ASTRONOMY CLUB OF TULSA

OBSERVER

DECEMBER 2021

Bringing Stars to the eyes of Tulsa since 1937

Editor – John Land

2021 Astronomy Club Dinner

Our annual club dinner was a great success. Was a great time to renew old acquaintances and welcome new members to our club. There was plenty of good food from Oklahoma Joe's BBQ. We also enjoyed a mixer game based on the Chinese Zodiac animals. A big Thank You goes out to all the volunteers who helped decorate and set up - serve the food and clean up!
Also thank you to Dan Zielinski for the planetarium show.

More in the Photo Gallery at the end of the newsletter.

Contents:

Astronomy Club Events

Check our website AstroTulsa.com events section for updates

Observatory ONLY OPEN for SCHEDULED EVENTS. Click for Observatory Map

During Winter Months Dress in layers with hat and gloves
Our rural site is cooler than in town - there is a classroom to warm up

Saturday Oct 30 6:00 PM DST Members & also Limited RSVP Guests
Saturday Dec 4 4:30 PM CST Members Only night

Telescopes at the Gathering Place Winter Wonderland event

Saturday Dec 18 - As the sun sets the Christmas lights will come on. Our club has been invited to set up some telescopes to see the planets and the moon. Look for us on the lawn near the Boat House area. The Winter Wonderland features a variety of events from Dec 17 thru Dec 26. See **MORE DETAILS**

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

We are pleased to announce our return to IN PERSON club meetings.
Friday Dec 10 - 7:00 PM at the Jenks High School planetarium

OBSERVING NIGHT GUIDELINES

We ask you to please be thoughtful of the health safety of others around you.
1 At observing sessions, please observe social distancing when not with persons of your group. 2 Ask if you may join others at their telescope. 3 Observe spacing in the classroom and respect those who choose to wear a mask for protection. 4 If you or a person in your household is showing signs of illness, please postpone your visit for another date.

When at the Jenks High School, we need to observe their guidelines. The Current Policy states All Jenks Public School staff members, visitors, and students in grades 3-12 will be required to wear face coverings. Any exceptions require the approval of the site principal.
These policies are for the protection of the students who use the buildings as well as yourself.

Astronomy Club Meeting - Friday Dec 10 - 7:00 PM

Jenks High School planetarium 105 E B Jenks OK

Ever dream on having a telescope you could use daytime or nighttime , cloudy or clear skies?

Our guest speaker Michael Hann is going to tell us about building a radio horn telescope designed specially to pick up the 21-cm emission line from the hydrogen atoms in the Milky Way Galaxy. His presentation will provide a brief summary of the history of radio astronomy, discuss the electromagnetic spectrum, and then describe in greater detail the radio telescope he has built.

Karl Jansky, the father of radio astronomy, was born in Norman in 1905 - Territory of Oklahoma where his father was Dean of the College of Engineering at OU. This year 2021, is the 70th anniversary of the first observation of the 21-cm hydrogen line by Harold Ewen at Harvard.

Want to try your hand at building your own radio telescope using an old Dish Network antenna. Try looking at **http://www.aoc.nrao.edu/epo/teachers/ittybitty/procedure.html**

A YouTube recordings of Club meetings is available of our -
September 10 - Lunar Impact Craters with Michael Hann

October 22 - Making Osage Hills State Park a Dark Sky friendly site with John Blaesi

President's Message John Land

Greetings to all our Astronomy Club of Tulsa Members.

Daylight Savings time is finally gone, and we can begin enjoying the stars early in the evening. I hope many of you had a chance to see the Lunar Eclipse Nov 19th Despite the cold I love seeing the bright winter stars and constellations. Orion was probably the first constellation I learned to recognize other than the Dipper.

As we look forward our club's 85th Anniversary in 2022, I would like input from you as members as to how we can celebrate this occasion. I would also like to hear from you about ways in which we can improve our club's activities in the coming year.

As life returns to more normal activity, we are beginning to get requests to set up telescopes for a variety of groups. Volunteers to set up a telescope at these group events. We are looking for more volunteers willing to help on observing nights. You don't have to be an astronomy expert just willing to invest your time and energy.

I hope you all had a great Thanksgiving and Wish You many Blessing this Christmas

John Land - 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

December Skies. - Last month to enjoy evening planet viewing. The Planets Venus, Saturn and Jupiter are nicely lined up in a row for viewing in the SW sky for a few hours after sunset. However they will slip behind the Sun in early January and not return to the evening sky until late summer 2022.

Moon Phases - - New Dec 3 - - 1st Q Dec 10 - - Full Dec 19 - - 3rd Q Dec 26

The moon passes Venus Dec 6, from Saturn and on to Jupiter Dec 7 , 8 & 9

Venus - is our bright "evening star" in the SW. It opens the month as a fat crescent shape 39" wide and by Christmas it hugs the horizon as a thin sliver crescent 57" wide. Its best to observe Venus while the sky is still bright. This is the time of its maximum brilliance. Try to see if you can locate it in the daytime on Dec 6th when it will be about 3 degrees above the moon.
Illustration from **https://www.shadowandsubstance.com/**

Mercury emerges in the evening twilight in late December. Look for it near Venus Dec 28 & 29. Then follow its rise toward Saturn in early January.

Jupiter and Saturn are still in Capricorn but have moved a bit farther east.
Try to observe in the early evening before they sink too low in the atmosphere to see good detail.

Neptune and **Uranus** are past opposition but still well placed for viewing.
Neptune is near the water jar of Aquarius and Uranus is in Aries.
See our November newsletter for tips on observing these ice giants.
Printable Finder Charts **For Uranus** **For Neptune** **For Ceres**

Mars finally emerges in the SE predawn twilight by mid-month. Watch as its skims by its rival star, Antares, in Scorpio Dec 28. The name Antares means Rival of Ares (Mars) for their similar color.
Dawn of Dec 31st finds the thin crescent moon passing between the pair.

Alternate Constellations Observing Program Check In By Brad Young

Hope autumn is treating you well. Some of you expressed interest in completing the Alternate Constellations Program, or know someone who is, and others of you are in my local club, or at least on my contact list. If any of you are having trouble doing the program, please let me know how I can help. I have also expanded the resources list thanks to feedback from observers. Below is the link my website section about the program (including the resources and some other info):
https://hafsnt.com/index.php/alternate-constellations/

Official page is https://www.astroleague.org/content/alternate-constellation-observing-program

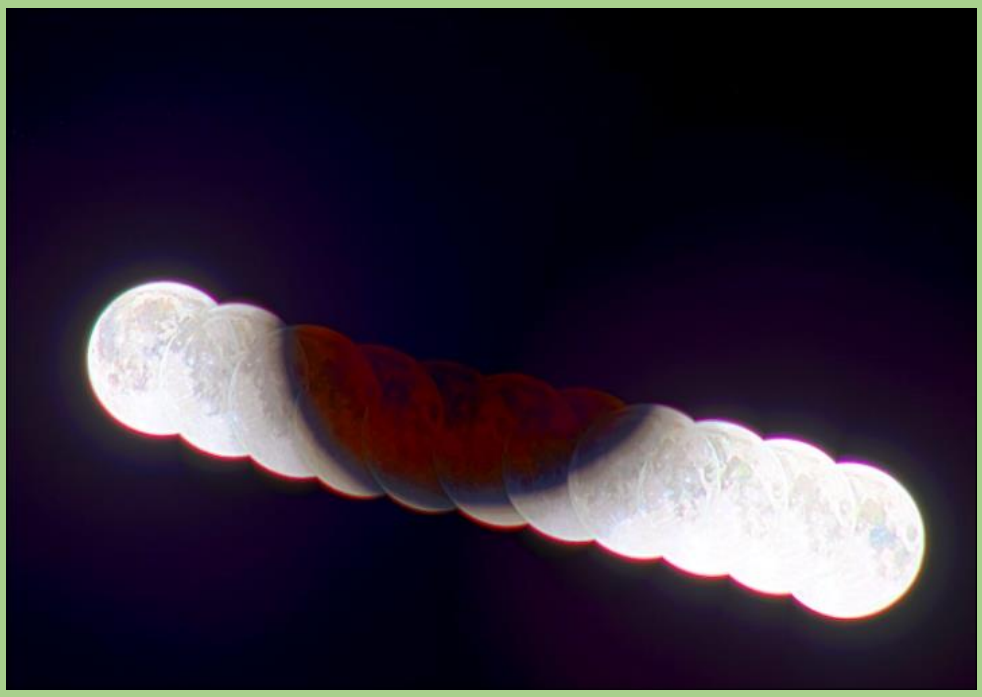
NOV. 19, 2021, 97% PARTIAL LUNAR ECLIPSE

Several of our club members braved the frigid night temperatures to witness the eclipse. According to **SpaceWeather.com** this 3 1/2-hour event was the longest *Partial Eclipse* in 600 years. The moon was near its apogee point in its orbit thus moving more slowly through the Earth's shadow. (Umbra) However the TOTAL LUNAR eclipses of May 15-16 and Nov 8, 2022 will be longer as the moon passes more centrally through the Umba.

