Volume 29 Issue 1

January 2015

The Observer

East Valley Astronomy Club

The Segull Nebula (IC 2177 - Canis Major)
APOD January 11, 2014 Michael Miller

Upcoming Events:

Public Star Party - January 9

EVAC Monthly Meeting- January 16

Local Star Party - January 17

Deep Sky Party - January 24

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

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EVAC This Month

by Claude Haynes

The winter solstice is past. The bells heralding the new year ring out. 2015 is upon us, and there is much ahead. Our January 16 meeting will be at the Freestone Recreation Center at 1141 E Guadalupe Rd. From the library, it is just down Guadalupe Rd., west of Val Vista on the south side of the street. The Town of Gilbert and the Library are hosting an event for the Dr. Martin Luther King Jr. Holiday, and we agreed to move for the evening. Our speaker is Richard Harshaw, who will be speaking about research he did as an amateur at Kitt Peak.

The Holiday Party was certainly fun. Thanks to Jan Barstad for helping to organize things. I hope you had a chance to walk through the "Riparian After Dark". It is a lovely park, and we are fortunate to have such a good relationship with Parks and Recreation.

We have 16 school star parties on the calendar, so far this spring. Please join us if you have a chance. I will have more time to attend these parties since I have retired. My personal email is **azstargeazer@gmail.com**, and my cell phone continues at:

Evac This Month

Continued from page 1

480-221-5792. Please feel free to contact me if you have comments or suggestions on the club. If you happen to use my old Pearson address you will get an out of office message. Until then – clear skies. Keep Looking up

Claude

If It's Clear…

by Fulton Wright, Jr. Prescott Astronomy Club

January 2015

If it's clear for January 2015
by Fulton Wright, Jr.
Prescott Astronomy Club

Celestial events (from Sky & Telescope magazine, Astronomy magazine, and anywhere else I can find information) customized for Prescott, Arizona. Remember, the Moon is 1/2 degree or 30 arc-minutes in diameter. All times are Mountain Standard Time.

If you are into eclipsing binary variable stars, you might want to check out the website: http://www.aavso.org/observing-campaign-alf-Com. There is a chance to observe a rare event. Sky & Telescope magazine has an article on p. 50 of the January 2015 issue.

On the night of Thursday, January 1, the Moon will be passing through the Hyades cluster in Taurus and occulting stars. In particular, Delta 1 (magnitude 4) will be hidden from 11:36 PM to 12:13 AM (Friday) and Delta 2 (magnitude 5) will be hidden from 11:59 PM to 1:13 AM.

On Sunday, January 4, the full Moon rises at 5:34 PM (right at sunset) spoiling any chance of seeing faint fuzzies for the night.

On Tuesday, January 6, from 4:57 AM to 7:08 AM, Io's and Europa's shadows will be on Jupiter.

On Wednesday, January 7, about 7:00 PM, Algol (now magnitude 3.4) will be at its minimum. It stays there for about an hour, then slowly brightens to magnitude 2.1.

On Saturday, January 10, about 6:10 PM, look for Venus (magnitude -4) and Mercury (magnitude -1) less than one degree apart very low in the southwest. The two will be close for several days around this date.
On Monday, January 12, the Moon is at last quarter phase and rises at 12:44 AM (Tuesday).

On Friday, January 16, from 8:50 PM to 9:58 PM Io's and Europa's shadows will be on Jupiter.

On Monday, January 19, it is new Moon and you have all night to hunt for faint fuzzies.

On Friday, January 23, from 2:05 AM to 2:20 AM, Callisto's shadow falls on Ganymede, gradually dimming Ganymede by 1.4 magnitudes. (My planetarium program doesn't simulate Jupiter satellite mutual eclipses, so I haven't been able to verify this event.)

On the night of Friday, January 23, you can see a lot of events with Jupiter's moons (and I mean a lot). Here is the schedule:
06:58 PM Jupiter rises.
08:10 PM Callisto's shadow falls on Jupiter. (1 shadow!)
08:31 PM Io goes by Callisto.
09:35 PM Io's shadow falls on Jupiter. (2 shadows!!)
09:54 PM Io moves in front of Jupiter.
10:51 PM Io's shadow passes close to Callisto's shadow.
11:18 PM Callisto moves in front of Jupiter.
11:22 PM Io covers Callisto's shadow (!)
11:26 PM Europa's shadow falls on Jupiter. (3 shadows!!!)
11:51 PM Io's shadow leaves Jupiter. (2 shadows left.)
12:06 AM (Saturday) Europa moves in front of Jupiter.
12:11 AM Io appears from in front of Jupiter.
12:58 AM Callisto's shadow leaves Jupiter. (1 shadow left.)
01:24 AM Europa passes south of Callisto.
(near the meridian of Jupiter but hard to observe against the planet.)
02:20 AM Europa's shadow leaves Jupiter. (None left.)
03:00 AM Europa appears from in front of Jupiter.
03:00 AM The Great Red Spot transits.
04:00 AM Callisto appears from in front of Jupiter.
07:00 AM Twilight interferes with observing.
Now, that's a lot of events.

