

THE OBSERVER

East Valley Astronomy Club

From the Desk of the President by David Douglass

Wow! What a month. GRCO (and thus EVAC) received write-ups in at least six different periodicals this past month. Pictures, interviews, and on site-observations by most. All very good press for both GRCO and EVAC.

Then came the big event, the Eclipse. But just before the eclipse, there were star parties, to include the City of Chandler event, which included solar observations, and evening objects as well.

I don't think anyone was prepared for what happened on Sunday, May 20th. We knew there would be a good turnout, and were expecting quite a few people. But, a thousand? That was one estimate, following the event.

Claude Haynes did a TV spot with Channel-3 on the eclipse, and received excellent reviews.

Channel 3 gave us a link to the segment for web viewing, and most everyone enjoyed viewing it.

Channel 10 actually came out to the GRCO, and reported live from the scene during their news coverage. Their filming gave us all a good look at the crowds. It was unbelievable.

A "Well Done" goes to observatory manager Dave Coshow, and his entire group of volunteers. The EVAC turnout for this event was fantastic. And at the end of the day, everyone went home tired. A large "Thank You" to everyone who participated.

And it's not over yet. On Tuesday, June 5th, we have the Venus Transit, and again, we expect a large crowd. Probably not anywhere near the size the eclipse crowd, but still, it should be a well attended event. And the

Continued on page 5

UPCOMING EVENTS:

Public Star Party - June 8

Local Star Party - June 9

General Meeting - June 15

Deep Sky Observing - June 23

Check out all of the upcoming club events in the Calendars on page 8

INSIDE THIS ISSUE:

The Backyard Astronomer Attacking the June Sky with 7x50 Binoculars by Bill Dellings

From time to time it's nice to give the telescope a rest, grab the old 7x50's and cruise around the night sky.

This "lowly" instrument gives us two advantages over a telescope: a wide field of about 7° and the ability to use both our eyes as nature intended.

Let's work our way across the June firmament from west to east hitting just a few of its many splendors. For this article, a Vixen 7x50mm Foresta with a 7° real field was utilized.

Why not a larger glass? Simply, the 7x50 (or 10x50) is a more common binocular owned by stargazers than

"giant" class models and offers the largest real field.

I recommend using the binoculars on a tripod, as I did for the following observations. For objects near the zenith, you may want to hand hold the binoculars or tilt the tripod back on two of its legs.

High overhead in the void between Leo and Bootes lies Mel (Melotte) 111, the Coma Berenices star cluster. The cluster is 288 light years away, making it the third closest cluster to us after the Big Dipper stars and the Hyades. Being relatively close by, it's huge in angular diameter,

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The Backyard Astronomer

Continued from page 1 just fitting its roughly thirty-five, 4th and 5th magnitude stars in the binoculars 7° field.

Before Coma Berenices (Berenice's Hair) was created by Gerardus Mercator in 1551, this hazy patch of stars was considered by the Greeks to be the tuft of hair at the end of Leo's tail. You can use Beta and Gamma Comae Berenices (the two top stars in the constellation) to guide you east one binocular field to M3, a globular star cluster in Canes Venatici, The Hunting Dogs. M3 will only be a small amorphous blob in the binoculars. But consider the small blob is the aggregate light of a half million stars. The 6th magnitude globular is 32,000 light years away.

Below Coma Berenices lies Virgo, the Virgin. This is the second largest constellation after Hydra, The Water Snake. Except for 1st magnitude Spica, Virgo's stars are dim and a challenge to trace out. If you can identify the top stars near its east side, 110, 109, and Tau Virginis, you can follow that line east 4° and scoop up M5, another globular star cluster, 26,000

light years away. M5 is actually in Serpens Caput, The Serpent. Two arc minutes to its southeast is 5th magnitude 5 Serpentis, a handy marker and fine double star (AB 5.1, 10.1, separation 11.4') though not resolvable in 7x50 binoculars.

Facing north, Draco can be spied winding itself over the top of the Little Dipper, Ursa Minor. The faintest star in the quadrilateral representing the Dragon's head is Nu Draconis or Kuma, a pretty double star. Its two 5th magnitude white stars are a generous 62" apart and easily split in the 7x50 binoculars. At this low power, they exhibit a delicate intriguing look, like cat's eyes in a dark alley; how appropriate, as Draco also contains NGC 6543, the Cat's Eye Nebula, beyond the grasp of our binoculars. The two stars are 100 light years away and separated by 2,300 Astronomical Units. Let's knock off two more doubles while in the area. Fifteen degrees east of Kuma is brilliant Vega, brightest star in Lyra, the Lyre. Sci-Fi buffs may recall Vega was the star Jodie Foster traveled to in the movie "Contact." Less than 2° northeast of

Vega is Epsilon Lyrae, the famous "Double-Double" multiple star. While it takes a telescope to see all 4 stars, binoculars will easily resolve Epsilon 1 and 2, which are a generous 3.5' apart. In fact, eagle eyed observers can split the pair with the naked eye. Can you? Zeta Lyrae, the closest of Lyra's parallelogram stars to Vega, can also be split. Its magnitude 4.4 and 5.7 stars have a separation of 43.7".