The images below taken by Skip Whitehurst vividly show the location of the Earth's shadow in relation to the moon. By observing the moon passing through the Umbra early Greeks like Aristotle and Aristarchus argued that the Earth was a sphere by observing that its shadow was always curved during lunar eclipses.

Skip wrote a computer code to guide his telescope on the location in the sky directly opposite of the sun. The above image is made by composites from a total of 77 images taken through a 500 mm f/8 lens stopped down to f/11, ISO 1000, at a range of shutter speeds.

Below are 11 images spaced 30 minutes apart with the same exposure stacked into a single image (showing overlapping moons), then the 7 stacked images, with a different exposure, were combined into a single high dynamic range image which contains details from each of the individual exposures.



Brain Wattenbarger offers these outstanding images taken with a William Optics Zenithstar 61 paired with a Skywatcher HEQ5 Pro equatorial mount, a ZWO 30mm guide scope with an ASI120mm mini guide camera. The main camera is a ZWO ASI533MC-Pro astrocam For the lunar eclipse I used the Z61 rig with an Optolong UV/IR cut filter shooting single frames and some video. The 97% eclipse photo is a single 10 second exposure processed in GIMP. The full moon shot is prior to the start of eclipse and is made from a 90 second video with about 400 of the frames stacked in Registaxx and finished with GIMP.

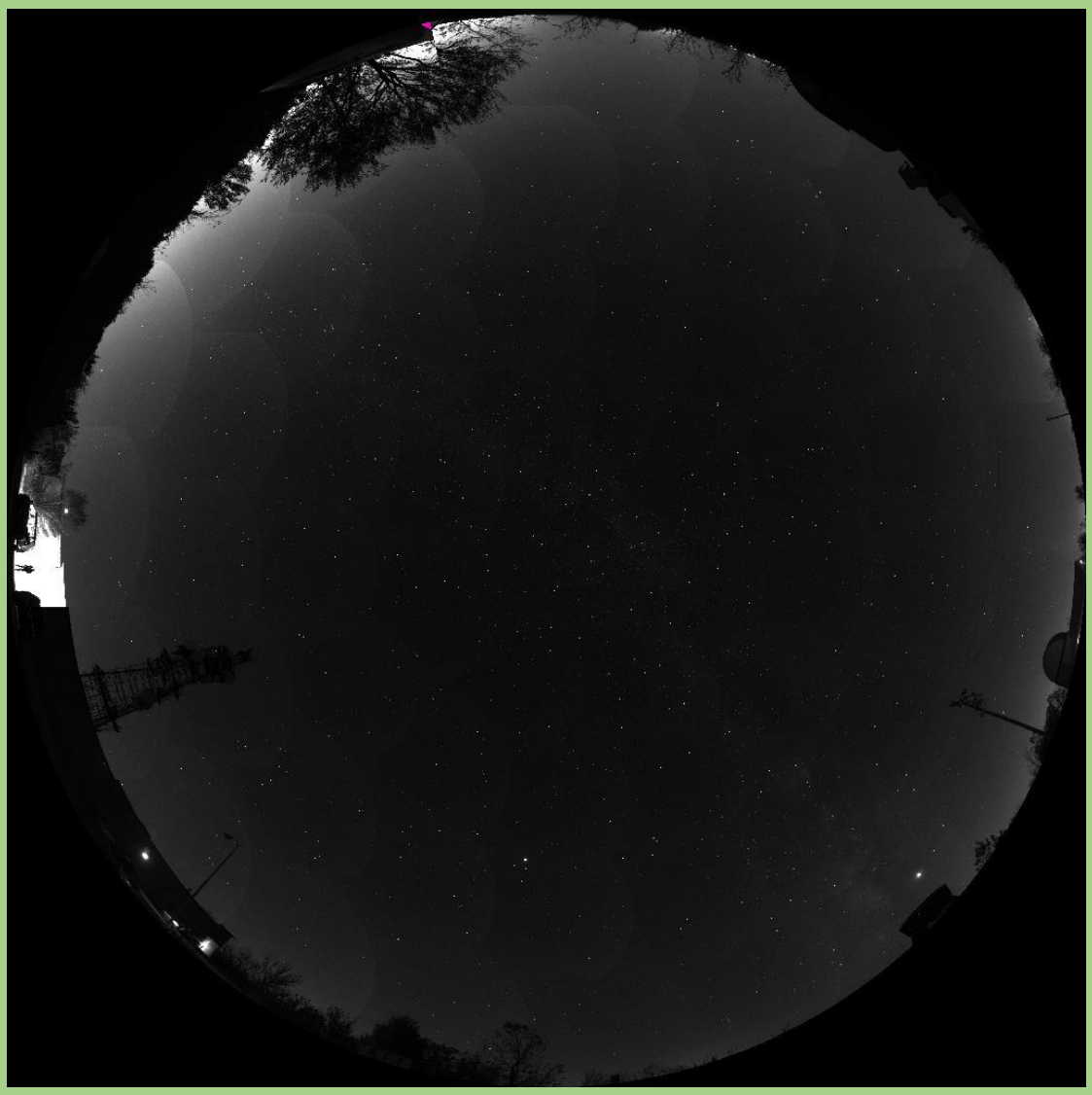
John Land made this wide view image with a iPhone X on an unguided tripod using the app ***NightCap*** which uses AI technology to stack multiple images creating a longer exposure of about 15 seconds. How many constellations or stars can you name in the image?

Measuring light pollution at our Observatory by Dana Swift

Prior to the Okie-Tex star party, Bev and I were in Kansas and I was wondering how dark the skies were? A short search on the web revealed a paper by the National Park Service “Measuring Night-Sky Brightness with a Wide-Field CCD Camera” that explained how to do the measurements and get standardized results. That led to the idea of writing a program to follow the method described in the paper and then use that to compare the light pollution at various sites. The intent was to get the data-acquisition working and be able to try it at the Okie-Tex star party, however the gremlins of fate decided that attending the OTSP was not an option this year. Regretfully we have no data from that facility from this instrument. Other sky quality meters were used indicating a very dark sky tho! ☺ (We’re envious!) In very simple terms, to measure the background light an ASI1600MM cooled astronomy camera was fitted with a F1.8 20mm fixed lens, no filter, and adapted to the ASI camera. The camera and lens were mounted on a Celestron CGX for computer control of the pointing. The CGX mount points the camera to a set of spherically spaced positions, then the camera would take a 1 second exposures at each position. Prior to starting the sampling sequence, a dark frame was taken, then 57 rectangular “tile” images covering the entire sky, followed by another dark frame.

This procedure is described in the NPS paper, for those wishing to replicate the experiment. The NPS used older equipment, so instead of a CCD camera, the ASI-1600 CMOS camera was used, the result images should almost identical. A different field of view resulted from the available lens and camera combination. As an alternative to using flat field images, a software vignetting correction model was used. All wide-angle lenses require vignetting correction.

