Volume 29 Issue 4

April 2015

The Observer

East Valley Astronomy Club

Moon Through GRCO Telescope

Upcoming Events:

Public Star Party - April 10

Local Star Party - April 11

EVAC Monthly Meeting- April 17

Deep Sky Party - April 18

Check out all of the upcoming club events in the Calendars on page 12

Inside this Issue:

EVAC This Month

by Claude Haynes

It was great to see so many EVAC members at the Messier Marathon. It was a wonderfully clear night, but the downpour of dew was a surprise. I was able to find all 110, but using an LX 200 is a bit like "shooting stars in a barrel". I managed to get all of the available objects a few years ago while using a 10 inch Dob, and having an observing partner in my son-in-law. It is a lot different to star hop and circle-search. Using a Go-To is a repetitive routine, and the pressure of finishing the list makes one quickly observe that the object is there, not to spend time admiring it.

I thought of that in comparison to Don Wrigley's talk at our meeting the night before. It was nice that we had nine visitors, and while many members had gone out to the airfield to observe, we did have a good crowd. The Moon is something that we religiously try to avoid, but Don's talk has started me looking at it more closely. Observing the moon on successive nights you come to better appreciate the play of light and shadow. There are many sights that rely upon special timing to catch the sun at its best angle to highlight a valley or rille. It is amazing how much beauty

Evac This Month

is right in front of us, if we just take the time to find it.

As a plus, we have a lunar eclipse to start the month early on Saturday April 4. The first shadow contact is at 2:01 am, and the maximum eclipse is at 5:01 am. The moon sets at 6:17, so you can go back to sleep then.

Our speaker for the April meeting is another EVAC member, Steven Aggas, who will be speaking about "Beyond Telescope Building". Many of you are aware of the monster telescope that Steven has built at his property on the Mogollon Rim. He will provide an update on the project, and recent astronomical endeavors. It should be another great meeting.

Keep looking up (and closely)

Claude

If It's Clear…

by Fulton Wright, Jr. Prescott Astronomy Club

April 2015

Celestial events (from Sky & Telescope magazine, Astronomy magazine, and anywhere else I can find information) customized for Prescott, Arizona. All times are Mountain Standard Time.

On Thursday, April 2, between 2:37 AM and 3:00 AM, Ganymede goes behind Callisto. Ganymede is almost completely covered in the middle of the event and the brightness of the pair drops 1 magnitude.

On Friday, April 3, at 6:26 PM (26 minutes before sunset), the full Moon rises spoiling any chance of hunting for faint fuzzies for the night. Later that night (Saturday) there is a barely total eclipse of the Moon. The partial phase starts at 3:17 AM (Saturday), the total phase is from 4:52 AM to 5:11 AM. Nautical twilight dawn starts at 5:18 AM.

On Friday, April 10, before sunrise, the Moon travels in front of the open cluster, M 23. The bright limb of the Moon starts to cover stars about 3:20 AM. The cluster is completely covered about 4:45 AM and stars start to appear from behind the dark limb of the Moon. At about 5:10 AM, morning twilight interferes.

On Saturday, April 11, the Moon is at third quarter phase and rises at 1:39 AM (Sunday).

On Saturday, April 18, it is new Moon and you have all night to hunt for faint fuzzies.

On Wednesday, April 22, after about 7:30 PM, you can see the north-east (IAU, terrestrial) part of the Moon at its best. Libration tips that part toward us. The next few nights are also good.

On Saturday, April 25, the Moon is at first quarter phase and sets at 1:35 AM (Sunday). You can also see some events with Jupiter's moons. Here is the schedule:

09:08 PM Io moves in front of the planet.

09:30 PM Europa and Ganymede pass within a couple of arc-seconds of each other.

09:33 PM Callisto starts to enter Jupiter's shadow.

10:21 PM Callisto is completely in Jupiter's shadow.

10:23 PM Io's shadow falls on the planet.

11:24 PM (approx.) the shadow and the great red spot cross Jupiter's meridian and Io emerges from in front of the planet.

12:38 AM (Sunday) Io's shadow leaves the planet.

01:16 AM Europa's shadow starts to fall on Ganymede.

01:25 AM Europa's shadow leaves Ganymede (there has been 0.7 magnitude drop).

02:11 AM Jupiter sets

On Thursday, April 30, about 8:00 PM, you can see Mercury near the Pleiades about 10 degrees above the west-northwest horizon.