Now face south and seek out the northern section of Ophiuchus, the Serpent Holder, low in the southeast. There are three open star clusters running west-east that beg to be observed with wide field optics. A degree above Beta Ophiuchi is I.C. 4665, a small group of 30, 7th magnitude stars.



This is perhaps the best of the trio. Moving east ten degrees (use 71 and 72 OPH as guide stars) you will sweep up NGC 6633, a slightly smaller, dimmer cluster of 26 stars. Three degrees southeast of NGC 6633, in Serpens, the Serpent, is the largest of the three clusters, I.C. 4756. This sparse shotgun blast of 80 stars is two moon diameters wide – the 7° field of

the binoculars really pays off here. All three clusters are about 1,000 light years distant. Serpens is the only constellation that is divided into two parts.

Later in the evening as Scorpius rises, two jewels slide into target range. Just above Antares is 22 SCO. Two degrees above that star is Rho Ophiuchi, a quadruple multiple star. The 7x50's will reveal 3 of its stars in a cute tight triangle of 5th and 7th magnitude stars. It takes a telescope to split the 3.1" AB pair. Let's finish up with grand M7, just east of the scorpion's stinger (and the most southern Messier object). God created this star cluster for binocular owners. This is a big, bright cluster! It can be seen naked eye in a moderately dark sky, appearing like a detached piece of Milky Way. The object is glorious in any kind of optical equipment. Though the 7x50 does an admirable job here, try observing M7 in 10x70mm or 20x100mm giant binoculars for a mind blowing experience. You might find yourself on Vega with Jodie Foster.

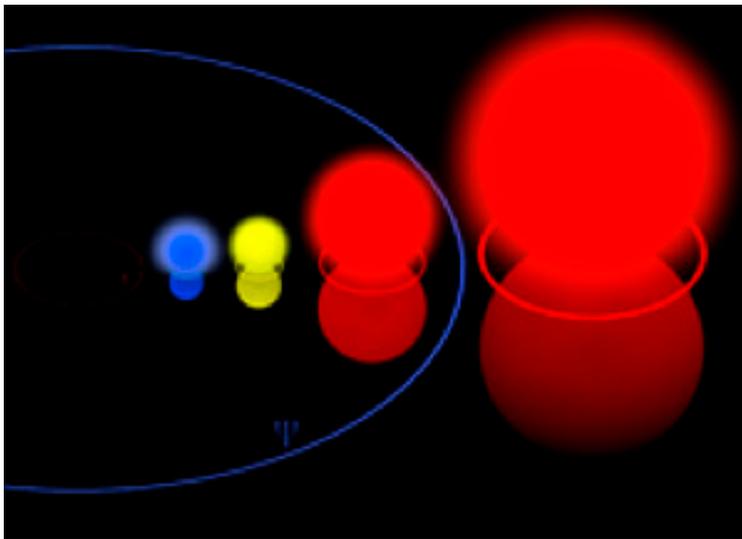
VY Canis Majoris

by Henry De Jonge IV

Introduction

Awhile back I read and also heard on TV that the largest star that we knew of was a star called VY Canis Majoris. This intrigued me so that I thought to investigate things further and learn more. This inquiry, as usual, proved more interesting than first imagined.

VY Canis Majoris, (VY CMa) is a very large, evolved, single system, massive star, classified as a variable red supergiant. It has a period of about 2,000 days and resides in the constellation Canis Major. Large stars such as this play an important role in our Universe with their vast energy output, strong winds, and eventual SN explosions. We know that a stars life is inversely proportional to its mass-that is the greater the mass the shorter the lifespan. Stars as massive as VY CMa which is about 25 solar masses at present, (but may have been born at about 40 solar masses) are expected to only live about 10 million years or so. Due to these relatively short life spans, these massive stars are also somewhat rare, especially in the present age of our Universe, (they were much more common in the early Universe). VY CMa gives us a unique opportunity to study such massive stars near the end of their lives.



From right to left: VY CMa, Betelgeuse, Rho Cassiopeia, Pistol Star, and the orbits of Jupiter and Neptune. The sun is too small to be seen at this scale.

The Star

VY CMa is one of the most studied red supergiants, yet there are still many things we are not certain of. Its distance has been measured via annual trigonometric parallax to be about 1.14 to 1.2 kpc. However other estimates can take this out to 1.5 kpc for example, if it is assumed to be a member of star cluster NGC 2362 and using the color magnitude method of distance calculation. Still using another method known as statistical parallax, its distance is determined to be about 1.4 kpc. For most calculations astronomers use the 1.5 kpc number.

Its bolometric magnitude is generally assumed to be about 300,000 times that of the sun, however this also is not com-

pletely certain and has ranged from 200,000-500,000 times that of the sun to only 60,000 times that of the sun. This corresponds to a surface temperature of about 3650 degrees K on average. The actual radius of the star is estimated to be 1800-2100 times that of the sun and if placed in the center of our solar system would extend to at least the orbit of Mars and probably out to Saturn. It is estimated that VY CMa is already about 8.2 M years old.