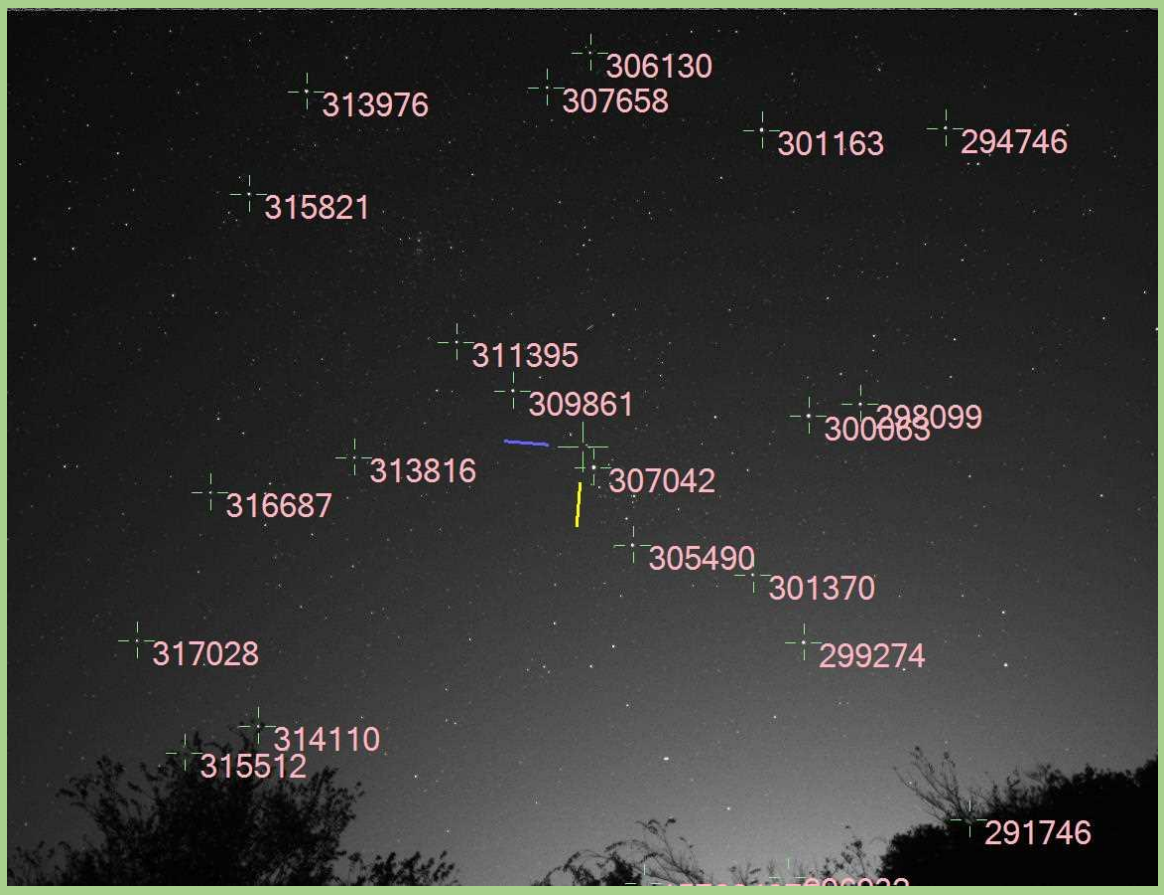
When the 59 images were all saved, a second program combined the images into a 16bit “fisheye” view as well as a “product” view matching the fisheye image geometry. At the Oct 30 public night, the fisheye view constructed from the 57 sky tile images was:



In this image North is up, West is right, East is left, and South is down.

The observatory dome is on the right. At the time the tile on the far left was taken somebody was silhouetted against the AT&T building from car lights. The dark image of the AT&T microwave tower is clearly visible just below center on the left. The light dome from Tulsa is clearly visible at the upper left. The image has some “fish scale” artifacts due to internal reflections of the nearby light domes with the inexpensive lens being used. Bright stars are clearly visible in the composite image.

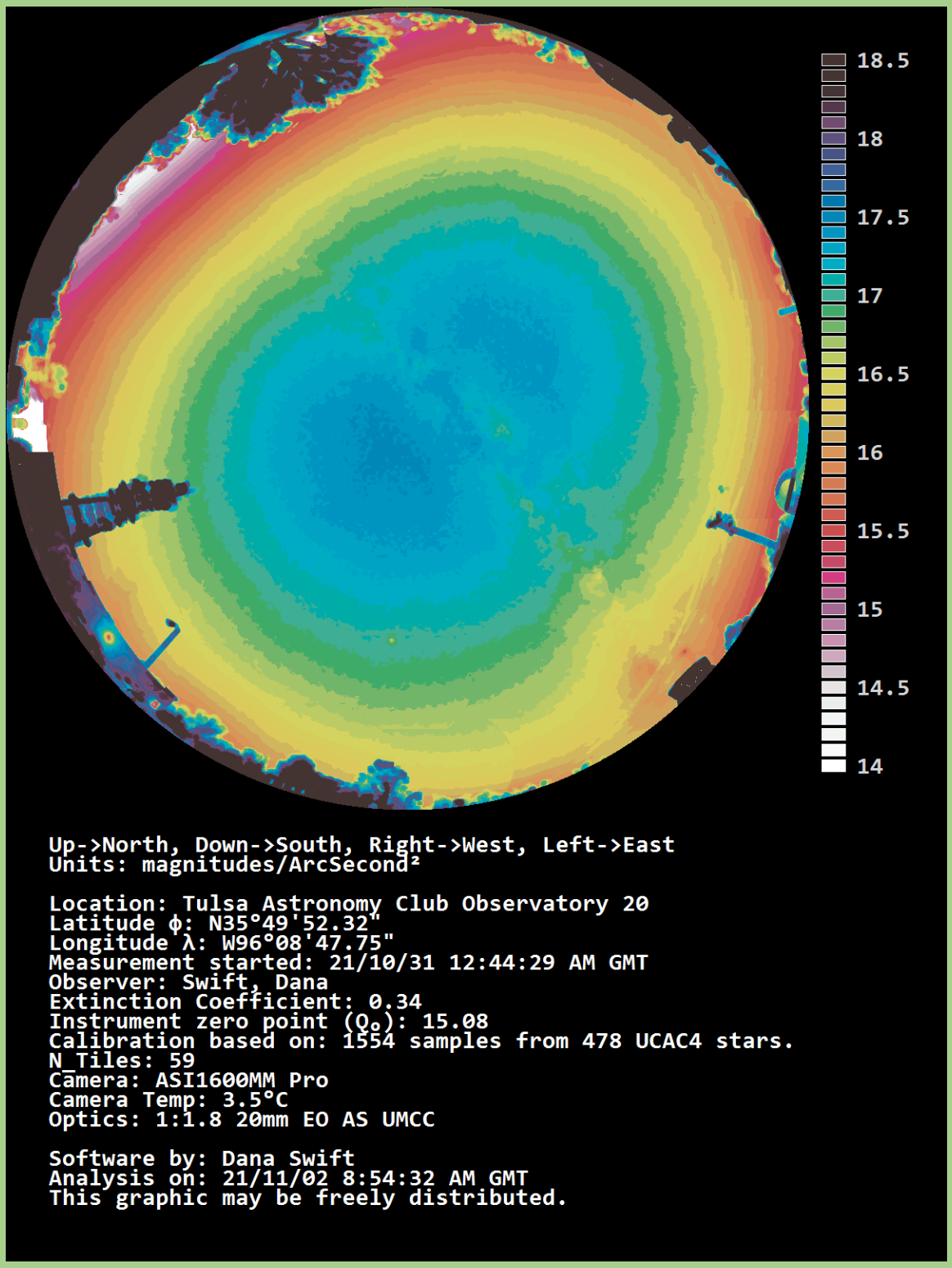
To get a calibrated result, each tile is searched for stars, with up to 64 stars per tile being positively identified and qualified using the criteria outlined in the NPS paper. If a qualifying star is found in a minimum of three tiles, it is included in the calibration computation. Here is one of the 57 tile images showing the star field and 27 of the brightest 64 stars that were identified using the UCAC4 star catalog with their catalog ID number.



