



# OBSERVER

AUGUST 2021

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



**These two nebula M 20 top and M 8 bottom are popular observing targets in Sagittarius  
This stunning two frame photo was taken by Michael Blaylock with an SBIG ST-8300C  
camera and process with PixInsight 1.8 software**

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## ***Astronomy Club Events***

Check our website [AstroTulsa.com](http://AstroTulsa.com) events section for updates

Observatory ONLY OPEN for SCHEDULED EVENTS. [Click for Observatory Map](#)

**We are continuing our Members ONLY Events observing nights**

**Friday, August 6, 8:00 PM      Friday, Aug 27, 7:30 PM**

**Friday, Sept 3, 7:15 PM      Friday, Sept 24, 6:45 PM**

**Weather Backup observing nights on Saturday**

**NOTE:** If weather conditions are unfavorable or hazardous forecasts predictions our events may be postponed or cancelled. Please check our website before heading out.

**September General Meeting Date still to be announced**

**The previously announced club picnic will be rescheduled for a later date**

### ***Guidelines for Members' ONLY Observatory Nights.***

**Our goal is to ensure enjoyment of our hobby while keeping each other safe and well**

**We are still limiting attendance to our membership however you may bring family or a couple of guests with you. - No large groups please.**

**Due to the CDC recommendations related to the recent spike in Covid infections it is advisable to wear a mask when not you're your own group. However, when you are **INSIDE the classroom or viewing in our dome telescope**, we request to respect others health by wearing a mask. This mask guideline does not apply to younger children. We will leave that to their parent's discretion.**

**If you decide to join other members at their telescope, we would still advise that you ask their permission. Our Rest Room and Classroom areas are Open.**

**Please exercise proper hand washing and other common health hygiene practices.**

**Dress for weather conditions. This is a rural setting so closed toed shoes are recommended.**

**Temperatures in on our hilltop observing grounds are cooler than city forecasts. Please do not spray insect repellents around our telescopes. Do that at your car.**

**Be sure to review the map directions carefully. When arriving or departing be aware of people or telescopes on the field.**

You may watch YouTube recordings of our Spring 2021 club meetings online. Links to all Five programs may be found in our June 2021 newsletter on page 5 [https://www.astrotulsa.com/CMS\\_Files/2021-06.pdf](https://www.astrotulsa.com/CMS_Files/2021-06.pdf)

- January - Search for Meteorites in Antarctica
- February - Understanding & Observing Stellar Spectra
- March - Amateur Astronomer Searching for Exoplanets
- April - James Webb Infrared Space Telescope
- May - Preparing for Artemis: Understanding the Moon's most important resource



## ALCON 2021 Thurs Aug 19 thru Sat Aug 21 Register Free at <https://www.alconvirtual.org/>

The National Astronomical League will be conducting its 2021 Conference in a Virtual format this year using the League's YouTube channel. This will give you a great opportunity to hear top notch speakers and presentations from the comfort of your home. Registered participants will be eligible for some great **DOOR PRIZES** donated by astronomy clubs throughout the country. **You can participate on either Zoom or Streaming YouTube.** See the impressive line up and speakers and door prize drawings <https://www.alconvirtual.org/schedule>

These are only a few of the Stellar group of guest speakers lined up for your enjoyment. :

**David Levy** - famed comet hunter .**Jocelyn Bell Burnell** - discovered pulsars

**David Eicher** is an American editor, **Conal Richards** an up and coming astronomy youth.

**J. Richard Gott** is professor emeritus of Astrophysics at Princeton,.

**Dr. Caitlin Ahrens** - Dr. Ahrens gave an inspiring talk at or 2018 Midstate's convention telling of her work with data from the New Horizon's spacecraft and laboratory studies of ices on Pluto. She is now turning her interest toward ices on the moon.



Mark your calendars <http://www.okie-tex.com/>  
Friday Oct 1<sup>st</sup> to Saturday Oct 9<sup>th</sup>  
Registration Now OPEN - Sign Up Early

The 38<sup>th</sup> Annual Okie-Tex Star Party is held each year at the far western tip of the Oklahoma panhandle. Astronomy enthusiasts are drawn from all over the nation to revel in some of the darkest sky on the planet. Rated at Bortle 1 - the Milky Way looks like a river of starlight and the Zodiacal light is easily seen. Check out the details on their website.