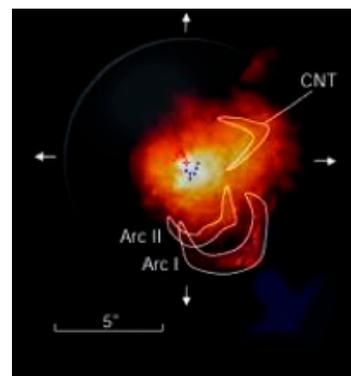
The reason for all this uncertainty is that from earth the star appears to be surrounded by a huge asymmetrical, dusty, reflection nebula with some degree of polarization, (as are most reflection nebula). Thus VY CMa is highly obscured by a huge circumstellar cloud of gas and dust and only about 1% of the total luminosity is detected at visible wavelengths. Therefore to study this star more seriously we must resort to other wavelengths such as in the IR and radio regions. This large circumstellar shell surrounding VY CMa has been studied extensively in such ranges, especially in the 1 mm range. These studies have shown that the envelope surrounding VY CMa contains a great variety of elements and compounds. In one study of VY CMa, (done on Mt Graham in AZ) 128 emission lines were detected in the outer envelope including an abundance of O, (a relatively O rich envelope) SiO₂, SiS, and at least 6 different C molecules, for a total of over 18 different molecules, with good old NaCl, and H₂O added in.

These types of massive stars during their lives can shed off very large amounts of mass into the ISM. It is estimated that VY CMa loses about 1/30,000 solar masses per year due to shedding its outer envelop and from its strong stellar winds, (super winds).

One lingering question about red supergiants is that theory



VY CMa with gas ejecta



VY CMa with various components of its circumstellar cloud

predicts them to be at a certain position on an HR diagram, (a plot of luminosity Vs temperature) however according to observation red supergiants seem to be too cool and too luminous for this theoretical, (modeled) position. The exact position of VY CMa on the HR diagram is still a matter of debate. Much of this is due to uncertainty in measuring its effective temperature and its exact distance, made more difficult by its vast circumstellar surroundings. Due to this feature of such stars, measuring the exact distances to the few known red

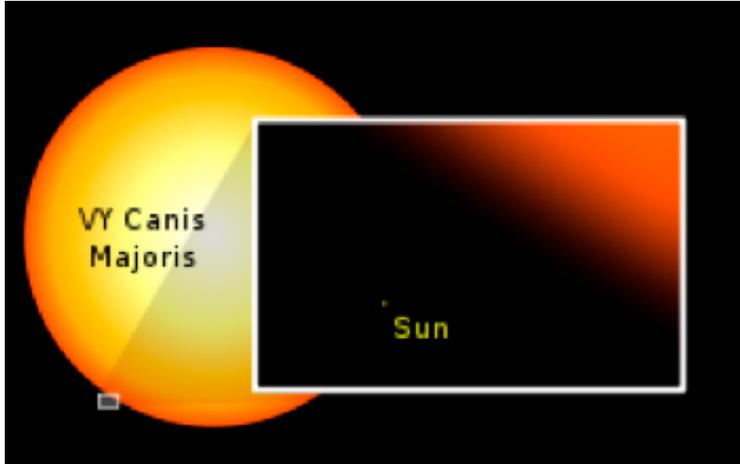
Continued on page 4

VY Canis Majoris

Continued from page 3

supergiants is very difficult. By a more accurate placement of such stars on an HR diagram, more details about their properties and evolution could be derived.

We see that there are many things in the late life of such massive stars and their influence that are still uncertain and awaiting discovery.



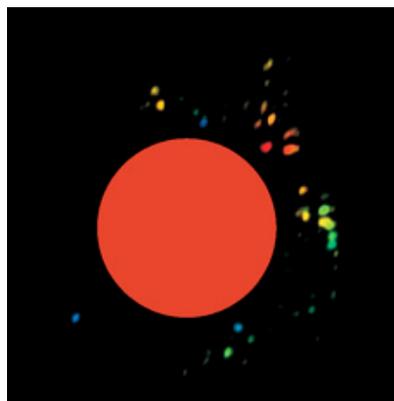
Comparison of VY CMa and our Sun

Masers

It has been reported via radio astronomy observations that water masers have been detected around VY CMa, and their motions studied. SiO and OH maser emission has also been observed in the circumstellar envelope. These masers via their proper motions, (using the time delay between changes and the angular diameter of the source) also confirm that the upper limit to its distance is about 1.5 kpc.

Masers are not uncommon around such red giant stars and by measuring the maser parameters such as distribution, composition, direction, velocity, and polarization, one can get a better reading of the exact position and distance of the central star, its proper motion, and derive some of its outer shell properties. Using the distribution of masers surrounding VY CMa, (which was fairly irregular) the central position of the star was determined to less than 10 mas, (milli arc seconds or about 15AU at its distance)

The masers detected surrounding VY CMa were found to have velocities in the tens of km/sec and also were widely spaced about the star. They would also appear and disappear over time, (usually in terms of months or years). Interestingly enough the masers were found to point both inward to the star and flow outward, (circumstellar dynamics at work or masers on the other side of the star pointing towards it?). By



SiO maser images around a star's outer envelope

studying the masers we have learned a great deal about the outer envelope of this star, for example not detecting any dominant bipolar flows but indicating more of a slow, partly spherical, outflow. The study and application of masers in all these areas is still young and incomplete.