The Backyard Astronomer

by Bill Dellinges (April 2015)

Where Stands the Sun

Every star you can see at night with the unaided eye is bigger and brighter than the Sun. Does that mean the Sun is lacking in stellar stature? No. The Sun is actually larger and brighter than most of the stars in the universe. Though seemingly a contradiction, both statements are true. How can that be? There is a very simple explanation. There are seven basic spectral classifications for stars on the Main Sequence of the Hertzsprung-Russell diagram, O, B, A, F, G, K, and M. The letters reflect the surface temperature of the star. Type O stars are the hottest and M stars the coolest. To keep things simple, we shall ignore other designations in this system, like the small cool stars in the class L, T, and Y beyond class M that may not even be undergoing nuclear fusion. Also omitted are 1) the numerical suffixes between main types (O1,2,3,4,5,6,7,8,9, B0,1,2,3 etc) that indicate gradual temperature changes between classes and 2) the Roman numerals indicating luminosity class such as the Sun's G2 V designation.

The answer to our opening riddle is the fact that nature prefers to make smaller things over large things. Seventy percent of the universe's stars are class M. Class G stars represent 10% of stars, B class 0.1% and O stars 0.001%. The bigger and brighter the star, the fewer there are. An analogy of this situation would be to note there are more ants on the Earth than elephants. When we look at the night sky's stars, we are seeing very luminous stars. Although they are few in number, the bright O, B, and A stars dominate the night because they can be seen over huge distances (the closest B star is 24 light years away and the closest O star, 800 light years away). For every one of those bright stars, there are thousands of relatively faint G, K, and M stars, but they are generally too dim to see – especially the M stars. Astronomer James Kaler goes so far to say in his Little Book of Stars that for every O star there are a million M stars! Yet, of the 8000 naked eye stars, none are class M stars because they can't be seen naked eye beyond about 13 light years.

The Sun is a pretty respectable star in its neighborhood. Among the 25 nearest stars within 11 light years of the Sun, only three stars outshine it: Sirius, Procyon and Alpha Centauri. This supports the concept the Sun is above average in stature. But if we compare its intrinsic luminosity to the night's panoply of stars, it doesn't look so hot (no pun intended). Absolute Magnitude (A.M.) is how bright a star would appear at a distance of 32.6 light years (10 parsecs). This allows us to compare how luminous stars really are. So where does the Sun stand in that lineup? Let's take the Sun and the 25 brightest stars of the night sky and place them 32.6 light years away and judge their brightness. All would be far brighter than the Sun's A.M. of +4.8. Not till we went through 280 of the night sky's brightest stars would we come to one with a fainter A.M. than the Sun – and that would be Tau Ceti with an A.M of +5.6 (a spectral class G8 V star 12 light years away). But take solace Earth people. For you, the brightest star in the universe is the Sun, with its apparent magnitude -26.72!

Thorne-Zytkow Objects

by Henry De Jonge IV

What is a TZO?

Recently I attended a lecture by Philip Massey from Lowell Observatory where he discussed massive stars and their evolution. One of the things he mentioned was that they, (he and his team of fellow astronomers) may have recently observed a totally new type of massive star, (red supergiant or RSG) with a neutron star, (NS) center called a Thorne-Zytkow Object or TZO. I recalled reading about these objects years ago but until recently they were considered strictly theoretical objects and this aroused my interest which resulted in this article.

TZOs were first formally proposed in 1975 by Kip Thorne and Anna Zytkow, although the idea of such objects was discussed earlier in the 1930s by George Gamow. They are essentially a new class of star in which a NS, (of at least 1.4 solar masses) core is surrounded by a large, diffuse envelope, (at least several AU in radius). These unique stars are thought to have masses of at least 11 solar masses and larger. They obtain most (95%) of their energy from thermonuclear reactions at the base of the convective envelope on top of the NS in their center and only about 5% of their energy from gravitational accretion. Thus they appear as "regular"

What is a TZO?

Continued from page 3

RSG stars for the most part with a highly unusual core that powers the star.

How might they be formed?