If It's Clear...

Continued from page 2

On Sunday, January 25, at about 10:15 PM, Ganymede completely covers Europa for about a minute, just as Ganymede's shadow appears on Jupiter.

On Monday, January 26, at 9:49 PM, the Moon is at first quarter phase and sets at 12:04 AM (Tuesday). At the moment of first quarter, see if the terminator looks exactly straight to you.

On Saturday, January 31, between 1:45 AM and 2:21 AM, Io and its shadow leave Jupiter and Europa and its shadow appear on Jupiter.

The Backyard Astronomer

by Bill Dellinges (January 2015)

Camelopardalis - Auriga Starwalk

To say that Camelopardalis is a faint constellation would be an understatement. I can't think of another constellation more difficult to see or trace out. It's one of the newer group of faint constellations formed during the 1600's by desperate astronomers trying to fill empty spaces between the major established star groups. Camelopardalis was created by Petrus Planicius in 1613. It fills the void between Auriga and Ursa Minor and represents a giraffe, not a camel. The word comes from the Greek words for giraffe and leopard and Latinized into Camelopardais meaning an animal with the long neck of a giraffe and spots like a leopard.

Let's visit a few of the giraffe's highlights. One of the more interesting things found in this constellation is an asterism called Kemble's Cascade. Found by Canadian amateur Lucian Kemble in 1980, it was named by Walter Scott Houston and featured in his book Deep Sky Wonders, where a photo of the asterism is found on page 31 (a diagram of it is on page 94 of Stars and Planets by Ridpath and Tirion). The object is a two degree string of 8th magnitude stars terminating at NGC 1502, a petite open star cluster. There is a conspicuous equal magnitude double star, Struve 485, almost dead center in the cluster and easily split at 29x in a 70mm refractor. The components are both magnitude 7.0 and separated by 17.9 arc seconds (SAO 13031). This asterism is best observed with binoculars and can be found by extending a line from Algol and Mirfak in Perseus east about the same distance between those two stars. That will put you in the general area.

About a degree and a half SSW of NGC 1502 is the planetary nebula NGC 1501. In an 11" telescope at 233x with an OIII filter, the nebula is large but faint. There is a hint of mottling on its surface but no sign of the magnitude 14.4 central star. The giraffe's long neck comes in handy to reach the elusive galaxy NGC 2403 in the far eastern reaches of the constellation. This large bright magnitude 8.6 galaxy was somehow missed by Messier. William Herschel discovered it in 1788. At my semi-rural site, with the galaxy about 45 degrees above the horizon, the galaxy was an amorphous blur bounded by two foreground stars. This object should be more rewarding when viewed on the meridian in darker skies.

Leaving our giraffe to graze for a while, let's stroll southeast and hop a ride in a chariot. In Greek mythology Auriga the Charioteer represents Erichthonius, king of Athens and the inventor of the chariot. The constellation may not look like a chariot but displays a striking pentagon shaped affair and is one of the bright winter constellations forming the large asterism called the Winter Hexagon. The Hexagon is a line connecting the bright stars Capella, Castor/Pollux, Procyon, Sirius, Rigel, Aldebaran and back to Capella. Capella is Latin for "She-goat" as Auriga is often depicted as the King sitting in his chariot with a goat on his lap. A whimsical touch to the scene is the three faint stars forming a triangle next to Capella sometimes referred to as the "Kids" (three baby goats). Though shaped like a pentagon, the most southern star of the pentagon is actually Beta Tauri or Alnath, belonging to Taurus the Bull, and making the tip of one of his horns. Still, it will always be a pentagon to me! Capella, magnitude 0.08 (6th brightest star in the sky) is a spectroscopic binary comprised of two yellow giant stars. They weigh in at 7 and 13 solar masses and are separated by 70 million miles, orbiting one another in 104 days.