In general a maser can be produced by various molecules. This is when electrons in the molecule are pumped up from a lower energy state into a higher, longer lived metastable state. The electrons can then move downward back to a lower energy state when a photon stimulates it with energy equal to the difference in energy between the two states. Basically one energy level of a molecule becomes preferentially populated by the incoming radiation and the molecule cools by stimulated emission. Then the original photon and the emitted photon will both travel in the same direction and will also be in phase thus amplifying the radiation.

Many times the astronomical object itself will be called a maser when it is really just the radio emission from particular molecules. Water, OH, (hydroxyl radical) and SiO and other molecules can produce maser emission. Since the emission is amplified it makes it easier to detect. There are over 10,000 maser examples in our Galaxy and they commonly occur in stellar nurseries, the outer atmospheres of large stars, of variable stars, and around stars with high mass loss such as SN, and stars generating planetary nebula. Masers are also found in many galaxies and especially in active galaxies, and AGN.

The Future and Conclusions

We know that VY CMa is one of the largest and most luminous red hyper giant stars in our galaxy. Since the lifetimes of such massive stars in this late phase is only in the 10's of thousands of years this star has been and will continue to be extensively studied. There is little doubt that VY CMa will go SN, (HN?) in the relatively near astrophysical future.

In the future it is hoped that more precise measurements of its distance, circumstellar atmosphere, and surface temperature will enable more accurate stellar models and a better understanding of stellar evolution. We have seen that measuring these parameters of red hyper giant stars is made more difficult because of their variable nature and all the dust and gas surrounding the star. These types of red variable supergiant stars play a crucial role in the chemical and physical evolution of the ISM. Thus VY CMa gives, (and will continue to give) us rare and unique opportunities to learn a great deal more about stars, their evolution, and the ISM.



HST image of VY CMa in visible light and polarized light

June Guest Speaker: David A. Williams

Dr. David A. Williams is a Faculty Research Associate in the School of Earth and Space Exploration at Arizona State University, Tempe, Arizona.

Dr. Williams is the Director of the NASA Regional Planetary Image Facility at ASU and the NASA Planetary Aeolian Laboratory at the Ames Research Center in California.

David is currently performing research in volcanology and planetary geology, with a focus on planetary mapping, geochemical, and remote sensing studies. His research has included computer modeling of seismic wave propagation through planetary interiors, visible and near-infrared spectroscopy of the lunar surface, planetary geologic mapping of the satellites of Jupiter and the planet Mars, computer modeling of the physical and geochemical evolution of lava flows in a variety of planetary environments, and petrologic study of lava samples from Mount St Helens.

He was involved with NASA's Magellan Mission to Venus and Galileo Mission to Jupiter. He is a Co-Investigator on the European Space Agency's Mars Express orbiter mission, and

he is currently serving as a Participating Scientist on NASA's Dawn Mission to asteroid 4 Vesta. David is the immediate Past Chair of the Planetary Geology Division of the Geological Society of America, has served on several NASA committees including the 2007 Jovian System Observer Science Definition Team, and is currently a steering committee member of the NASA Outer Planets Advisory Group.

Dr. Williams will give us a presentation on Asteroids, Ion Propulsion, and NASA's Dawn Mission to Vesta.



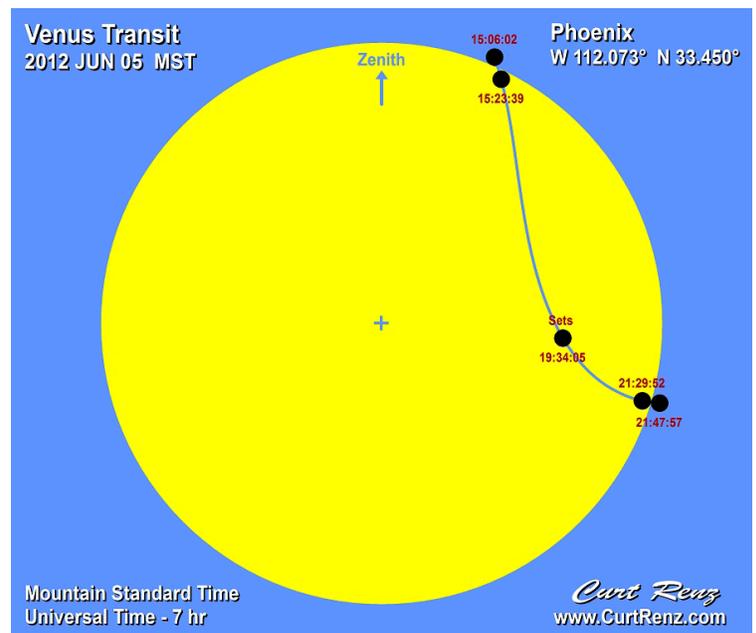
From the Desk of the President

Continued from page 1 GRCO group, along with fellow EVAC members are ready.