# PRESIDENT'S MESSAGE

BY TAMARA GREEN



*Hey Y'all !*

Have you ever wondered why the period between July 3 and August 11 is called the “**Dog Days**” of Summer ? The weather has nothing to do with dogs, except it is a very good idea to keep them indoors during this period and give them plenty of fresh, cool water to drink. After all, if you're hot, they're hot too!

You could say that the oppressive heat at this time is not fit for a dog. But is also has to do with.....Astronomy!



<<Image from go-astronomy.com, found on Google



The term ***Dies Caniculares***, or Dog Days, comes from the ancient Romans. Since during Summer, the constellation Canis Major occupies the same area of the sky as the Sun, They observed that the star Sirius, the brightest star visible from anywhere on Earth (other than our own Sun), rises with it. Because the star is so bright, they believed that it contributed extra heat during this part of the Summer. Of course, Sirius is actually too far away, 8.611 light years in fact, to contribute anything into our atmosphere. It's pretty to look at, but too far away to affect the daytime temperatures!

According to the Farmer's Almanac, <https://www.farmersalmanac.com/why-are-they-called-dog-days-of-summer-21705>, Sirius rises with the Sun. On July 23, it is in conjunction with the Sun, meaning that it is right in line with it. The term came to mean the 20 days before the conjunction, the conjunction itself, and the 20 days following the conjunction, being July 3 to August 11.

The heat is due to the tilt of the Earth on its axis, and its position in its orbit around the Sun. At the Summer Solstice, which this year was on June 20, the Northern Hemisphere is tilted directly into the Sun. So that means we get a direct hit of heat and light. The Sun takes on a northern declination above the celestial equator which also means it is above the horizon for a longer period of time than it is below it. Daytime heat continues to build up. We continue to get this bombardment of heat and light throughout the Summer until the Autumnal Equinox, which is around September 22. That's why it does not get appreciably cooler until along about mid-September, as Earth is approaching the equinox.

Thankfully, the temperatures here in Oklahoma cool down in the evenings to a pleasant 70-odd degree range, making observing really nice. Especially with the nice deep-sky objects to observe, such as the Dumbbell Nebula in Vulpecula, the Ring Nebula in Lyra, M13 in Hercules, the Blinking Planetary Nebula in Cygnus, and the magnificent Milky Way! I look forward to seeing these Summer favorites with y'all!

*Clear Skies, Tamara Green - President*



Click on these images to links on the Internet



See our [website observing page](#) for a collection of [Interactive Sky Watching Tools](#) Moon phases - Sun rise & Set - [Make your own custom interactive sky chart](#) and more

**August Skies.** - as darkness sets in the Summer Triangle reigns high overhead with the broad Milky Way extending all the way to the southern horizon in Sagittarius / Scorpius region. Many deep sky treasures lie along this river of stars. Many visible in binoculars and small telescopes. It may not seem like it in the August heat, but the days are getting shorter and the nights longer. August 1 has 13 hrs 57 mins of daylight 40 mins less than the Summer Solstice on June 21. By August 31<sup>st</sup> it drops to 12 hrs 58 mins and sets 36 mins earlier. While you're enjoying the Scorpius region check out [Seven Deep Sky Treasures on M 7](#)

**August Evening Planets -**

**Venus**, now shines brightly as our evening star in the West as dusk arrives. A thin crescent moon is nearby Aug 10. **Mars** at magnitude +1.8 is essentially lost in the twilight zone **Mercury** is slowly emerging from its superior conjunction behind the Sun Aug 1<sup>st</sup>. Its Aug 18 close conjunction with Mars will also be washed out by the evening dusk. Mercury reaches its greatest evening separation from the Sun Sept 13.

**MEET THE OPPOSITION !**

**Saturn** pass directly opposite the Earth from the Sun on Aug 14 rising at sunset. The next month of so should give excellent viewing of this ringed wonder **Jupiter** reaches opposition just 5 days later on Aug 19<sup>th</sup>. Take time for night to night to sketch the changing positions of its four Galilean moons. Its Great Red Spot should be visible about a hour or so center at midnight for our August 6<sup>th</sup> observing night. The almost full moon passes Saturn Aug 20 and Jupiter Aug 21.