In this image the blue line in the middle indicates North, and the yellow line indicates East. The sky glow from Muskogee and others is visible at the lower part of the image.

The calibration equations from the NPS paper compute one other important value: atmospheric extinction. Extinction is how much light is being lost due to haze, dust, humidity, etc. per unit thickness of the atmosphere. The best extinction numbers for ground-based observatories are around 0.16 (low numbers are better) the value measured at the public night was 0.34, indicating how much dust and other optical obstructions were in the air that evening. This allows the effects of the atmosphere to be corrected in images taken session-to-session, or two locations imaging the same object at the same time.

The final data product image, also plotted in a fisheye perspective matching the gray scale image geometry is:



In the product image the Milky Way shows up as a slight increase of “light pollution” from the upper left to the lower right. In the annotations created at the bottom of the image, it shows 478 stars were found in the required minimum of 3 tiles, allowing a total of 1554 measurements of the light from those stars. The final result shows the darkest part of the sky is the area overhead with a “glow” of just under 18 stellar magnitudes per arc-second squared (MPSS). That unit of measurement is probably not familiar, but it is the industry standard units for light pollution. What that means is every tiny square patch of sky one arc second on a side over head is glowing as brightly as a 17.9 magnitude star would appear. (Higher numbers are better.)

That general background glow is fairly constant over the upper half of the sky, with the background getting brighter as the horizon is approached. In simple terms, to view a nebula whose visual magnitude is fainter than the high seventeens, it will be difficult to distinguish from sky! On another night with a higher MPSS and the same observing instrument that nebula should be easier to see.

The process of scanning the sky takes about 12 minutes; the analysis takes another 15-20 minutes producing a finished product around 30 minutes after starting. Several scans can be made in an evening as long as using the CGX isn’t reused to host a telescope. Most often after doing a scan, a telescope would be fitted to the mount and some other experiment would begin using the atmosphere info for data quality and correction.

I hope that made sense! It’s been an interesting project, and I will keep making these measurements when I can to compare the consistency of the sky at our observatory site.

Dana Swift

Vintage (late 1970s) Celestron C 5. **f 5** $ 400

Aperture 125 mm Focal Length 1250 mm

This includes scope and mount (in original footlocker), wedge and tripod. The optics are good and the clock drive still works. Several 0.965” eyepieces, a porro prism and a barlow are included, although the scope could be easily converted to 1 1/4” eyepieces with the addition of the appropriate visual back adapter. You can find an interesting description of the C 5 starting on page 7 of this **July 1978 Celestron Catalog.**

Contact John Grismore **jrgrismore@icloud.com**

Editor Note: These are great rugged grab and go scopes. They are also popular for nature viewing. I used the club’s C 5 for several years at public events. It’s now a guest use scope at the observatory.

LESSONS FROM OKIE-TEX 2021 BY BRAD YOUNG

INTRODUCTION

As I mentioned last month in my article, there were several positive and enjoyable things this year about the Okie-Tex Star Party (OTSP). Of course, the big improvement was that there was one, as the 2020 party had to be canceled. As usual, I had several excellent nights and views of the objects I planned to observe. This year, the focus was the remaining NGC objects I am trying to observe visually. Several of these targets were quite surprising, even though I am through all the Herschel objects now and deep into the dimmest and smallest of the objects. But, with a fantastic inky sky (Bortle 1) adjacent to Black Mesa, clear weather, and a great telescope there are still some surprises out there for me after more than 40 years of observing.

GEGENSCHEIN

One of the first surprises was a little embarrassing. One of my friends was commenting on the gegenschein, which was quite evident on three or four of the nights that week. I sat and admired the view with my friend a while and then went back to the telescope. Soon enough, I was having trouble finding some of the faint galaxies on my list. But I had not had issues with very similar circumstances all that night and the two before. As I became more concerned, it finally hit me what was going on. Skyglow – no matter its source - interferes with drawing out faint objects. I don't remember in times past noticing that the gegenschein had dimmed any deep sky objects, but sure enough, outside the border of its oval glow, everything went back to the same level of visibility as before.

Having learned a bit of a lesson, I noticed on the two nights that I was able to make it to almost dawn that the zodiacal light rising from Leo into Cancer was also very bright and enjoyable. It also had an augmented effect against the objects in that area, with the Milky Way bright at this dark site. Of course, we want to see the Milky Way, but with both together it really looked like dawn was coming and at that point (about 6:00 a.m.), I didn't need much convincing to go ahead and call it a night.

USEFUL AND ENJOYABLE METHODS FOR FAINT TARGETS

I made survey quality images of the NGC objects that remained unseen by me when I began my current attempt at completing the catalog visually. Using even poor images, you can identify the field stars and approximate visual appearance of the object. When you've looked at dozens of tiny faint fuzzy smudges with averted vision, they do all kind of look the same. The field stars can help you identify items later especially if you have a big group of galaxies involved. As I have no imaging equipment of my own, I use remote telescope imaging.

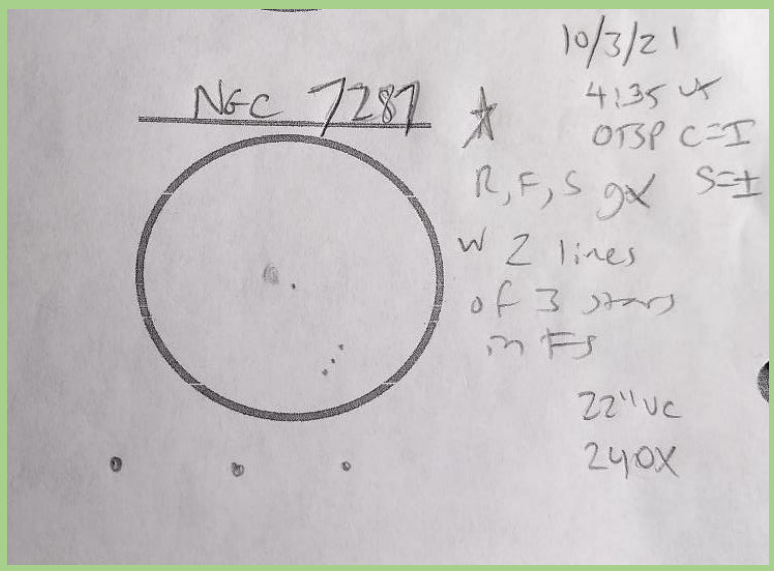
It may seem the effort is unwarranted – web services like Aladin and many planetarium programs already provide images from a searchable interface. However, in my experience, these images are not good representations of what a visual observer will see. There may be vast difference in imaging methods, optics used, and processing involved. So, I took (almost) all my images with one scope, one exposure (60 sec) and Luminance only. Limiting the quality also limits temptation to “see” at the eyepiece the image used for comparison. However, I very rarely look at the image before I try the visual observation; I do of course refer to charts sometimes in the field. For the “deep cut” NGC items I’m currently on, you’ll need an atlas like Uranometria, but for the brighter objects the Pocket Sky Atlas may be useful instead.

For discussion below, I looked back through the survey images to see if I could find good examples. Unfortunately, most of the images were OK for my use, but not for explanatory purposes. So, for the examples here, I re-imaged several targets using a remote telescope in New Mexico, T21. Of course, the images are better in brighter than what I saw with my eye, but it does show I hope what the sketching of an approximate field star alignment can do for your enjoyment and records.