The Venus transit begins at around 3:00 in the afternoon, and lasts until sunset, about 7:30. If you have some time available, come on out to the GRCO, and enjoy.

Remember the solar glasses, or solar viewers (boards), or solar film for the cameras, and telescopes.

And remember too, that to see it, you have to "keep looking up".



● FULL MOON ON JUNE 4 AT 04:12

◐ LAST QUARTER MOON ON JUNE 11 AT 03:42

○ NEW MOON ON JUNE 19 AT 08:03

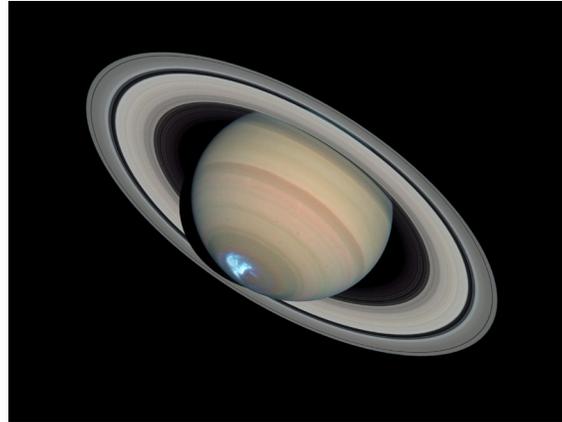
◑ FIRST QUARTER MOON ON JUNE 26 AT 20:31

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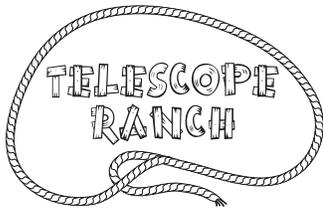


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Upcoming Meetings

June 15

July 20

August 17

September 20

October 19

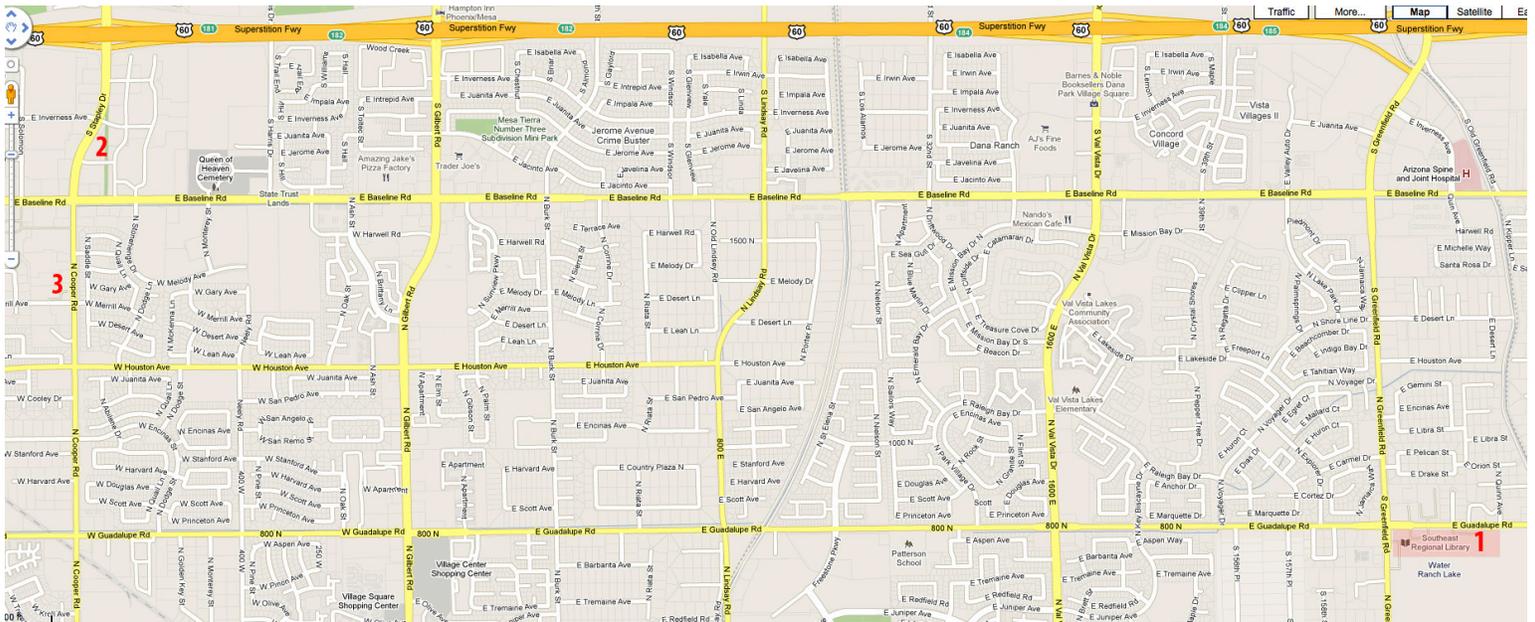
November 16

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



JUNE 2012

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

June 5 - Venus Transits the Sun

June 8 - Public Star Party & SkyWatch

June 9 - Local Star Party at Boyce Thompson

June 15 - General Meeting at SE Library

June 23 - Deep Sky Observing Night

JULY 2012

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	31				

July 13 - Public Star Party & SkyWatch at Riparian Preserve

July 14 - Local Star Party at Boyce Thompson

July 20 - General Meeting at SE Library

July 21 - Deep Sky Observing Night

East Valley Astronomy Club -- 2012 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):