Auriga has the unique distinction of hosting three fairly

The Backyard Astronomer

Continued from page 3

open star clusters, M36, M37, and M38 that form a somewhat straight line five degrees long. As with every cluster, each has its own personality. Which do you like best? I like M37 for its powdery appearance. A nice quadruple star, 14 Aurigae (SAO 57799) makes a shallow triangle with Alnath and Iota Aurigae. The 11.1, 7.3, and 10.4 magnitude stars are separated by 10, 14.1, and 184.5 arc seconds respectively. My 11" split them all at 165x. Close to 14 Aurigae is Struve 666 (SAO 57836), two equal 8.4 magnitude stars with a separation of 3 arc seconds. The 11" split them at 165x. Finally, Struve 644 (SAO 57704) is a challenging double star near NGC 1778. Its magnitude 6.8 and 7.0 stars are only separated by 1.6 arc seconds. The 11" barely split them at 230x. I think you'll enjoy traipsing through these two constellations to enjoy their deep sky treasures, especially Kemble's Cascade and M37. This time of year, don't forget your electric socks.

Magnetars Part 2

by Henry De Jonge IV

The variety of magnetars

Magnetars come in a variety of "shapes" and play different roles in astrophysics. We now know that soft gamma repeaters, (SGRs) and anomalous x-ray pulsars, (AXPs) are two of the main classes of magnetars with the SGRs being the most active and the AXPs being the least active ends of the magnetar spectrum. In fact the original magnetar model was developed in the early 1990's to explain the behavior of SGRs. In both cases these classes of "young" magnetars generally have spin rates of 2-12s and an age of about 10,000-100,000 years. It is thought that both types are usually, (although not always for AXPs) found in binary star systems and probably involve accretion disks and flow in their outputs. Lately some scientists have considered these classifications of magnetars to be more historical or observer biased rather than true distinctions. More data and observations are needed to clarify this, (sort of like the unified AGN model).

SGR's are thought to be magnetars that have regular gamma ray and softer x-ray flaring activity which is linked to their strong internal magnetic field dissipations. These bursts are usually relatively "soft" and repeating. They are non-thermal and can arise from relativistic magnetized plasma explosions in magnetospheres. A super strong SGR burst, (hyperflare) is sometimes called a fast radio burst, (FRB) and can have the energy equivalent to that of 1/10,000 that of a SN. However FRB's can form from other events like a Type II SN or neutron star mergers, and are on the order of milliseconds, thus making their exact origins difficult to ascertain.

Another interesting, (and new to me) explanation for some weaker SGRs is that they arise from highly magnetized, (although weaker than a magnetar) massive, and fast spinning white dwarfs, (WD). These are called WD pulsars and are a class of magnetized WD, (MWD). It is calculated via observations that MWD comprise about 10% of the known WD population or between 200-500 candidates. The first known WD pulsar was AE Aquarii. Some currently know pulsars are now thought to be WD pulsars and there are undoubtedly more of these objects about.

AXPs are very similar to SGRs but differ in being weaker overall, usually without the giant outbursts, having "softer" x-ray output, low to no gamma rays, and with less noise in their x-ray spectra. They may also have slightly slower spin rates than SGRs and many are thought to not be in binary systems. Still they appear to emit more energy than their slower rotation would predict and thus are called "anomalous".

Most suspect that magnetars in general are accreting matter from a large companion as well as experiencing surface, (and possibly subsurface) disruptions. Another interesting observation, (and question as to why) is that SGRs and AXPs are unusually radio quiet unlike most pulsars, yet they are found in roughly the same places in our galaxy. In 2002 at least one AXP was found to be an SGR. Thus both types of these pulsars are considered magnetars and many scientists have now classified them both under the AXP magnetar label, (model)-obviously the distinction is not fully mature and more data needs to be had.

In summary, there are currently at least 4 possible explanations, (each worthy of their own paper) to explain magnetars including SGRs and AXPs--current, (MHD) magnetar models, accretion models, quark stars, (aka strange stars) and MWDs, with the magnetar MHD model being the most commonly applicable. However this model is not fully accepted. Unfortunately no theory can even explain all the observations of SRGs and AXPs, so that there is a lot of exciting future research to be done on observation, classification, and understanding of magnetars.

One of the most examined magnetars is 1E2259+586, (since the early 1980's) which displayed over 80 x-ray bursts in 2002 and helped lead the way to connect neutron stars with high,