Use Field Stars for Object Verification

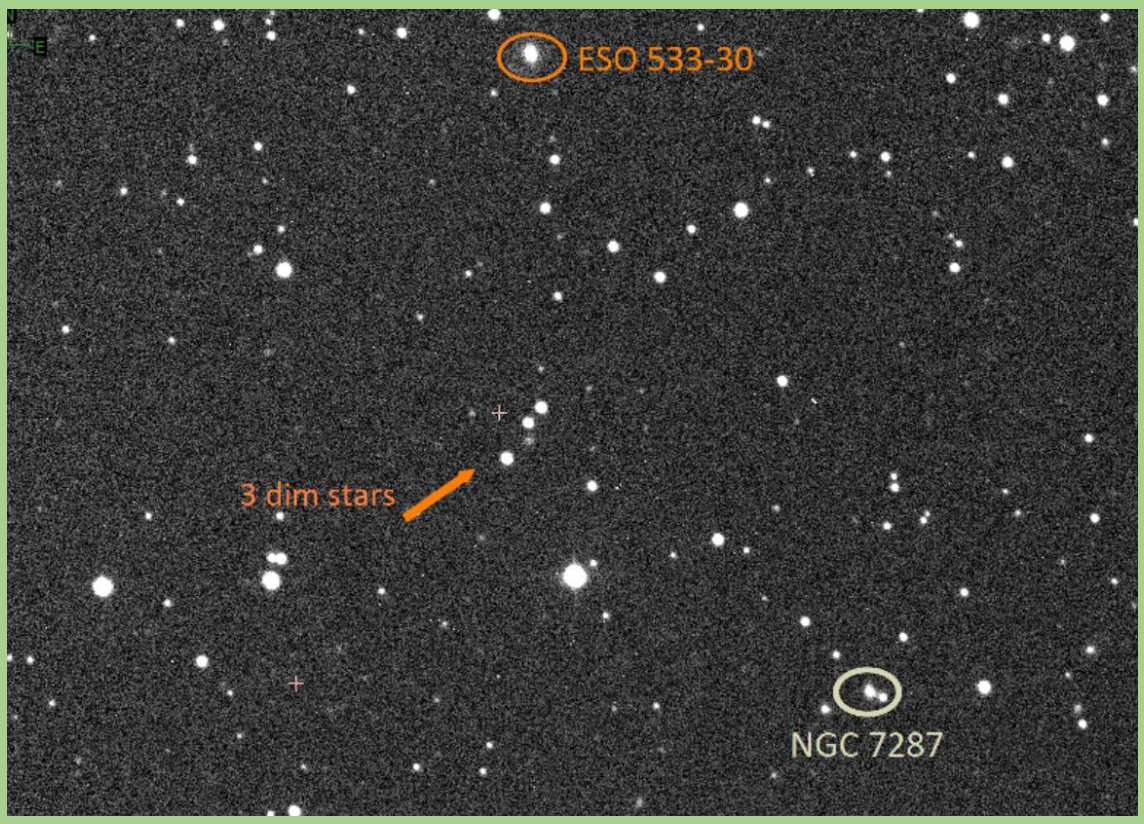
Many of my sketches have been focused on the field stars around the object. Not only is this important for verifying that the identification is correct, it's also quite pleasing in some cases with unique shapes and lines of stars to add the view. Since these very faint, often small objects are ones I've never seen before, I use my sketch of patterns of the stars around the object to compare to the survey images. Most of the time, the identification is easy from the field sketches. But there may be confusion when more than one object is visible, or you may want to confirm the position of the object if averted vision was required. You can also check the PA of an extended galaxy, extension of a cluster or nebula. This method has often helped me to identify other objects nearby that I wouldn't have expected to see. I tend to be dyslexic with my drawings and often get the directions mirrored or inverted. Comparison of the field stars against some other directional clue helps me catch when I do this.

As an example, I chose NGC 7287. As you can see from my sketch, the object has a nice field with a line of three 10-11 mag stars and a small line of three dimmer stars.



South is UP

Later, checking my newer version of an image of NGC 7287, I noticed that even allowing for errors in orientation, this was the nearby galaxy ESO 533-30:

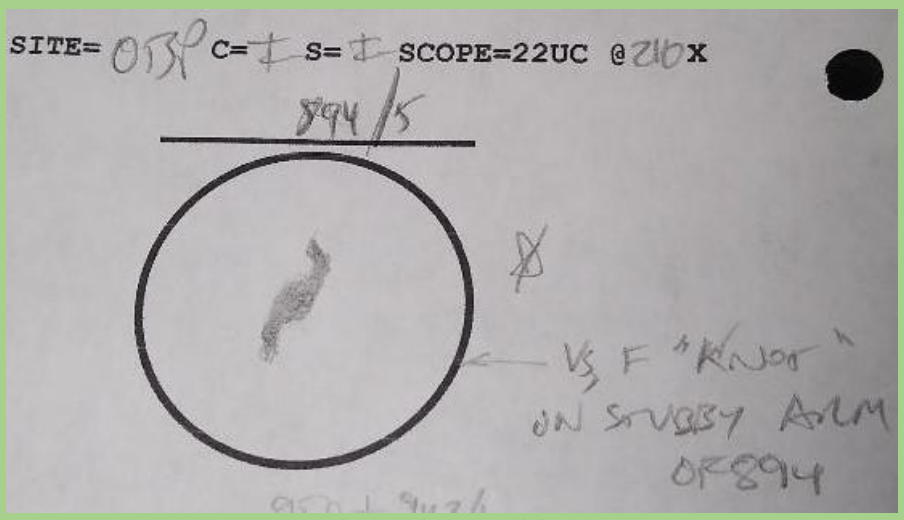


South is UP

Not the answer you want, but it is better to know and revisit the missed object. ***Glass half full*** –
I did see a new galaxy, and ESO 533-30 was still a nice catch, with an interesting field.

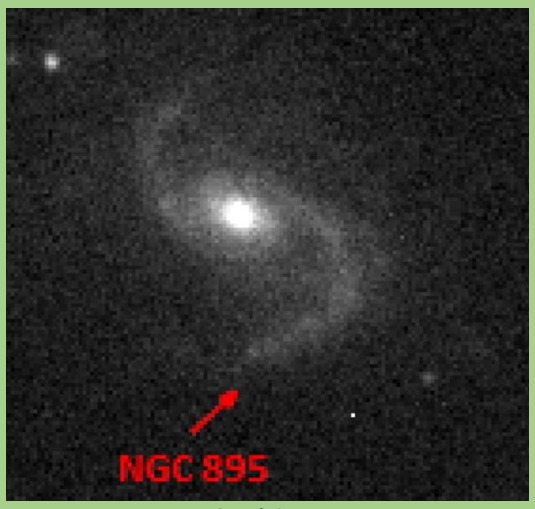
Look Around While You're There

This segues into the next type of observing method to discuss. If you do happen on an unexpected nearby object, it may be on your current or later list, or it may just be an interesting or beautiful thing to see. This "**While You're There"** method has been used with success as the basis of an Astronomical League Observing Program Two in the View. The idea is this: if you are looking at an object, [e.g., a bright galaxy] and you're confident you see it, look around in the field of view, or on your charts or database to see if there's anything else of interest nearby. There may be a dimmer object associated with the main one (nebula in an open cluster etc.). You may have spotted something that's also on your list of things to look for or might be later.
For a specific example of this effect, consider NGC 895, now on my list to complete the NGC. I knew from the description in the catalog that it was associated with NGC 894, a relatively bright spiral with two main arms. I was able to see a very faint glow in one arm that differentiated it from the other.



South UP and I reversed drawing

Although I've seen this galaxy a few times, I never noticed an extension of one of its arms. Once I saw it, it was not difficult to see, and I only wish I had known about it before so I could have noticed how it affects the shape and texture of the main galaxy. A great image from Kitt Peak AOP shows how the extension is several distinct knots in an almost straight line. My image shows it well, but with much less resolution:

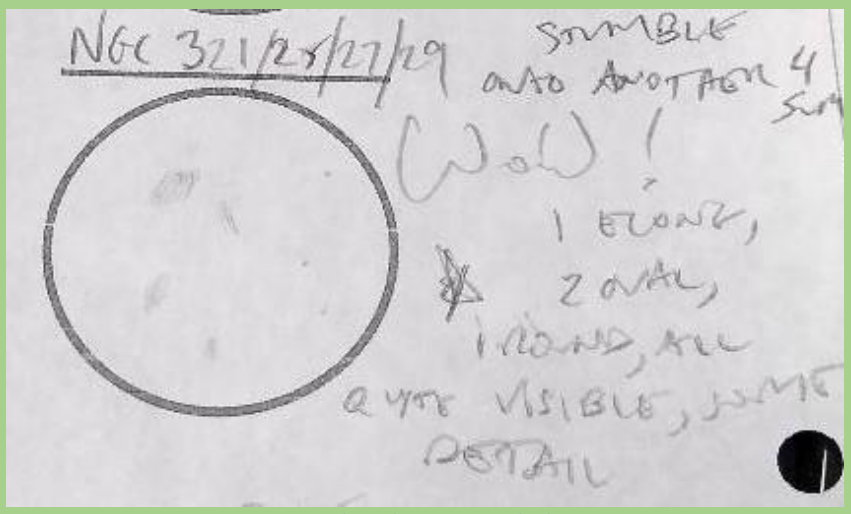


South is UP

Wait on the WOW!