<input type="checkbox"/> \$30.00 Individual January through March	<input type="checkbox"/> \$22.50 Individual April through June
<input type="checkbox"/> \$35.00 Family January through March	<input type="checkbox"/> \$26.25 Family April through June
<input type="checkbox"/> \$15.00 Individual July through September	<input type="checkbox"/> \$37.50 Individual October through December
<input type="checkbox"/> \$17.50 Family July through September	<input type="checkbox"/> \$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: <input style="width: 300px; height: 25px;" type="text"/>	Phone: <input style="width: 300px; height: 25px;" type="text"/>
Address: <input style="width: 300px; height: 25px;" type="text"/>	Email: <input style="width: 300px; height: 25px;" type="text"/>
City, State, Zip: <input style="width: 250px; height: 25px;" type="text"/>	<input type="checkbox"/> Publish email address on website URL: <input style="width: 300px; height: 25px;" type="text"/>

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):

<input type="checkbox"/> General Observing	<input type="checkbox"/> Cosmology
<input type="checkbox"/> Lunar Observing	<input type="checkbox"/> Telescope Making
<input type="checkbox"/> Planetary Observing	<input type="checkbox"/> Astrophotography
<input type="checkbox"/> Deep Sky Observing	<input type="checkbox"/> Other

Please describe your astronomy equipment:

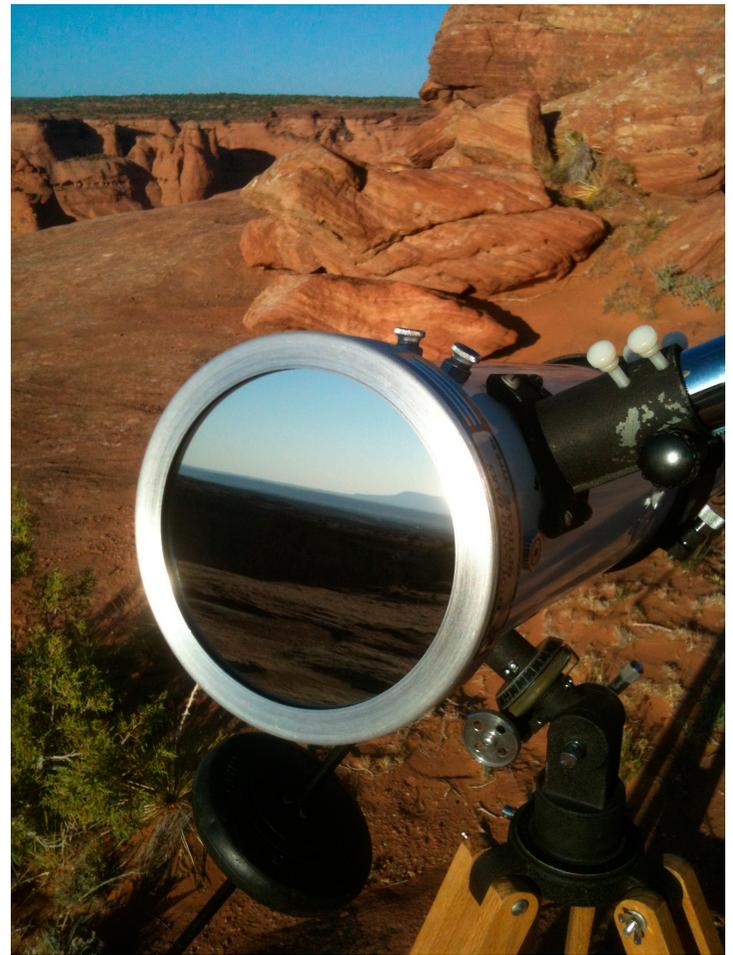
Would you be interested in attending a beginner's workshop? Yes No

How did you discover East Valley Astronomy Club?