Magnetars Part 2

Continued from page 4

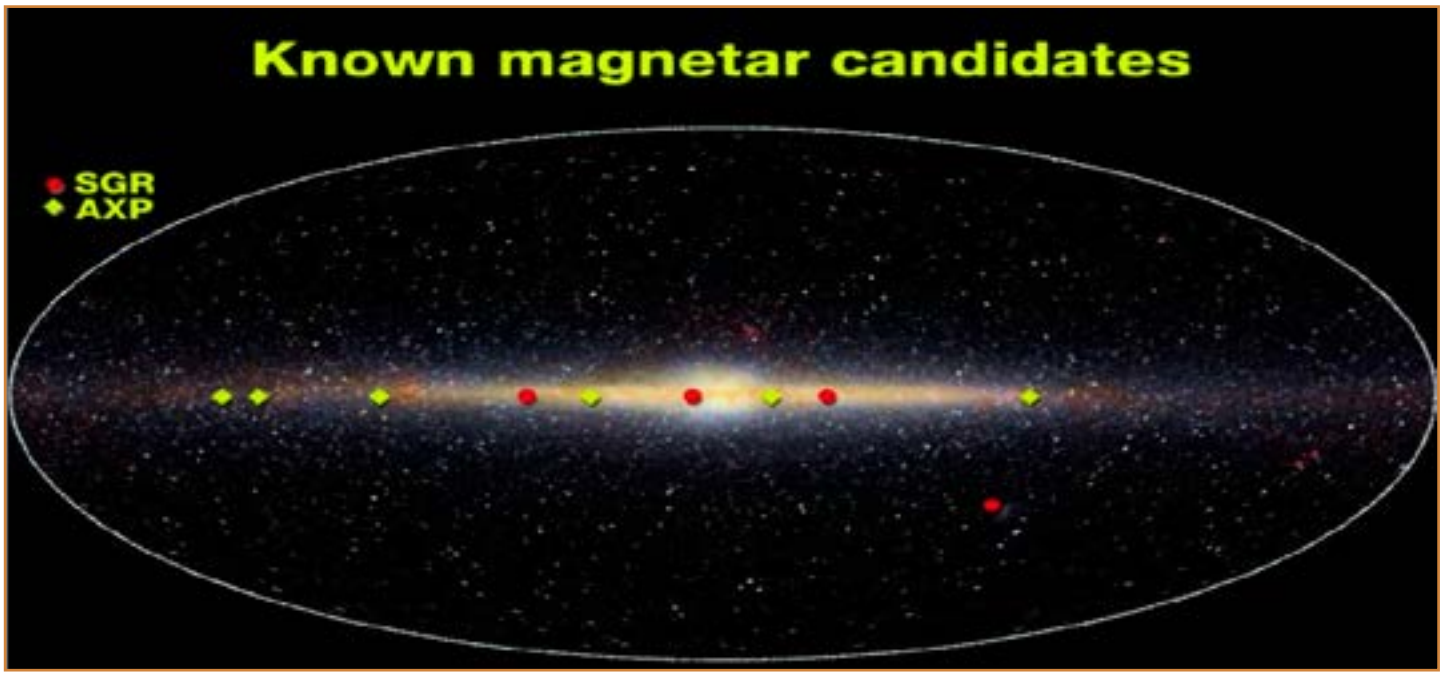


Figure 1: A view of known magnetar candidates in our galaxy - note the distribution in the plane.