There are a few theories about how TZOs may be formed. The first part in all of them is that we must have a neutron star, (NS) to begin with, thus a former massive star that has blown off its outer layers and has collapsed as a Type II SN. The second part is that we need to have a red supergiant star (RSG) that is more massive than an ordinary red giant and nearing its final stages of life. To wrap it up there must also be a way in which the NS becomes imbedded in the center of the RSG to begin the fun. Regardless, the exact mechanisms by which this may occur are all not fully understood or accepted and remain theoretical.

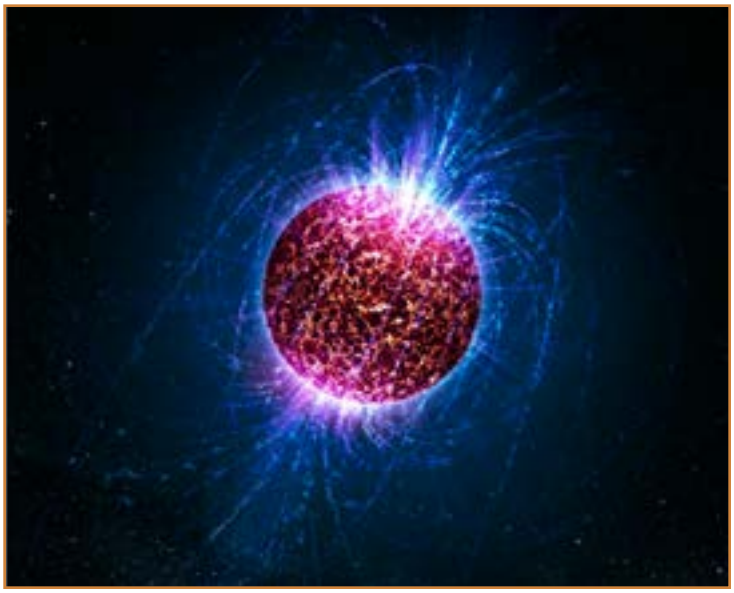


Figure 1. A Picture of a neutron star.

One way this may happen is that a NS companion of a RSG star in a close binary system begins to accrete the mass off the RSG to the point where it captures and contains the majority of the RSGs mass and begins to act like a red giant on its own. However the potential for SN explosions may limit this process from becoming common.

Another scenario is that sometimes when a massive star in a close binary system goes SN, since the explosions are usually very asymmetrical, this can cause the NS to be propelled into the RSG companion star's interior, thus becoming a TZO. This may happen relatively quickly.

A third way is that over time, (perhaps hundreds of years) a NS and RSG in a very close binary system will lose energy especially as the NS becomes more imbedded in the outer layers of the RSG so that the NS slowly spirals into the RSG, while it is accreting material on the way in as well. Perhaps one or both of the binary companions could also have been given a "push" by another outside astronomical event.

In another scenario perhaps a TZO is a failed SN explosion where the SN ejecta and outer layers of the dead star fall back onto the NS core for some reason and does not convert it to a BH.