**PO Box 2202
Mesa, AZ 85214-2202
www.evaonline.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.

Eclipse Photos by Steven Aggas

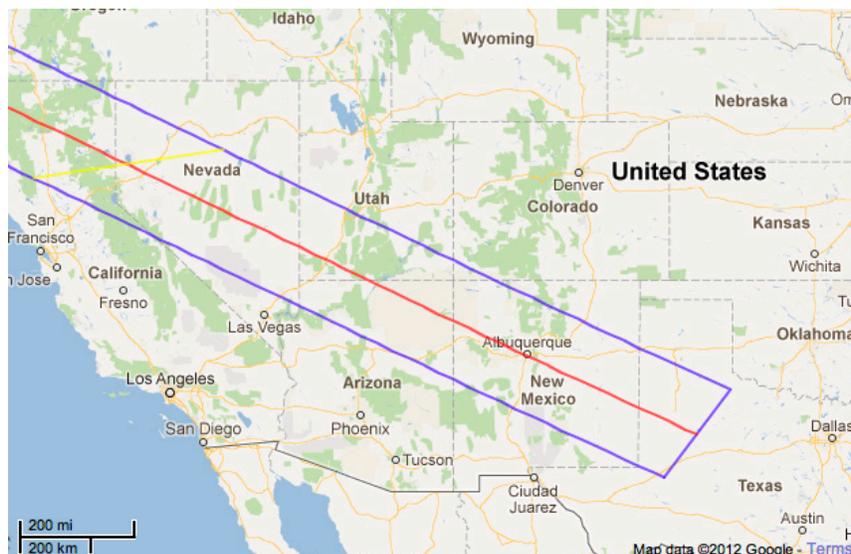


An annular solar eclipse took place on May 20, 2012, with a magnitude of 0.9439.

A solar eclipse occurs when the Moon passes between Earth and the Sun, thereby totally or partially obscuring the image of the Sun for a viewer on Earth.

An annular solar eclipse occurs when the Moon's apparent diameter is smaller than the Sun, causing the Sun to look like an annulus (ring), blocking most of the Sun's light. An annular eclipse appears as a partial eclipse over a region thousands of kilometres wide. This is also known as Ring of Fire.

The annular phase was visible from the Chinese coast, northern Taiwan, the south of Japan, and the western part of the United States. Guangzhou, Taipei, Tokyo and Albuquerque were on the central path. Its maximum occurred in part of the North Pacific, south of the Aleutian islands for 5 min and 46.3 s, and finished in the western United States.



Thank Goodness for Magnetism

by Dr. Tony Phillips

Only 93 million miles from Earth, a certain G-type star is beginning to act up.

Every 11 years or so, the solar cycle brings a period of high solar activity. Giant islands of magnetism—"sunspots"—break through the stellar surface in increasing numbers. Sometimes they erupt like a billion atomic bombs going off at once, producing intense flares of X-rays and UV radiation, and hurling massive clouds of plasma toward Earth.

This is happening right now. Only a few years ago the Sun was in a state of deep quiet, but as 2012 unfolds, the pendulum is swinging. Strong flares are becoming commonplace as sunspots once again pepper the solar disk. Fortunately, Earth is defended from solar

storms by a strong, global magnetic field.

In March 2012, those defenses were tested.

At the very beginning of the month, a remarkable sunspot appeared on the Sun's eastern limb. AR1429, as experts called it, was an angry-looking region almost as wide as the planet Jupiter. Almost as soon as it appeared, it began to erupt. During the period March 2nd to 15th, it rotated across the solar disk and fired off more than 50 flares. Three of those eruptions were X-class flares, the most powerful kind.

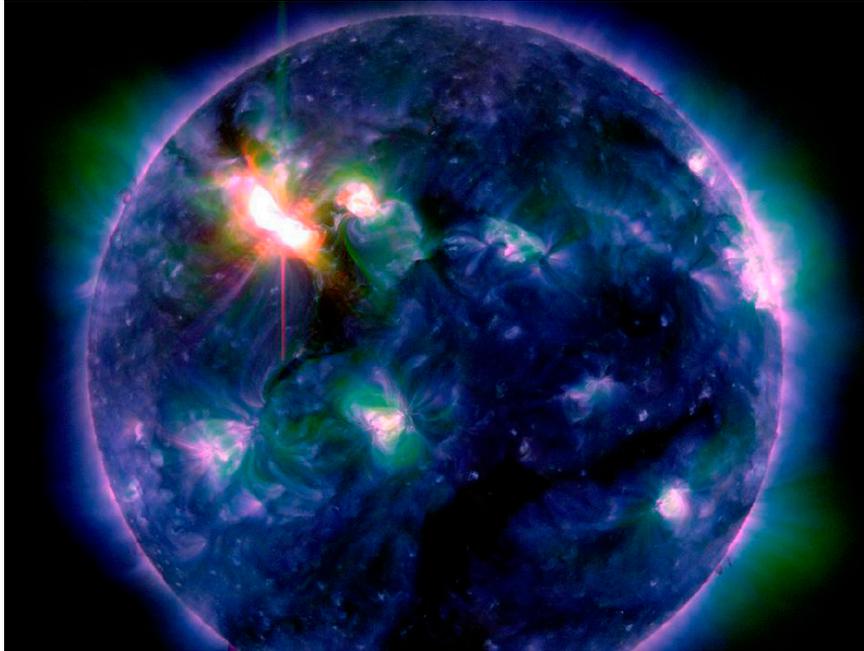
As the eruptions continued almost non-stop, Earth's magnetic field was buffeted by coronal mass ejections or "CMEs." One of those clouds hit Earth's magnetosphere so hard, our planet's magnetic field was sharply compressed, leaving geosynchronous satellites on the outside looking in. For a while, the spacecraft were directly exposed to solar wind plasma.

