce, and draws rocketeers from all over Oklahoma, Kansas, Missouri, Arkansas and Texas.

The idea for hosting the star party as part of the rocket launch was Vince's idea, since at the time Vince was a Scout leader who took his crew to a similar event in Kansas. The Scout Venture Crew that Vince led was focused on STEM-related activities, which of course rocketry is heavily STEM-focused. While camping with his crew in a field at the Kansas event, Vince realized that it would be a perfect opportunity to have a star party not only for his crew, but also for the other rocketeers camping on the field. When High Frontier was conceived, this was a core idea that Vince wanted to promote and was enthusiastically received by Tulsa Rocketry as well as the Pawhuska Chamber of Commerce who helped promote the event.

The rocket launch itself is open from 9 am to 5 pm on both Saturday and Sunday, weather permitting. Kids under 18 can fly free with a parent in attendance. Adults must be members of either Tripoli Rocketry Association or the National Rocketry Association for liability and insurance reasons, but no such restrictions exist on kids. We have seen lots of kids over the years come year after year and fly their rockets. Door prizes are given out to the kids throughout both days, so they actually have an opportunity to win a rocket to build that year or in the future.

Traditionally, ACT has hosted a public outreach star party on the Saturday evening on the field at the Pawhuska Airport. In recent years, members of the Bartlesville Astronomical Society have joined ACT members to help put on the star party. ACT members have also been on hand one or both days with solar equipment as well to allow people to safely view the Sun.

**This year's launch dates conflict with Okie-Tex Star Party, so many of the volunteers that usually go to Pawhuska for the event will be at OTSP, so we are asking for volunteers who will not be attending OTSP to help with the star party Saturday night.** Of course, you are not limited to just going up for the star party – there will be a number of exciting high-power rockets launched throughout the weekend. If you decide to go, it is strongly recommended that you take some sort of portable awning as there is absolutely no shade anywhere on the field. Tent and RV camping is allowed on the field as well for those who might be interested.

You can find out more details about the event at <http://tulsarocketry.org/high-frontier/> . You can also contact Owen or Tamara Green or Tony White (at [tony.white@cox.net](mailto:tony.white@cox.net) ).



This article is distributed by NASA Night Sky Network

August 2019

The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit [nightsky.jpl.nasa.org](https://nightsky.jpl.nasa.org) to find local clubs, events, and more!

## . Spot the Stars of the Summer Triangle

David Prosper

September skies are a showcase for the **Summer Triangle**, its three stars gleaming directly overhead after sunset. The **equinox** ushers in the official change of seasons on September 23. **Jupiter** and **Saturn** maintain their vigil over the southern horizon, but set earlier each evening, while the terrestrial planets Venus, Mercury & Mars remain hidden.

The bright three points of the **Summer Triangle** are among the first stars you can see after sunset: Deneb, Vega, and Altair. The Summer Triangle is called an **asterism**, as it's not an official constellation, but still a striking group of stars. However, the Triangle is the key to spotting multiple constellations! Its three stars are themselves the brightest in their respective constellations: Deneb, in Cygnus the Swan; Vega, in Lyra the Harp; and Altair, in Aquila the Eagle. That alone would be impressive, but the Summer Triangle also contains two small constellations inside its lines, Vulpecula the Fox and Sagitta the Arrow. There is even another small constellation just outside its borders: diminutive Delphinus the Dolphin. The Summer Triangle is huge!

The **equinox** occurs on September 23, officially ushering in autumn for folks in the Northern Hemisphere and bringing with it, longer nights and shorter days, a change many stargazers appreciate. Right before sunrise on the 23<sup>rd</sup>, look for Deneb - the Summer Triangle's last visible point - flickering right above the western horizon, almost as if saying goodbye to summer.

The Summer Triangle region is home to many important astronomical discoveries. Cygnus X-1, the first confirmed black hole, was initially detected here by x-ray equipment on board a sounding rocket launched in 1964. NASA's Kepler Mission, which revolutionized our understanding of exoplanets, discovered thousands of planet candidates within its initial field of view in Cygnus. The Dumbbell Nebula (M27), the first planetary nebula discovered, was spotted by Charles Messier in the diminutive constellation Vulpecula way back in 1764!

Planet watchers can easily find **Jupiter** and **Saturn** shining in the south after sunset, with Jupiter to the right and brighter than Saturn. At the beginning of September, Jupiter sets shortly after midnight, with Saturn following a couple of hours later, around 2:00am. By month's end the gas giant duo is setting noticeably earlier: Jupiter sets right before 10:30pm, with Saturn following just after midnight. Thankfully for planet watchers, earlier fall sunsets help these giant worlds remain in view for a bit longer. The terrestrial planets, Mars, Venus, and Mercury remain hidden in the Sun's glare for the entire month.