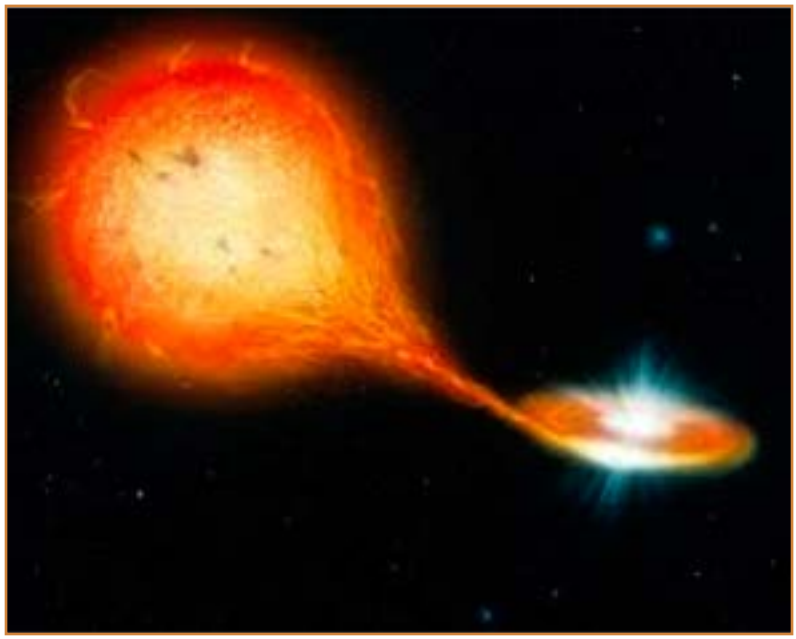


Figure 2. Neutron Star Accreeting matter off its RSB

I could also imagine that in another scenario a passing NS could be more quickly gravitationally captured, by a RSG (or is it the other way around?) and thus create a cosmic collision of sorts whereby the NS directly enters the RSG and becomes its new core. We know that this may happen in old, crowded, globular clusters as is the case for the rare blue stragglers, where two stars merge and sort of begin life anew as a blue giant star. These types of unique and bizarre collisions are also thought to be possible with white dwarfs, (WD) and other stars. For example it may be possible for a NS to merge with a WD in dense cluster environments. In the end though the TZO will probably evolve into a larger NS, probably with an accretion disk, or even a BH at the end of its life. It may also go SN beforehand.

What is a TZO

Continued from page 4

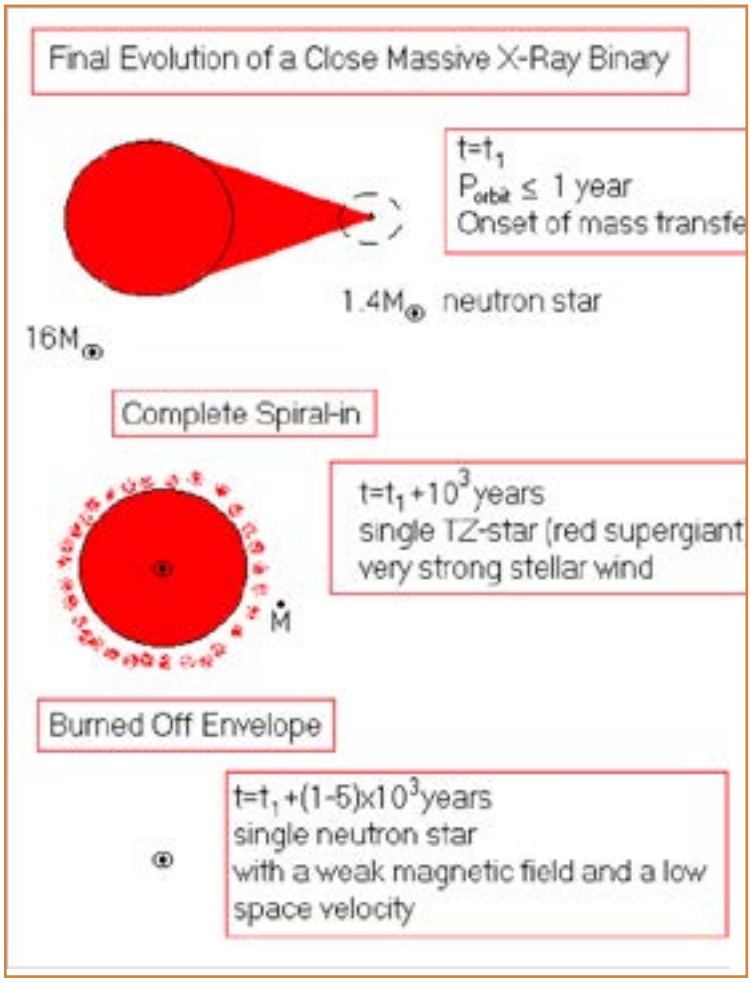


Figure 3. Possible evolution of a TZO ending up as a NS.

Pros of their existence?

Unfortunately TZOs appear superficially just like usual RSGs and are thought to be very, very, rare thus hindering our search for these strange objects. TZOs are not expected to have very long relative lifetimes which also hinder our search. They have been looked for over the years and some candidates have shown certain unique attributes for such objects but until recently none have shown such a solid grouping of these "known" theoretical TZO characteristics. It is also due to the fact that over the years since their prediction our technology, (especially in resolution and analysis) and theoretical models of stellar evolution have advanced to the task. For example we can now model stellar rotation and convection into the supercomputer models.

In mid-2014 while doing a study of RSGs in the LMC, SMC, and our Milky Way galaxy, astronomers found the unique spectral signature of this potential TZO in the SMC which is about 200,000 light years distant. This star is labeled HV 2112 and is the first ever star to show the predicted spectral, (chemical) signature of this heretofore theoretical object. The spectrum is distinctly different from that of other RSG in the SMC. It has a surface temperature of about 3450 degrees Kelvin, a luminosity of over 100,000 times that of the sun, and with a mass of about 15 solar masses. Remember that while it is massive and extremely hot in the interior it has a very large diameter and somewhat tenuous outer structure as most giants thus spreading out its heat and making it look very bright red.