**Pluto** was at opposition July 19<sup>th</sup> a mere 4.98 Billion kilometers away. (3.09 Billion miles or 33.3 AU.) so the first couple of weeks of August are a great time to try to catch it in an astrophoto or view it in a 12" or larger scope. Try this link - [How to Photograph Pluto](#)



**The Perseid Meteor shower reaches its peak activity the 2<sup>nd</sup> week of August. This year the peak night is Aug 11/12** However they can be seen a few nights before and after. The moon sets about 10:30 PM and will not interfere with the best viewing times after midnight the morning of the 12<sup>th</sup>. The bits and pieces from Comet Swift-Tuttle slam into the Earth's upper atmosphere at some 130,000 miles (210,000 km) per hour, lighting up the nighttime with fast-moving Perseid meteors. On a good year you can see more than 50 per hour.

To watch for meteors, pick a site with a good view to the NE and overhead. No need for binoculars or telescopes, Just get a nice lawn chair, a note pad to keep count and enjoy the show.

[Perseid Meteor Shower 2021: All You Need To Know](#)



**Telescopes for Sale**

**Nathan** - [nathanwebb314@gmail.com](mailto:nathanwebb314@gmail.com)  
**iOptron 150mm f/12 Mak-Cass** with impressive set of accessories.

**Richard** 918-252-7342 Handmade 8" f 6 Reflecting telescope  
**FREE**

## Solar System Walkway coming to Broken Arrow



The VOYAGE exhibition is a highly accurate 1/10 billionth scale model of the Solar System designed for permanent outdoor installation. (  $1 AU = 15 \text{ meters}$  ) Both the distances between the planets and the scale size of the planets are to the same scale. The 2,000-foot walking path will be located on 61<sup>st</sup> St about a mile east of Bass Pro. It will extend from Creekwood Elementary (1301 E. Albany Street) toward Broken Arrow High School.



Each planet will be displayed on an attractive 8-foot-tall stanchion with a scaled tactile model of the planet and information about the planet. The displays will also feature a QR code that can be scanned on a phone to learn more about each planet.

Families, school kids and casual walkers can stroll along the path, learn about the planets, and get a physical as well as mental image of the vast scale of our solar system. The exhibit will be open to the entire Tulsa regional area to come visit and experience. In addition to the actual physical model, area schoolteachers will have access to many age appropriate STEM lesson plans to teach about the solar system in their classrooms.

The concept of the 1/10 billionth scale solar system was first conceived by astrophysics Dr. Jeff Goldstein in the late 1990's while he was a visiting scientist speaking to Broken Arrow schools. Since then, full scale exhibitions have been installed on the National Mall in DC., Kansas City, Denver and Corpus Christi. Dr. Goldstein has invited Broken Arrow to be part of a new campaign to place Voyage Planet walkways at many more cities throughout the country.

See the [Voyage National website](#)

A committee of retired and present schoolteachers, community leaders and others has come together to raise the approximately \$ 50,000 to purchase, install and maintain the exhibition. They currently are about half-way to that goal. Individuals can make any size donation to the "Friends of the Galaxy" fund. Also, business or individuals can choose to sponsor an entire planet. Once in place it will be an excellent place for our astronomy club to hold a public telescope viewing event.

If you would like to be part of this **FUND RAISING** effort you can find information at:

[www.keepbabeautiful.org](http://www.keepbabeautiful.org) use the DONATE NOW link - then in click the arrow in the box to select Voyage Solar System

### Go Fund Me Site

<https://gofund.me/1af55044> Broken Arrow Voyage Account

Update Google Slides <https://drive.google.com/file/d/15ftRTE0aTzCi0ZMAkyI5IJm30YUs-aDC/view>

Or Contact John Land, our Astronomy Club editor, for Planet Sponsoring Details.





## MAKING GOOD USE OF CLUB'S DOME TELESCOPE

BY Don Bradford and Dana Swift

Never let it be said that the Meade 14 inch RCX400 telescope in the club dome has not been put to good use. On Friday, July 2, at least three interesting projects were done, two by Dana Swift and one by Skip Whitehurst. All with the help and trouble shooting suggestions by Don Bradford, Ken Weikel, Adam Koloff, and John Newton, the help was very useful.

Dana Swift tested his ZWOASI 1600MM Pro monochrome camera and his new ZWOASI 183MC Pro color camera. Accomplishing the setup of the



cameras on the telescope and the computer control presented some challenges, but very nice views of the Ring Nebula were had with both cameras. The color version produced vivid color of the nebula and the clearly visible central star. These dedicated astrophotography cameras demonstrated their use in **EAA** (Electronically Assisted Astronomy), where highly sensitive cameras can be used to enhance the viewing capabilities of a telescope with short, one-shot images (generally less than thirty second exposures), creating almost real time astrophotography. Robbin Jones gave an interesting presentation of EAA at the September 2020 Zoom members meeting, available on YouTube.