Then of course there are the moments that we all crave. You're going through another list of impossible to see faint objects and then one not only shows up easily in your eyepiece, but it is a beautiful or unusual gem. Perhaps totally unexpected, it can seem like discovering an unknown object, and make the night wonderful. I often write the note “WOW” near my sketch in the field, just so I can remember that feeling later.

There were a lot of “WOW” moments this year at OTSP, but this one was best. On Tuesday night, it was getting late I was lagging a bit, wondering if it was time to pack up. Then I happened on this field, and I just soaked it in for several minutes while I sketched it and thought it looked familiar, but not quite right. The specifics in this case are four galaxies in one field of view, NGC 321/325/327/329:



North is about 5 on a clock

My sketch certainly doesn't do them justice, and the original image was not very usable. My re-imaging this group brought it out well and gives some impression of the ghostly dim glow of the quartet will catch your eye if you're able to glimpse them some clear dark night.

North is UP

Now, why the familiarity? I was remembering Hickson 61, "The Box" in Coma Berenices, which is a favorite of mine. The Box is dimmer at my usual suburban observing site, and so is closer to the appearance of this group. But the types of galaxy structures are nearly opposite. Hickson 61 contains a lenticular, two edge-on spirals, and a diffuse odd spiral.

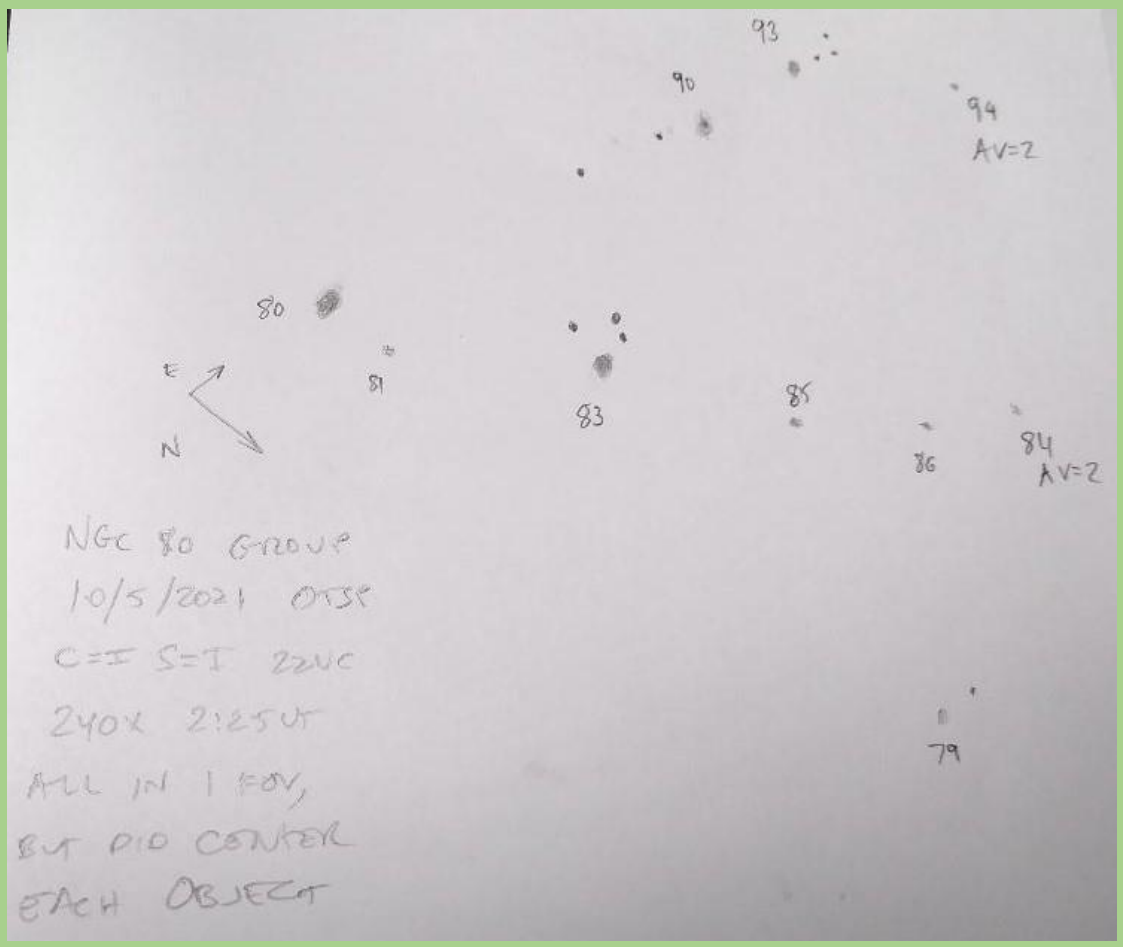
Plan Some Nice Views

Finally, there is the category I call “nice views”. This isn't a wow moment, it's just something that is nice to see. Maybe you planned to find this one. Or you revisit a target and discovered some new wrinkle to it. But “nice” is subjective, so for an example I chose two areas that have several objects that you can follow along in a line of just a few FOVs.

I have observed both galaxy groups before, but with a smaller scope. I wanted to pick up a few of the surrounding objects that may have been missed before or may not be on the official list of members, though they are in proximity.

Note that unlike the sketches above, these are edited – a sketch was drawn at eyepiece, and that was transferred as exactly as possible. The originals are too busy to copy well and do not give an accurate look and feel to the FOV(s). Alignment / scaling were changed if needed to better match the image, but the objects are drawn exactly as seen.

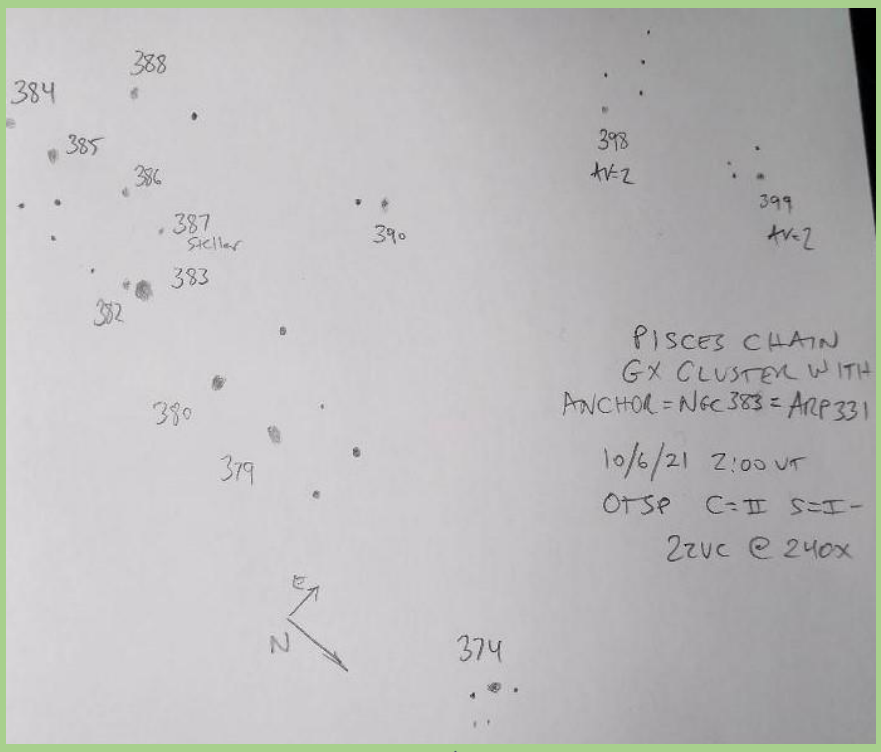
The first galaxy group (NGC 80 Group) is a swathe of several galaxies, in Andromeda:



The group starts with NGC 79 at the NW edge; to the SE is the main concentration with about 12 galaxies total. I had had some trouble a few years ago trying to pick these out but have gotten better at diving how catalogs and databases approach groups like these. NGC 90 and 93 are very interesting spirals with tiny arms – but I didn’t make that detail out visually on either one.