Figure 4. Location of HV 2112 in SMC.

Basically the only way we have to distinguish them from "ordinary" RSGs is their unique spectral signature indicating an abundance of certain heavy elements and an overabundance of Lithium lines, while still maintaining the surface temperature of a RSG. In particular they will show an abundance of elements such as Rubidium and Molybdenum as well as certain isotopes and energy levels of Strontium, and Zirconium. These heavy elements generally have proton rich nuclei. This will also be accompanied by an overabundance of Li.

These unique heavy elements and Li are produced by the convective envelope between the outer photosphere and the extremely hot burning region in the center near the NS core. This process involves unique rapid proton

What is a TZO

Continued from page 5

nuclear reactions due to the extremely high temperatures involved and the unique convective envelope which produce the critical abundances of certain nuclei. It is thought that near the surface of the NS there exists an abundance of protons which aid in producing these special nuclear reactions and byproducts. Convection and further nuclear processes along the way bring these elements to fruition and also to the surface for us to detect.

It is interesting to think that basically all elements with atomic number less than Fe are produced in most regular stars, and elements with atomic number greater that Fe are made in SN explosions. It appears that these classical explanations left out a few elements, (or isotopes) that only a TZO can make. There are still unanswered questions and new explanations being discovered about where all the things we take for granted come from!

Cons to its existence

There are of course alternate explanations as to what these recent observations of HV 2112 mean. One alternate is that HV 2112 is a rare super asymptotic giant branch star or SAGB (recall the HR diagram) with a unique O and Ne core supported by electron degeneracy and having thermal pulses that help dredge up lower layers. These stars are the late stages of massive stars of about 6-12 solar masses with a double layer burning, (H and He) core. These stars would have largely the same spectral signature as a TZO. However they lack an explanation for certain elements in the TZO spectra like enhanced levels of Ca which would be made in the initial forming accretion disk (merging) of a TZO but not in a SAGB. This theory is plausible but not strong enough to seriously disrupt the TZO explanation currently.

In another alternate explanation, perhaps enough, (a few %) of the core collapse SN explosion ejecta which formed the NS, is captured by a very close giant binary companion and forms a SN polluted giant, (SNPG) binary. The spectra of these new objects could have the same spectral signature of a TZO with the addition of the enhanced Ca lines. The giant binary companion would need to be quite massive with a mass of at least 9 solar masses, and it is also thought that these types of binary systems with the required make up are much more numerous than TZOs. Thus our galaxy may have many tens of these systems while the SMC may have up to about 10. Thus this alternative explanation satisfies more conditions of a TZO spectra.

Many questions remain unanswered. For example it is not know exactly how the jets that may or may not have been formed in the initial merger of the NS with the RSG play a role in forming a TZO or influencing the spectral, (chemical) signature of a TZO. It is still considered by some that a NS merging with a RSG is not even possible for a variety of reasons. Thus the debate continues.

What are the implications and future research pathways?

If these observations of a potential TZO prove to be correct this will open up a totally new level of stellar model evolution and understanding. It will also enlighten our understanding of binary stellar systems, nuclear physics, relativity theory, and other fields, not to mention show us a bit more in the treasure chest of wonders of the heavens. It will also enhance our chances of success in observing more of these rare and mysterious objects if confirmed.

We will need to continue examining HV 2112, (and other stars like it) to better determine its properties and better understand its structure in order to confirm if it really is a TZO. There are also some interesting properties that have been observed with HV 2112 such as a very high Ca/Fe ratio that are not predicted in the current models. However to date it is the best candidate ever observed for a TZO and other explanations/models for its unique chemical signatures are not as complete as the one for a TZO. Only time will tell if they really exist or not.

*Full Moon on April 4 at 08:06

Last Quarter Moon on April 11 at 11:44

New Moon on April 18 at 14:57

First Quarter Moon on April 25 at 07:55

Looking for that perfect weekend activity?

Why not resolve to getting involved?