This color image of the Ring Nebula is a one shot ASI183MC image (no post processing) taken at a 15 second exposure, bin 1, cooling set at -5C, gain 422, at: 2021-07-03 T03:30:37.9336Z. Captured with SharpCap via the snipping tool (to preserve the image color). Clearly a view of this quality could not be had with this telescope and any eyepiece. It would take a telescope with substantially greater aperture to obtain a comparable view. With a more sensitive camera a comparable image could be produced with even shorter exposure as was done the week before with the ASI 1600MM Pro camera.



Dana and Skip were able to find and photograph 10.5 magnitude **Comet Palomar 2020 T2** by creative calculations of RA and DEC coordinates (correction for precession was required), and use of plate solving on Dana's ZWOASI 1600MM Pro for coordinate feedback. The resulting single shot image of the comet is shown below, taken at 8 seconds exposure, bin4, cooling set at -5C, gain 300, at: 2021-07-03 T04:08:21.1632Z. Captured with SharpCap.



We are pleased to have Dana Swift, shown here with his 8" Celestron scope rejoin our astronomy Club. Dana was a member of the club during the 90's and has recently rejoined. He has been a long-time astronomy enthusiast. As a software designer he has a particular interest in writing software to search out obscure satellites and their orbits. He has been helping with the assembly of the 12-foot Ash Dome project and lately experimenting with using cameras on the club's 14" Meade RCX 400 scope in the dome. In the Top Left photo Dana is shown using his camera set up to show guests views through our dome scope.

**Note-** we are looking for astronomy cameras so we can create an apples-to-apples comparison of their sensitivity performance and image scaling. To make the test as even as possible, the cameras must work with SharpCap version 4. This test will happen at the next members night that has good weather.

## Asteroid Occultation timing using the Dome Scope by Skip Whitehurst

**Editor Note:** One excellent way to determine the size and precise orbit of an asteroid is make an accurate video recording when the asteroid passes in front of a star. The is type of event is called an Occultation. Sensitive video recording cameras acquire a beginning time stamp from GPS accurate to 1/10,000<sup>th</sup> of a second. Then images are taken at the rate of 30 frames per second which translates to 1,800 images per minute. **IOTA** ( International Occultation Timing Association ) announces predicted events and encourages observers to position themselves at many different locations along the predicted path. Once all the data is correlated a more precise orbit of the object can be calculated and also a profile of its size and likely shape. In several fortuitous occultations they have even observed that some asteroids are actually two objects orbiting each other.

**Skip's Occultation Report :** In early July the 12th-magnitude **asteroid 83 Beatrix** occulted two 12th-magnitude stars within a week of each other. The first of these was just after midnight the morning of Saturday, July 3 and the second was a few minutes before midnight the night of Friday July 9 (morning of July 10 UTC). Both of these events coincided with our club's Members' Observing Nights. After others had finished with projects using ACT's 14" Meade telescope, I used it to make video recordings of the events for later analysis. Accurate GPS-based time stamps inserted into each video frame at 30 frames per second as it was being transmitted from camera to the recording system to an accurate record of the timing is produced. Both events occurred within one second of their predicted times, which confirms the accuracy of the orbit prediction.

The **July 3** star and asteroid were both about the same magnitude, resulting in an 0.8-magnitude drop when the asteroid passed in front of the star, blocking its light. For the **July 10** event, the star was about half as bright as the asteroid (almost a magnitude dimmer), resulting in a magnitude drop of only 0.16 (1/6 of a magnitude). Neither of these subtle events was noticeable while watching the video as it was happening but were obvious in the light curves generated by processing, which measures the combined target star and asteroid blob brightness as recorded in the video, frame by frame.

The light curve charts on the next page show the **7.3-second occultation on July 3** with combined asteroid and star brightness (blue dots and blue lines) dropping from about 3430 counts to about 1350 with only the asteroid, somewhat more than half. And the **5.7-second occultation on July 10** dropping from about 4120 to about 3550 counts (the exposures were different, so the counts don't match from recording to recording).