North is UP

The other group includes **The Pisces Chain aka Arp 331**. I extended past the conventional limits and started at NGC 344, because, interestingly, these several objects run right along the +33° declination line. This involved 4 FOV, but the main group labeled as Arp 331 will fit in one field about 30" wide.



Note North Arrow

As you can see, the new image captured all the line, and give us some details that differentiate each other from the others.

North is UP

Hopefully, this article will give you some ideas about ways to approach what you plan to see and add to your enjoyment the next time you're out observing. Of course, the fun and excitement are the important parts. But if you approach your nights with some of these ideas in mind, you may ferret out dim objects more easily. If you do preliminary lo-fi images, you can get an idea of the field stars and of the object. Visual and imaging methods are not mutually exclusive. Use both, and any other idea you find that makes your amateur astronomy journey richer.
If you have any suggestions for improving planning and the observing process, or comments on this article, please **contact me** **Brad Young**

Equipment Data for images used in this article (all by author):

New Mexico Telescopes	FOV in Degrees	Filters	OTA	Observatory Code
Telescope 21	0.81 x 0.54	Luminance	Planewave 17" CDK	H06

Links used in article:

https://en.wikipedia.org/wiki/Bortle_scale
https://en.wikipedia.org/wiki/Gegenschein
https://en.wikipedia.org/wiki/Zodiacal_light
https://hafsnt.com/index.php/ngc-new-general-catalog-project/
https://aladin.u-strasbg.fr/AladinLite/
https://www.astroleague.org/programs/two-view
https://www.noao.edu/outreach/aop/observers/n895block.jpg
https://observing.skyhound.com/archives/apr/HCG_61.html
https://www.webbdeepsky.com/galaxies/object/NGC80
https://www.webbdeepsky.com/galaxies/archive/galaxy/2011/Nov
https://hafsnt.com/index.php/parks-and-barks/

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The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

The James Webb Space Telescope: Ready for Launch!

David Prosper

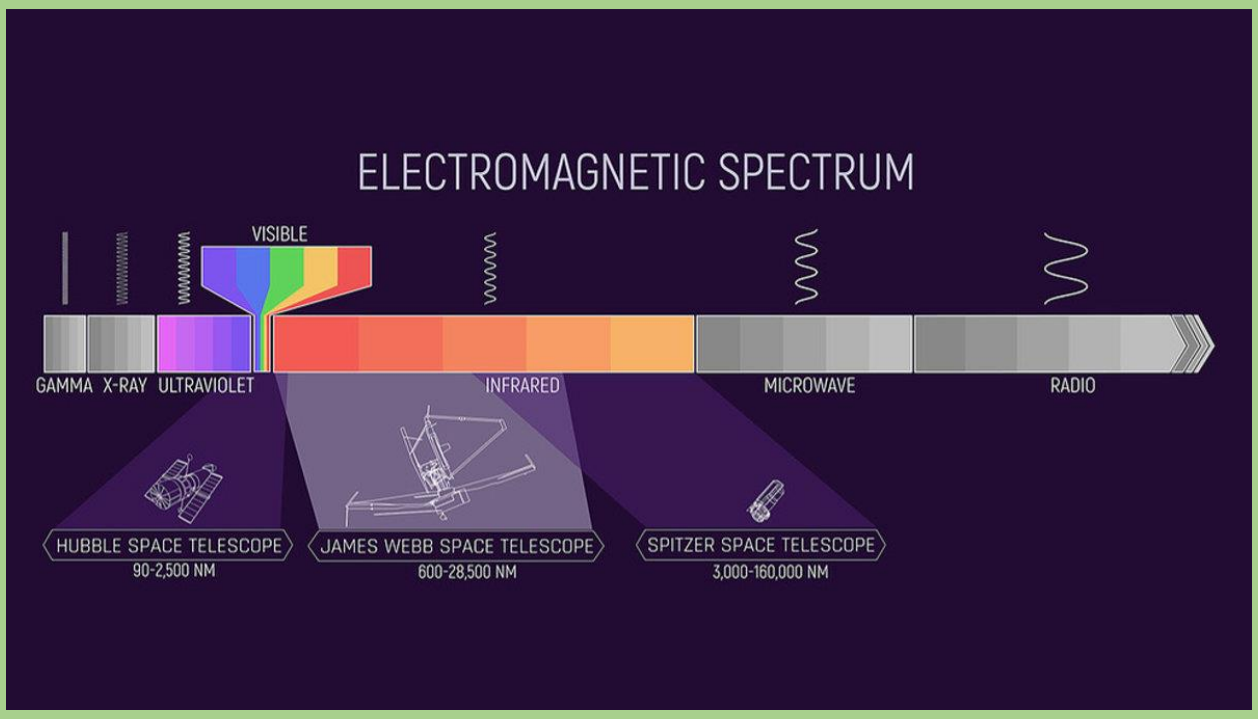
NASA's James Webb Space Telescope is ready for lift-off! As of this writing (November 15), the much-anticipated next-generation space telescope is being carefully prepared for launch on December 18, 2021 and will begin its mission to investigate some of the deepest mysteries of our universe.

The development of the Webb began earlier than you might expect – the concept that would develop into Webb was proposed even before the launch of the Hubble in the late 1980s! Since then, its design underwent many refinements, and the telescope experienced a series of delays during construction and testing. While frustrating, the team needs to ensure that this extremely complex and advanced scientific instrument is successfully launched and deployed. The Webb team can't take any chances; unlike the Hubble, orbiting at an astronaut-serviceable 340 miles (347 km) above Earth, the Webb will orbit about one million miles away (or 1.6 million km), at Lagrange Point 2. Lagrange Points are special positions where the gravitational influence between two different bodies, like the Sun and Earth, "balance out," allowing objects like space telescopes to be placed into stable long-term orbits, requiring only minor adjustments - saving Webb a good deal of fuel.

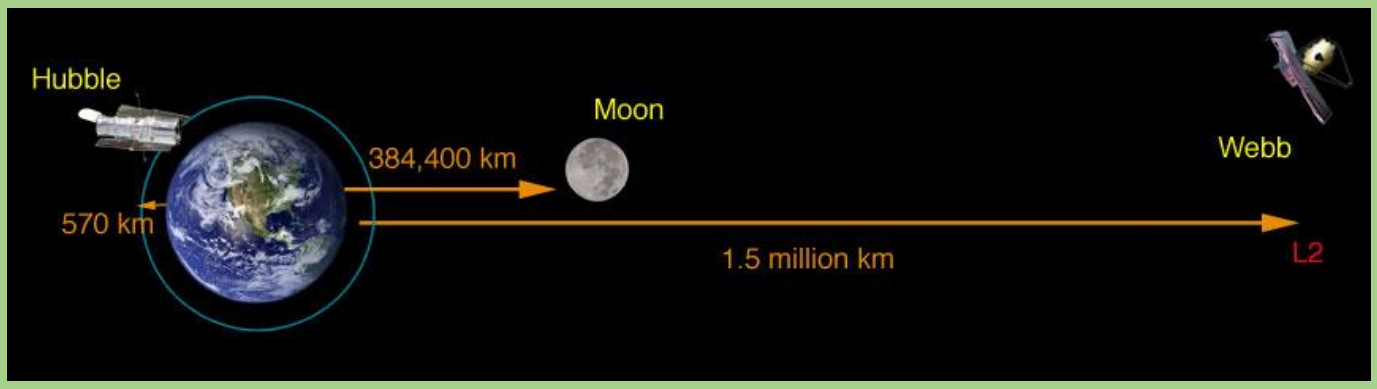
Since this position is also several times further than the Moon, Webb's sunshield will safely cover the Moon, Earth, and Sun and block any potential interference from their own infrared radiation. Even the seemingly small amount of heat from the surfaces of the Earth and Moon would interfere with Webb's extraordinarily sensitive infrared observations of our universe if left unblocked. More detailed information about Webb's orbit can be found at **bit.ly/webborbitinfo**, and a video showing its movement at **bit.ly/webborbitvideo**.