Contact Dave Coshow to join the staff at GRCO

Email: grco@evaconline.org

Dobsonian Telescope For Sale

In April of 1992 I bought a dobsonian telescope with a 17.5" mirror from Coulter Optical. They are no longer in business. I paid $1239.13 for the telescope. (Tax incl.) I have enjoyed using it but no longer have the means to transport it to a dark sky. The telescope needs to be used by someone who can get full use out of it so I am ready to bid farewell. I have the original operating guide. Some of the specifications are as follows:

- Mirror Diameter = 17.5
- Mirror Focal Length = 78.85
- Obscuration diameter = 4.25
- Focal ratio F/# = 4.5

I have just the original eyepiece that came with it. I never bought any extra eyepieces or filters. The overall condition of the telescope is good, but the mirror has never been cleaned. If you'd like to hear more about it, you may e-mail me. You can also leave a message at 480-483-3071. I will call back as soon as I get a chance.

Fred Marderness (reednote@yahoo.com)

Upcoming Meetings

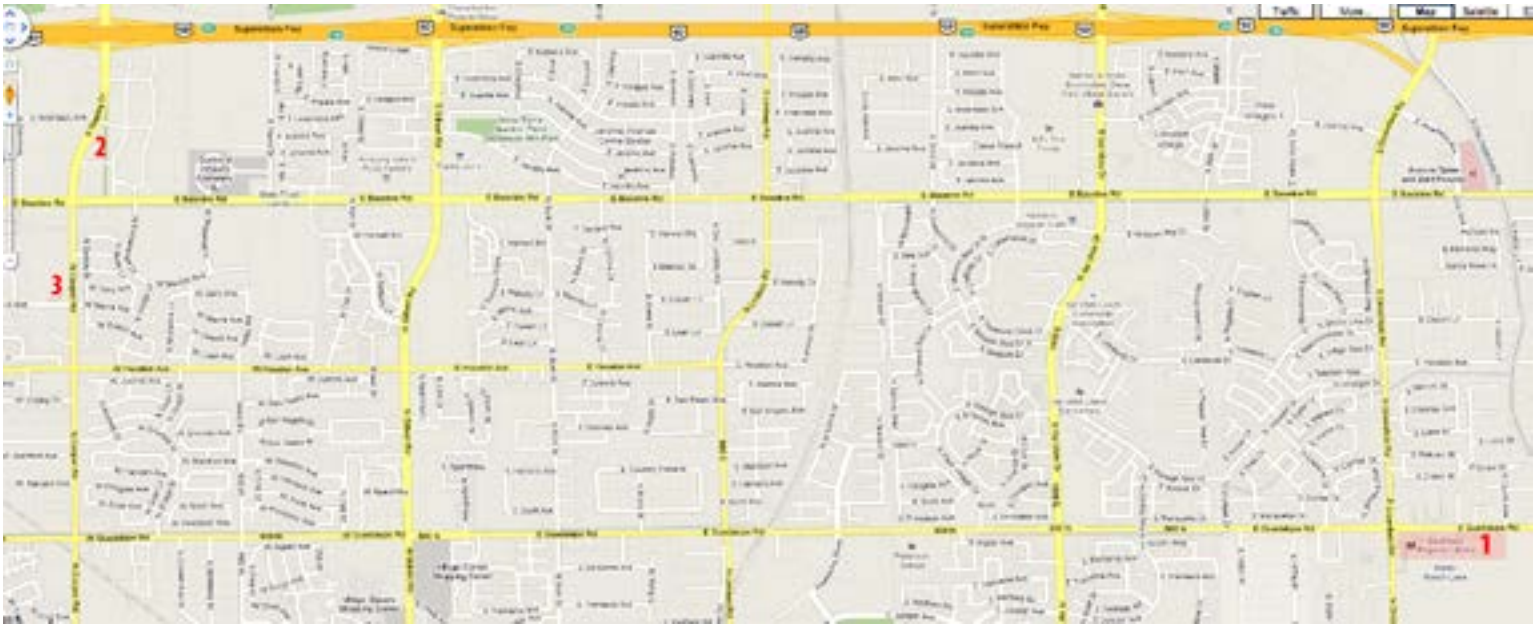
April 17
May 15
June 19
July 17
August 21
September 16
October 16
November 20

The monthly general meeting is your chance to find out what other club members are up to, learn about upcoming club events and listen to presentations by professional and well-known amateur astronomers.