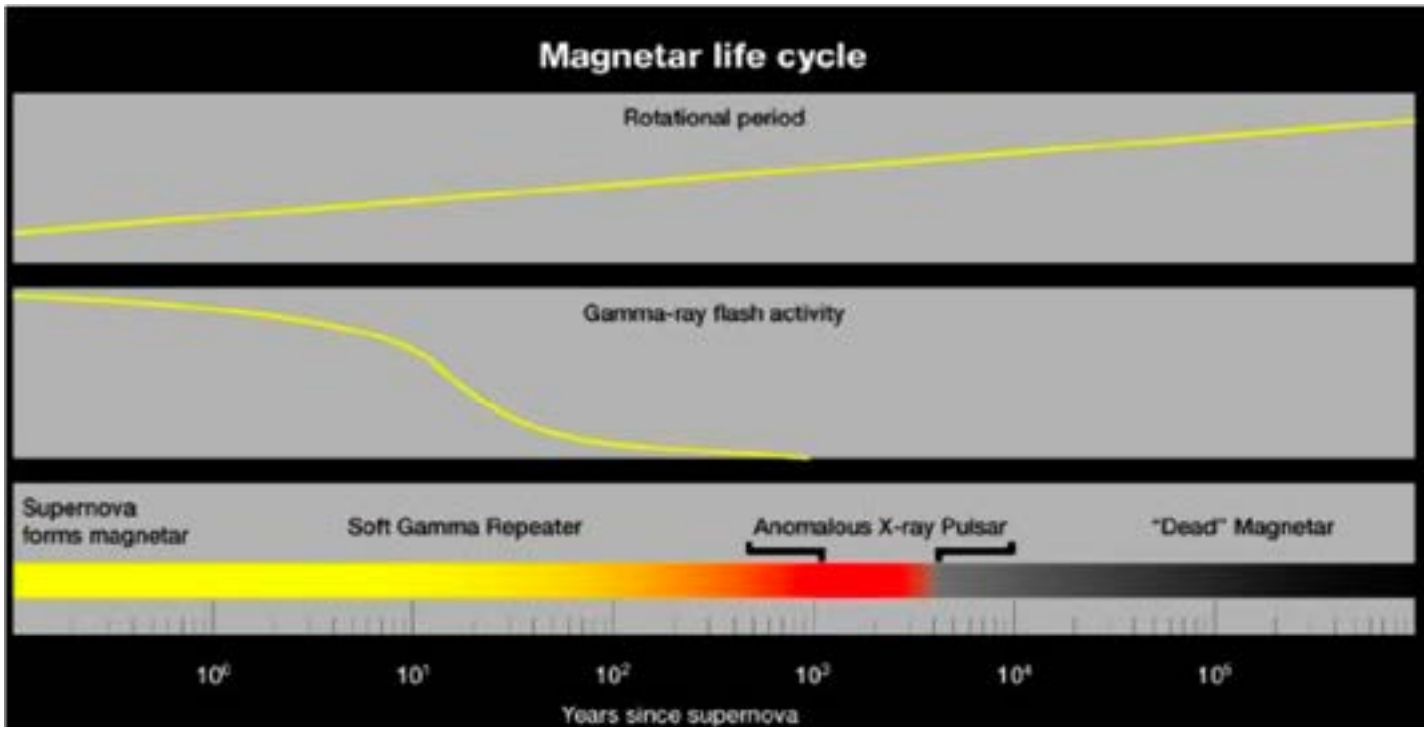


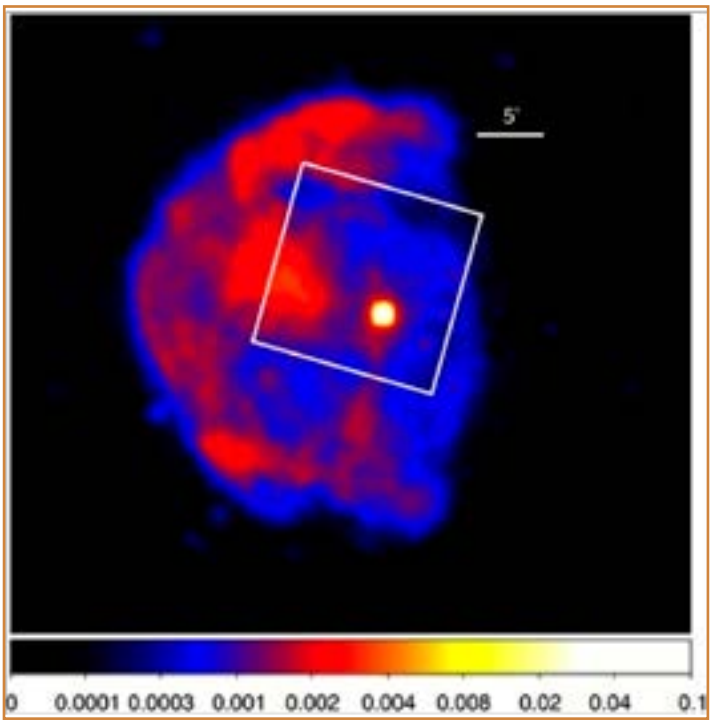
Figure 2: An overview of a possible life cycle of a magnetar.

intense, magnetic fields. It is near the center of a super nova remnant, (SNR- CTB 109) and is about 4 kpc distant. The spin period is about 7 seconds and the magnetic field is calculated to be about 0.5 x 10 to the 14th power-otherwise noted to be on the bottom of the magnetar scale. It has also displayed some powerful glitches, (sudden spin ups of a neutron star) in 2002 and 2007. It is estimated to be about 230,000 years old and is classified as an AXP. Another interesting behavior of some magnetars is called an anti-glitch. An anti-glitch is a sudden slowdown of a neutron star. Magnetar 1E 2259+586 was seen to experience an anti-glitch in 2013, but these activities are very rare and not well understood at all.

The NuStar satellite has discovered a magnetar near the center of our galaxy called SGR J1745-29. It is also thought

Magnetars Part 2

Continued from page 5



F igure 3: ROSAT image of SNR CTB 109 with the white frame showing the NuStar FOV and magnetar 1E 2259+586 as the bright dot

The NuStar satellite has discovered a magnetar near the center of our galaxy called SGR J1745-29. It is also thought to be near SgrA* and is about 8 Kpc distant. It has a 3.76s spin rate and a magnetic field of 1.6 x 10 to the 14th Gauss. By studying the magnetic field of this magnetar under such conditions it may be possible to better understand the gravitational field of our SMBH and also the ISM in the galactic center.