Discover the latest in space science from the NASA missions studying our universe at [nasa.gov](https://nasa.gov)

For a more extended article on the Summer Triangle see our [August 2018 newsletter](#) page 7



# TREASURER'S and MEMBERSHIP Report

BY JOHN NEWTON



As of Aug. 23rd, the Astronomy Club of Tulsa has **159 members**. We welcome our new members starting this month who include **Michael & Jo Ellen Hann, Gary Allcorn, Chris & Elodie Birdwell, David Lyons, Adina Redman, Todd Smith, Jack Reeder and Jonathan Fussell**. Hello and welcome to ACT! We look forward in seeing you at our meetings.

**Accounts as of Aug 23, 2019 -   Checking: \$ 6,158.89       Savings: \$ 5,781.87**  
**Investments: \$ 23,890.21**

**The club now has PayPal available for you** to start or renew memberships and subscriptions using your credit or debit cards. Fill out the registration form at <http://astrotulsa.com/page.aspx?pageid=16> **Click Submit** and you will be given the choice of either **mailing in your dues** with a check **or using PayPal** which accepts most major credit cards. A modest processing fee is added to PayPal transactions.

You may also renew your membership or join at one of our club events using your credit card by seeing one of our officers. We can take payments with the Square card reader. A small fee is also added on to these transactions.

**ALSO NOTE:** For our current members who are renewing their memberships, you can now go to a new link on the website to start your renewal process. On the home page, hover over the "Member" tab on the ribbon menu near the top of the page. Then select the "Membership Renewal" link and this will take to a page to fill out your information. Fill this out, submit it, then pay your dues by whatever method you choose.

**NEWS NOTE:** Both Sky & Telescope and Astronomy have free Digital subscriptions available with print subscriptions, or Digital subscriptions may be purchased separately. Details - Contact their websites

Membership rates for **2018** 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.**

<http://www.astrotulsa.com/page.aspx?pageid=16>

**Magazine Subscriptions:** If your magazines are coming up for renewal, try to save the mailing label or renewal form you get in the mail. Forms are available on the club website.

**Astronomy is \$ 34 for 1 year, or \$ 60 for 2 years.** [www.astronomy.com](http://www.astronomy.com)

To get the club discount you must go through the club group rate.

**Sky & Telescope is \$ 33 per year** [www.skyandtelescope.com](http://www.skyandtelescope.com)

Sky & Telescope also offers a 10% discount on their products.

You may renew Sky & Telescope subscriptions directly by calling their number **-be sure to ask for the club rate.**

Dates and Times for Events are found at [www.AstroTulsa.com](http://www.AstroTulsa.com) under EVENTS tab

Be sure to check the Website for Weather Cancellations before coming.

You are invited to come join us to learn more about Astronomy and view the wonderful sights in the night sky.

Check our Events Page of Dates [Link to Events Page](#)



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 3<sup>rd</sup> floor.**

[Click for Google Map Link](#)



### Sidewalk Astronomy Night

East side of Bass Pro in Broken Arrow near the lake.  
101 Bass Pro Drive, Broken Arrow, OK

[Click Map Link here](#)

On a Saturday evening near the 1<sup>st</sup> Quarter moon Astronomy Club volunteers set up telescopes to share views of the moon, planets and other bright objects. It's a come and go event where shoppers and restaurant goers get a chance to experience glimpses of the universe with their own eyes.



### 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.

### PUBLIC OBSERVING NIGHT on a Saturday

This event is open to individuals and families.  
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. [Link to Events Page](#)

[Click for Observatory Map](#)

CAUTION: **DO NOT use GPS** it will likely send you on some nearly impassible back roads.

## ASTRONOMY CLUB OFFICERS:

PRESIDENT – TAMARA GREEN  
[astrotulsa.pres@gmail.com](mailto:astrotulsa.pres@gmail.com)  
VICE PRESIDENT – JERRY CASSITY  
[astrotulsa.vp@gmail.com](mailto:astrotulsa.vp@gmail.com)  
SECRETARY – OPEN POSITION  
[astrotulsa.secy@gmail.com](mailto:astrotulsa.secy@gmail.com)  
TREASURER – JOHN NEWTON  
[astrotulsa.tres@gmail.com](mailto:astrotulsa.tres@gmail.com)

## BOARD MEMBERS-AT-LARGE:

RICHARD BRADY  
JOHN LAND  
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## MEMBER ARTICLES WANTED

### PLANNING A FUN ASTRONOMICAL ADVENTURE?

Got a new piece of equipment your dying to brag about?

Going on a vacation to an astronomical destination or done stargazing along the way.

Want to share your latest astrophotography success

Contact our Newsletter Editor about details at  
[Tulsaastrobiz@gmail.com](mailto:Tulsaastrobiz@gmail.com)

Submissions preferred in MS Word and submitted by the 20<sup>th</sup> of each month.

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