Our meetings are held on the third Friday of each month at the Southeast Regional Library in Gilbert. The library is located at 775 N. Greenfield Road; on the southeast corner of Greenfield and Guadalupe Roads. Meetings begin at 7:30 pm.

All are welcome to attend the pre-meeting dinner at 5:30 pm. We meet at Old Country Buffet, located at 1855 S. Stapley Drive in Mesa. The restaurant is in the plaza on the northeast corner of Stapley and Baseline Roads, just south of US60.

Visitors are always welcome!



2 Old Country Buffet
1855 S. Stapley Drive
Mesa, Az. 85204

1 Southeast Regional Library
775 N. Greenfield Road
Gilbert, Az. 85234

April 2015

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	**2**	3	4
5	6	7	8	9	**10**	**11**
12	13	14	15	16	**17**	**18**
19	20	21	**22**	**23**	**24**	25
26	27	28	29	30		

Apr 2 - San Tan Elementary

Apr 10 - Public Star Party

Apr 11 - AZ Museum of Natural History

Apr 11- Local Star Party

Apr 17 - EVAC Monthly Meeting

Apr 18 - Deep Sky Party

Apr 22 - Taylor Junior High

Apr 23 - Queen Creek Middle School

Apr 24 - Circle Cross Ranch

May 2015

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	**8**	**9**
10	11	12	13	14	**15**	**16**
17	18	19	**20**	21	22	23
24	25	26	27	28	29	30

May 8 - Public Star Party

May 9- Local Star Party

May 15 - EVAC Monthly Meeting

May 16 - Deep Sky Party

May 20 - Sequoia Path Finder Academy

East Valley Astronomy Club -- 2013 Membership Form

Please complete this form and return it to the club Treasurer at the next meeting or mail it to EVAC, PO Box 2202, Mesa, Az, 85214-2202. Please include a check or money order made payable to EVAC for the appropriate amount.

IMPORTANT: All memberships expire on December 31 of each year.

Select one of the following:

☐ New Member ☐ Renewal ☐ Change of Address

New Member Dues (dues are prorated, select according to the month you are joining the club):

☐ **$30.00 Individual** January through March

☐ **$35.00 Family** January through March

☐ **$22.50 Individual** April through June

☐ **$26.25 Family** April through June

☐ **$15.00 Individual** July through September

☐ **$17.50 Family** July through September

☐ **$37.50 Individual** October through December

☐ **$43.75 Family** October through December

Includes dues for the following year

Renewal (current members only):

☐ **$30.00 Individual** ☐ **$35.00 Family**

Name Badges:

☐ **$10.00** Each (including postage) Quantity: _____

Name to imprint: _____

Total amount enclosed: ☐

Please make check or money order payable to EVAC

☐ Payment was remitted separately using PayPal ☐ Payment was remitted separately using my financial institution's online bill payment feature

Name: ☐ Phone: ☐

Address: ☐ Email: ☐

☐ Publish email address on website

City, State, Zip: ☐ URL: ☐

How would you like to receive your monthly newsletter? (choose one option):

☐ Electronic delivery (PDF) *Included with membership* ☐ US Mail **Please add $10 to the total payment**

Areas of Interest (check all that apply):

☐ General Observing ☐ Cosmology

☐ Lunar Observing ☐ Telescope Making

☐ Planetary Observing ☐ Astrophotography

☐ Deep Sky Observing ☐ Other

Please describe your astronomy equipment:

Would you be interested in attending a beginner's workshop? ☐ Yes ☐ No

How did you discover East Valley Astronomy Club? ☐

PO Box 2202
Mesa, AZ 85214-2202
www.evaconline.org

All members are required to have a liability release form (waiver) on file. Please complete one and forward to the Treasurer with your membership application or renewal.

The Observer is the official publication of the East Valley Astronomy Club. It is published monthly and made available electronically as an Adobe PDF document the first week of the month. Printed copies are available at the monthly meeting. Mailed copies are available to members for a slight surcharge to offset printing and mailing expenses.

Please send your contributions, tips, suggestions and comments to the Editor at: news@evaconline.org Contributions may be edited. The views and opinions expressed in this newsletter do not necessarily represent those of the East Valley Astronomy Club, the publisher or editor.

The East Valley Astronomy Club is a 501(c)(3) nonprofit charitable organization.

www.evaconline.org

East Valley Astronomy Club
PO Box 2202
Mesa, Az. 85214-2202