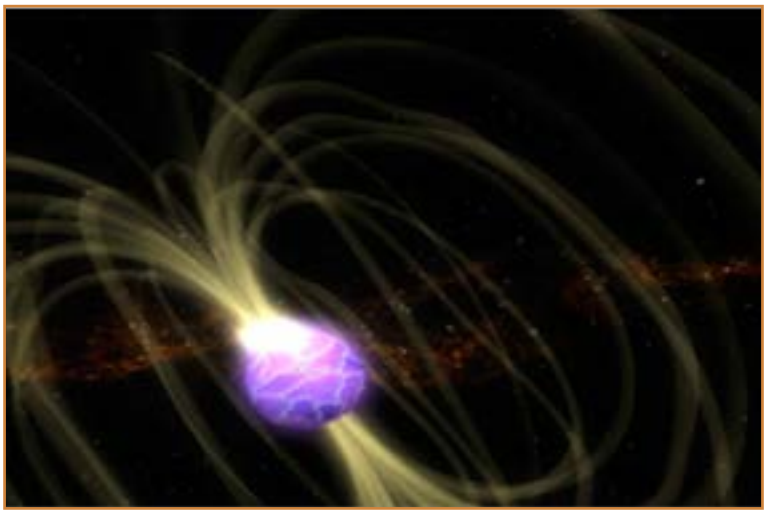


Figure 4: Artistic view of SGR J1745-29

More theory

In the early 1990's a theory about the origin of magnetars came out that proposed the strong magnetic fields came about via a dynamo mechanism. The interior of NS and magnetars has often been modeled as a neutron superfluid, with rapid spin rates and strong magnetic fields. For magnetars this would require a rapid initial rotation of a neutron star with a period of about 1ms. It has been generally accepted for decades that NS have a superfluid, superconducting, inner region in which magnetic fields behave very differently than in regular matter. This would consist of the neutron super fluid and a proton superconducting fluid. However it has been difficult to incorporate superconductivity into the models which mainly involve interactions between the crust and inner core at the boundary. One main reason for the superfluid core model are the seemingly random NS glitches in which the NS is seen to spin up slightly despite its long term gradual spin down process. This is best explained by a transfer of angular momentum from the superfluid core to the crust.

There may also be a period in this lifespan in which the initial field can be "frozen" or buried inside the neutron star while the surface of the neutron star would behave "normally". Sort of a magnetar inside with an anti-magnetar outside. This can be looked at as a fall back period in their life. This submergence of the magnetic field is also thought to be possible in ordinary NS. One such candidate for this unusual phenomenon is the neutron star in SNR Kes 79, (PSR J1852+0040). It spins about 10 times a second with the SNR estimated to be about 6,000 years old. The exact mechanisms for this fallback to occur are not yet understood but may involve accretion, magnetic field interactions, and varying spin rates of the NS.

In most versions of these theories it is accepted that most magnetars need a companion star, (s) in order to accelerate their spin and possibly generate their powerful magnetic fields. Overall the theories support the thought that magnetars are relatively short lived NS due to rapid spin down and magnetic field decay.

In another, (fairly recent) aspect of these strange and powerful objects, some short lived magnetars are thought to be the result of a GRB. In the case of a short GRB this could come about by a merger of 2 compact objects like a NS binary, WD binary, or a NS-WD merger, or the accretion induced collapse of a WD. A long GRB could be produced by a core collapse of a massive star, (collapsar model). In some short GRB there appears an extended emission, (EE) lasting some 2-300s that is thought to be caused by an accretion disc around a magnetar which undergoes a magnetic propellering of sorts. This is caused by the accretion material rotating very, very, fast, (and

Continued from page 6

emitting x-rays) due to the extremely rapid spins of 1-10ms, combined with the powerful magnetic fields, (near 10 to the 15th Gauss) of these systems. Other explanations for the EE are magnetar winds or the rapid spin down rate of these newly formed objects. This short lived magnetar causes the unusual brightness spike, (EE) and delays somewhat the eventual collapse of the stellar remnant into a NS or BH.