Once in its final position, its sunshield and mirror fully deployed and instruments checked out, Webb will begin observing! Webb's 21-foot segmented mirror will be trained on targets as fine and varied as planets, moons, and distant objects in our outer Solar System, active centers of galaxies, and some of the most distant stars and galaxies in our universe: objects that may be some of the first luminous objects formed after the Big Bang! Webb will join with other observatories to study black holes - including the one lurking in the center of our galaxy, and will study solar systems around other stars, including planetary atmospheres, to investigate their potential for hosting life.

Wondering how Webb's infrared observations can reveal what visible light cannot? The "Universe in a Different Light" Night Sky Network activity can help - find it at **bit.ly/different-light-nsn**. Find the latest news from NASA and Webb team as it begins its mission by following #UnfoldTheUniverse on social media, and on the web at **nasa.gov/webb**.

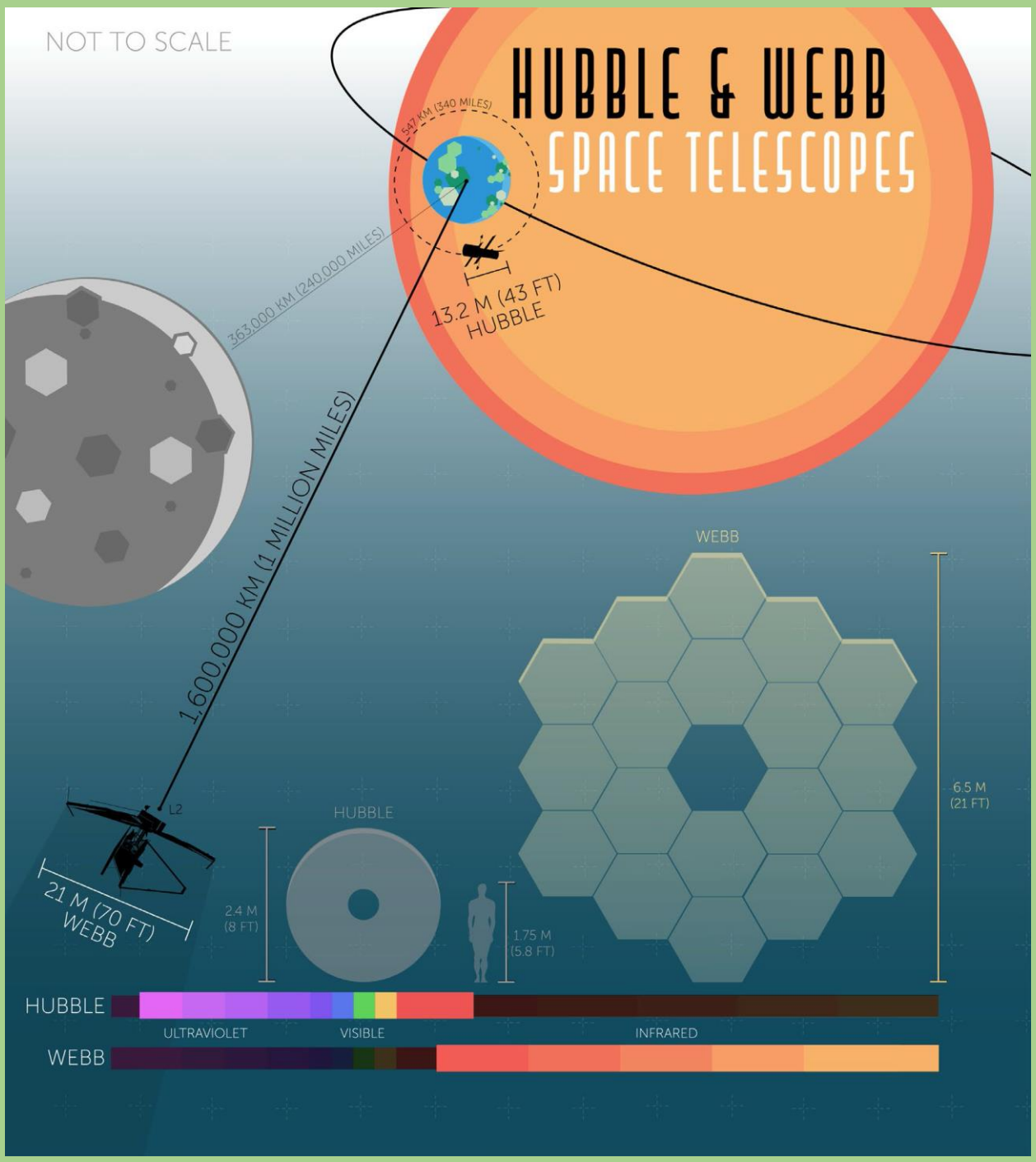


Webb will observe a wide band of the infrared spectrum, including parts observed by the Hubble - which also observes in a bit of ultraviolet light as well as visible - and the recently retired Spitzer Space Telescope. Webb will even observe parts of the infrared spectrum not seen by either of these missions! Credits: NASA and J. Olmstead (STScI)



A Solar Orbit

The James Webb Space Telescope will not be in orbit around the Earth, like the Hubble Space Telescope is - it will actually orbit the Sun, 1.5 million kilometers (1 million miles) away from the Earth at what is called the second Lagrange point or L2. What is special about this orbit is that it lets the telescope stay in line with the Earth as it moves around the Sun. This allows the satellite's large sunshield to protect the telescope from the light and heat of the Sun and Earth (and Moon).



Webb will follow up on many of Hubble's observations and continue its mission to study the most distant galaxies and stars it can - and as you can see in this comparison, its mirror and orbit are both huge in comparison, in order to continue these studies in an even deeper fashion! Credits: NASA, J. Olmsted (STScI)

TREASURER'S and MEMBERSHIP Report

BY JOHN NEWTON

As of Nov. 19, we had 212 members - 79 New members for 2021
We welcome this month our newest members - **Thomas Gray, Shaelyn Ochoa, Christopher Copeland, Scott Rokeby, Hector Cirino, Pamela McCray and Timothy Bodine. Hello and welcome to ACT!**

In addition, we want to recognize our long-term members who continue to renew their memberships with the club even in these restricted times. Finally, we can breathe easy again soon as restrictions continue to lift. Also, we look forward to seeing everyone at our virtual meetings by Zoom, General Meetings and at club events throughout the year when possible.

Accounts as of Nov. 19, 2021
Checking: $ 5,013.6
Savings: $ 13,786.65
Investments: $ 32,150.57 (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
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**

Club Dinner Photo Gallery

Members divided up into groups according to their Chinese Zodiac Animal group. (Year of the Tiger - Year of the Monkey etc.)

And collaborated to answer an Astronomy Trivia Quiz








Taking the Stars to the eyes of Young and Old.

Nov 11, 2021

Our club set up several telescopes at the Tulsa Botanical Gardens for their Starry Night program.

Over 70 people came to enjoy the stars, visit and make some SMORES







Cub Scout pack 199

Enjoyed seeing the stars and planets at the Will Rogers Birthplace house NE of Oologah. The scouts sent us a lot of nice Thank You notes with hand drawn pictures of what they saw.

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GROUP DIRECTOR – Open Position

NIGHT SKY NETWORK – Open Position

WEBMASTER JENNIFER JONES

Sorry I'm all out of Funny Astronomy Jokes and Cartoons.

This is Your CHANCE to get Published by getting your creative juices flowing to create amusing entries.

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

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

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

Create a Cartoon on a Space Theme

Contact our Editor John Land