**Vertical red lines** in the plots mark the disappearance in the frame sequence, and **green, reappearance**, as determined statistically by the Occultation Timing Extraction (OTE) program, PyOTE (written in Python, so it has the traditional "Py" prefix) from the light curves extracted from the video analysis program PyMovie. The green dots in the July 10 light curve plot are the brightness of a nearby star that was used as a reference.

Prior to these events, an attempt to use this telescope to record an occultation by a satellite of asteroid Menoetius in May was clouded out (it was nice until 15 minutes before the event... grrr!). This was a long shot since the observatory was well outside the predicted path of the shadow of Menoetius and the orbit of its satellite was not well known; other positive observations and misses suggest that this would have been a miss, anyway. This type of data helps to better determine the satellite's orbit.



The graphs below are oriented so that the time intervals along the X- Axis are similar

**July 3, 2021 Asteroid 83 Beatrix Occultation 7.3 Seconds**



**July 10, 2021  
Asteroid 83  
Beatrix**

**Occultation 5.7  
Seconds**





**This article is distributed by NASA Night Sky Network**

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

## **Corner the Great Square of Pegasus**

**David Prosper**

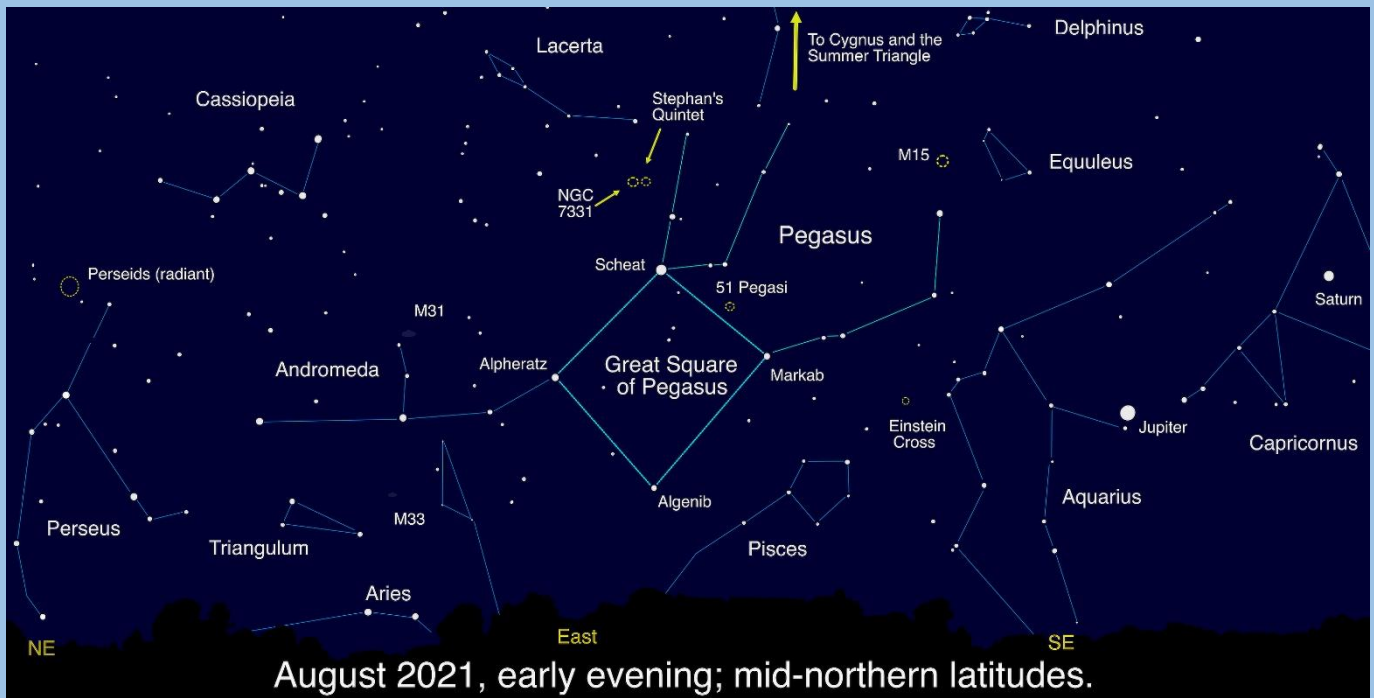
The Summer Triangle may be the most famous seasonal star pattern, but during early August evenings another geometrically-themed asterism rises: the **Great Square of Pegasus**. This asterism's name is a bit misleading: while three of its stars - Scheat, Markab, and Algenib - are indeed found in the constellation of the winged horse Pegasus, its fourth star, Alpheratz, is the brightest star in the constellation Andromeda!