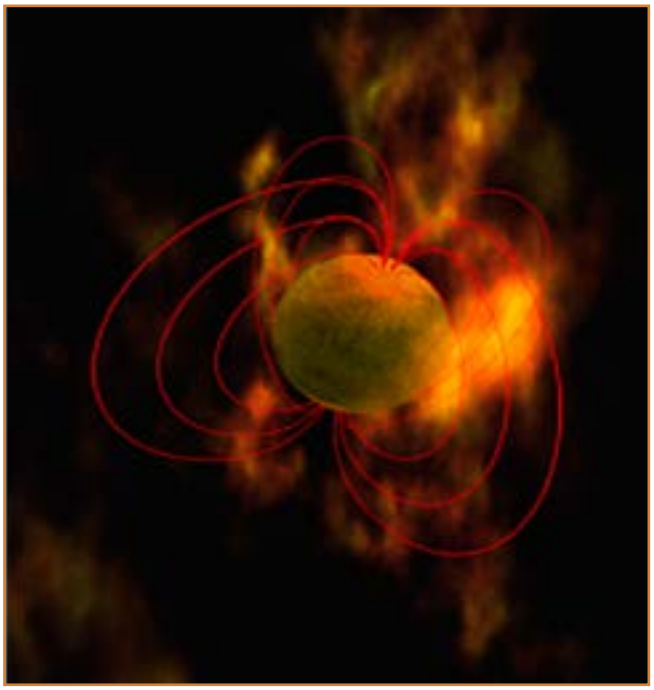


Figure 5: Image of a magnetar with field lines showing.

In another, (fairly recent) aspect of these strange and powerful objects, some short lived magnetars are thought to be the result of a GRB. In the case of a short GRB this could come about by a merger of 2 compact objects like a NS binary, WD binary, or a NS-WD merger, or the accretion induced collapse of a WD. A long GRB could be produced by a core collapse of a massive star, (collapsar model). In some short GRB there appears an extended emission, (EE) lasting some 2-300s that is thought to be caused by an accretion disc around a magnetar which undergoes a magnetic propellering of sorts. This is caused by the accretion material rotating very, very, fast, (and emitting x-rays) due to the extremely rapid spins of 1-10ms, combined with the powerful magnetic fields, (near 10 to the 15th Gauss) of these systems. Other explanations for the EE are magnetar winds or the rapid spin down rate of these newly formed objects. This short lived magnetar causes the unusual brightness spike, (EE) and delays somewhat the eventual collapse of the stellar remnant into a NS or BH.

Overall there are many questions to be answered and mysteries to explain. One major question about how the surface magnetic fields of NS differ from the interior magnetic fields and especially with regards to magnetars. Understanding this would lead to a better NS and magnetar classification scheme. So far mathematical models are the best way we have to probe these secrets. Future detailed observations will help this progress and understanding.

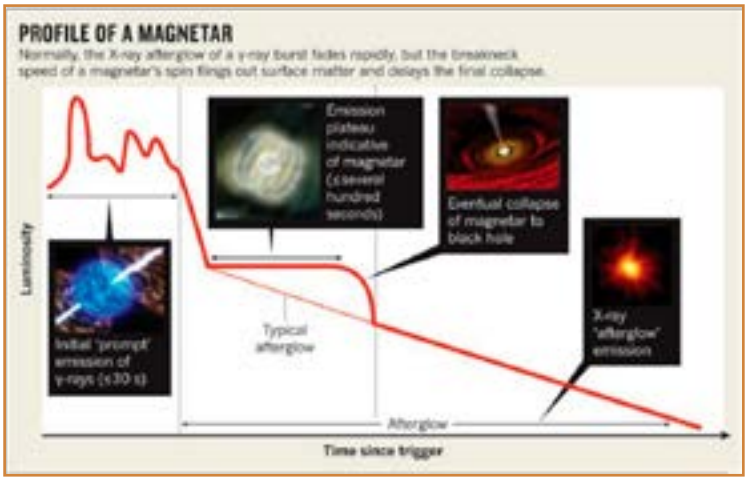


Figure 6: How a magnetar may be briefly formed during a SN outburst that evolves into a BH.

Summary

Basically we have seen that based upon our current understanding, magnetars are usually fairly young, both binary and isolated, (debatable) NS, and possibly MWD, that have outstanding x-ray luminosities which are mainly powered by the gradual decay of their intense magnetic fields and spin. Their pulsating x-ray emissions can go from bright bursts of about 10ms to persistent emissions lasting weeks or months. Their magnetic fields are in the range of 10 to the 14th or 15th power and are the strongest magnetic fields we know of in the universe to date. There are only a little more than 2 dozen known magnetars at this time although many more are suspected.

Their magnetic spectra usually show both a soft and hard component with models suggesting that each is generated by different methods. The hard component may be generated by the surface, (for example via crust deformation) while the hard component is thought to be generated by the magnetosphere, (for example by the breaking and reconnection of magnetic lines). The crustal/interior magnetic field of a magnetar is generally considered to be the stronger of the two.

It appears that perhaps by better understanding the solid state physics of the highly magnetized crust we can better understand these outbursts. However the origins of these hard and soft spectral components are still unknown while the models of magnetar structure and exact composition are very much a work in progress. As we have seen, their high energy

Magnetars Part 2

Continued from page 7

mag magnetic fields and outbursts can be achieved and explained by more than one method, for example by dynamo models, shear instabilities during a compact object merger, or magneto-rotational instabilities during core collapse.