August evenings are an excellent time to look for the Great Square, as it will be rising in the east after sunset. If not obvious at first, wait for this star pattern to rise a bit above the murky air, and remember that depending on your point of view, it may appear more like a diamond than a square. Look for it below the Summer Triangle, or to the southeast of nearby Cassiopeia at this time. As the Great Square rises in prominence during autumn evenings, it becomes a handy guidepost to finding more constellations, including some of the dimmer members of the Zodiac: Aries, Pisces, Aquarius, and Capricornus. Like the Summer Triangle, the Great Square of Pegasus is also huge, but Pegasus itself is even larger; out of the 88 constellations, Pegasus is 7th in size, and feels larger as the stars in its neighboring constellations are much dimmer.

There are many notable deep-sky objects found within the stars of Pegasus - ranging from easily spotted to expert level targets - making it a great constellation to revisit as your observing skills improve. Notable objects include the densely-packed stars of globular cluster M15, a great first target. The potential "Milky Way look-alike" galaxy NGC 7331 is a fun target for more advanced observers, and expert observers can hop nearby to try to tease out the much dimmer interacting galaxies of Stephan's Quintet. A fascinating (but extremely difficult to observe) object is a gravitationally-lensed quasar famously known as the Einstein Cross. Pegasus has quite a storied history in the field of exoplanet research: 51 Pegasi was the first Sun-like star discovered to be host to a planet outside our solar system, now officially named Dimidium.

While observing Pegasus and its surroundings, keep your eyes relaxed and ready to catch some Perseids, too! August 2021 promises an excellent showing of this annual meteor shower. The crescent Moon sets early on the evening of the shower's peak on August 11-12, but you can spot stray Perseids most of the month. If you trace the path of these meteors, you'll find they originate from one point in Perseus - their radiant. Giant planets Jupiter and Saturn will be up all evening as well. Look south - they easily stand out as the brightest objects in the faint constellations Aquarius and Capricornus.

Pegasus truly holds some fantastic astronomical treasures! Continue your exploration of the stars of Pegasus and beyond with NASA at [nasa.gov](https://nasa.gov).



While the stars of the Great Square of Pegasus are not as bright as those of the Summer Triangle, they still stand out compared to their neighbors, and make a great foundation for exploring this area of the night sky. Note that the brightness of the stars near the horizon is exaggerated in this picture.



Stephan's Quintet is one of the most famous deep-sky objects in Pegasus. First discovered in 1877, it contains the first galaxy group discovered (which includes 4 of the 5 galaxies making up the Quintet) – and has been studied extensively ever since. One day this group will merge into one supergalaxy! While famous, these galaxies are hard to spot in all but the largest backyard telescopes – but are a favorite target of astrophotographers. Take a virtual flyby of these galaxies with a tour created from Hubble data at: [bit.ly/quintetflyby](http://bit.ly/quintetflyby)

Credit: NASA, ESA, and G. Bacon, J. DePasquale, F. Summers, and Z. Levay (STScI)

# TREASURER'S and MEMBERSHIP Report

BY JOHN NEWTON



**As of July 22, we had 230 members - 53 New members for 2021**

We welcome this month our newest members - **Elmus Beale, Michael Linihan, Gibson Brasel, Cailin Stauffer, Teresa Moore and Jim Clark** Hello and welcome to ACT!

In addition, we want to recognize our long-term prominent and well-respected members who continue to renew their memberships with the club, even during these restricted times. We look forward to seeing you all at meetings and at club events throughout the year when possible.

## Accounts as of July 22, 2021

Checking: \$ 3,221.64

Savings: \$ 13,786.30

Investments: \$ 30,775.83 (Value tends to fluctuate with markets).

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 <https://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 the 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 2021 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/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. Both magazine now include online access with paid subscription.

**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** <https://skyandtelescope.org/>

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**

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*The Healing Power  
of Nature*

*Everybody needs beauty  
as well as bread,*

*places to play in and  
pray in,*

*where nature may heal  
and give strength  
to body and soul alike.*

*-John Muir,*

*The Yosemite*

**Shared by K C Lobrecht**

**Do you have ideas for our club 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**  
[Tulsaastrobiz@gmail.com](mailto:Tulsaastrobiz@gmail.com)

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