Whatever the final theories about magnetars in the future we know that it will probably involve both the spin rates of these neutron stars, their unique compositions, and the magnetic diploe moment, (magnetic fields) of these rare, strange, surprising, and wonderful objects.

***Full Moon on January 4 at 23:53**

Last Quarter Moon on January 13 at 04:46

New Moon on January 20 at 08:14

First Quarter Moon on January 26 at 23:48

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

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Upcoming Meetings

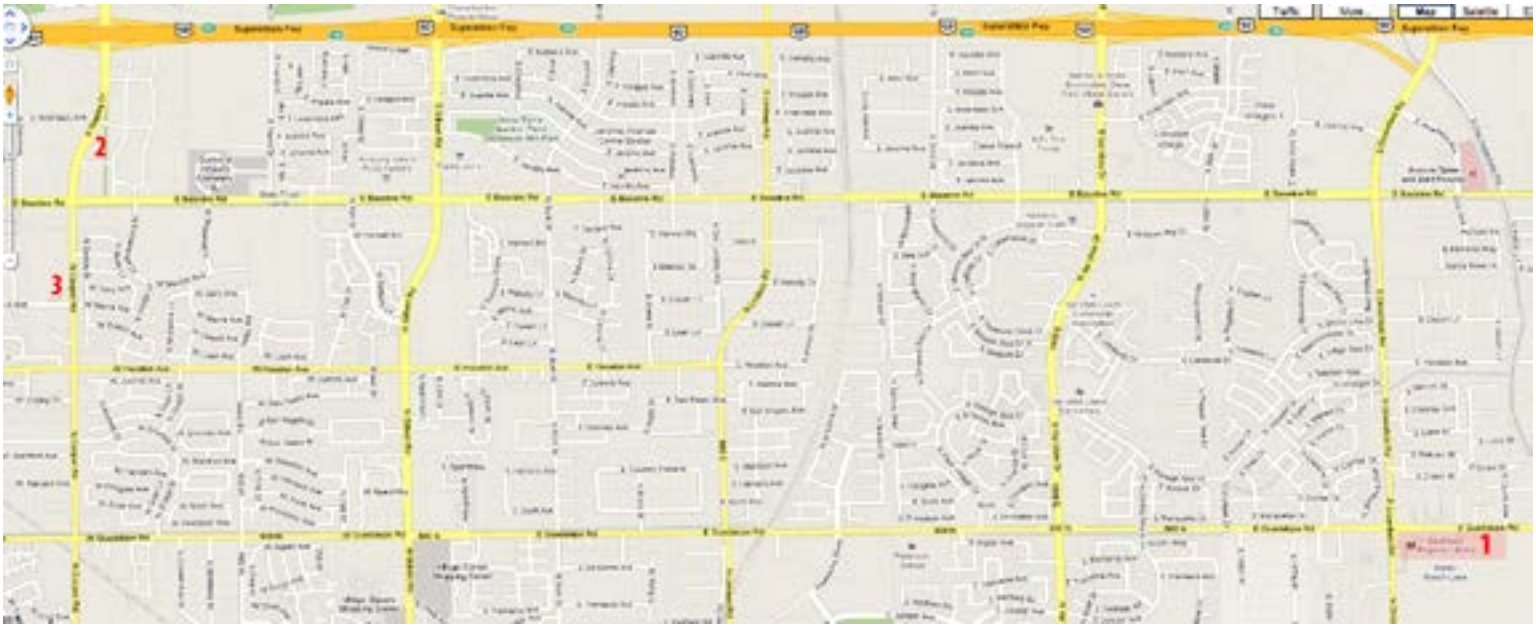
January 16
February 20
March 20
April 17
May 15
June 19
July 17
August 21
September 16

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

January 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	

Jan 9 - Public Star Party

Jan 16 - EVAC Monthly Meeting

Jan 17 - Local Star Party

Jan 20 - Charlotte Patterson Elementary

Jan 21 - Red Mountain Ranch Elementary

Jan 22 - Irving Elementary

Jan 24 - Deep Sky Star Party

Jan 27 - Concordia Charter School

Jan 28 - Assist GRCO

Jan 29 - Riggs Elementary

February 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

Feb 2 - Payne Junior High

Feb 4 - Navarrete Elementary

Feb 5 - Wilson Elementary

Feb 12 - C.O. Greenfield School

Feb 13 - Public Star Party

Feb 14 - Local Star Party

Feb 17 - Carol Rae Ranch Elementary

Feb 18 - Kyrene Middle School

Feb 19 - Knox Elementary

Feb 20 - EVAC Monthly Meeting

Feb 21 - Deep Sky Star Party

Feb 26 - Sousa Elementary School

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: ☐

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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? ☐

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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.

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