Charged particles propelled by the blasts swirled around Earth, producing the strongest radiation storm in almost 10 years. When those particles rained down on the upper

atmosphere, they dumped enough energy in three days alone (March 7-10) to power every residence in New York City for two years. Bright auroras circled both poles, and Northern Lights spilled across the Canadian border into the lower 48

states. Luminous sheets of red and green were sighted as far south as Nebraska.

When all was said and done, the defenses held—no harm done. This wasn't the strongest solar storm in recorded history—not by a long shot. That distinction goes to the Carrington Event of September 1859 when geomagnetic activity set telegraph offices on fire and sparked auroras over Mexico, Florida, and Tahiti. Even with that in mind, however, March 2012 was remarkable



Multiple-wavelength view of X5.4 solar flare on March 6, captured by the Solar Dynamics Observatory (SDO) in multiple wavelengths (94, 193, 335 angstroms). Credit: NASA/SDO/AIA

It makes you wonder, what if? What if Earth didn't have a magnetic field to fend off CMEs and deflect the most energetic particles from the Sun.

The answer might lie on Mars. The red planet has no global magnetic field and as a result its atmosphere has been stripped away over time by CMEs and other gusts of solar wind. At least that's what many researchers believe. Today, Mars is a desiccated and apparently lifeless wasteland.

Only 93 million miles from Earth, a G-type star is acting up. Thank goodness for magnetism.

With your inner and outer children, read, watch, and listen in to "Super Star Meets the Plucky Planet," a rhyming and animated conversation between the Sun and Earth, at <http://spaceplace.nasa.gov/story-superstar>.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

If It's Clear...

by *Fulton Wright, Jr.*

Prescott Astronomy Club

JUNE 2012

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 arcminutes in diameter. All times are Mountain Standard Time.

It is hard to believe you can STILL see comet C/2009 P1 (Garradd). You can, but it is getting pretty dim now. You will want at least a medium (6 inch) telescope and dark skies. See Astronomy magazine, June 2012, p. 42 for a finder chart.

On the night of Sunday, June 3, at 7:10 PM (29 minutes before sunset) the full Moon rises spoiling any chance of seeing faint fuzzies for the night. The Moon is near perigee so it will look especially big. The next few days will be a good time to look at the south planetary-east part as libration tips it toward us. The big show is after midnight (so actually on June 4), when you can see a partial eclipse. Here is the schedule:

- 1:51 AM Moon enters penumbra (not observable).
- 2:20 AM (approximate) First hint of penumbral phase visible.
- 3:03 AM Moon enters umbra (partial phase starts).
- 3:33 AM Astronomical twilight starts.
- 4:04 AM Maximum eclipse (38% of Moon in umbra).
- 4:12 AM Nautical twilight starts.
- 4:48 AM Civil twilight starts.
- 5:06 AM Moon leaves umbra (partial phase ends).
- 5:17 AM Sun rises.
- 5:27 AM Moon sets.

On Tuesday, June 5, you can see a transit of Venus. At 3:06 PM the planet just touches the disk of the Sun (1st contact). By 3:24 PM the planet will be completely in front of the Sun's disk (2nd contact). The transit will still be in progress when the Sun sets at 7:40 PM. You don't have to travel anywhere to

see it (although you might want to travel to avoid clouds), but you will want optical aid (binoculars or a telescope) and will need a real solar filter on the front of your binoculars or telescope (or in front of your eyes if you want to try to see the 1 arc minute black dot on the 30 arc minute Sun). This is not an especially spectacular event, but it is an especially rare one. You are unlikely to be able to view the next one on December 11, 2117.

On Sunday, June 10, the Moon is at last quarter phase and rises at 12:21 AM (June 11).

On Sunday, June 17, about 4:45 AM, you can see (top to bottom) Jupiter, the Moon, and Venus huddled barely above the east-northeast horizon.

On Monday, June 18, it is new moon and you have all night to hunt for faint fuzzies.

On Wednesday, June 20, the summer solstice occurs. Long, hot days, short warm nights.

On Tuesday, June 26, the Moon is at first quarter phase and sets at 12:08 AM (June 27).

On Friday, June 29, Pluto is at opposition. That means that any time this month or next is a good time to find our most famous non-planet. Sky & Telescope, June 2012, p. 52 has a finder chart.

On Saturday, June 30, Mercury is at greatest eastern elongation. This is not a particularly good one, but if you want to give it a shot, start looking about 8:15 PM, low in the west.

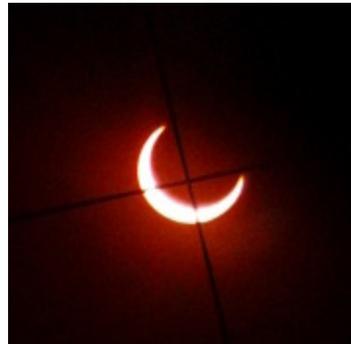
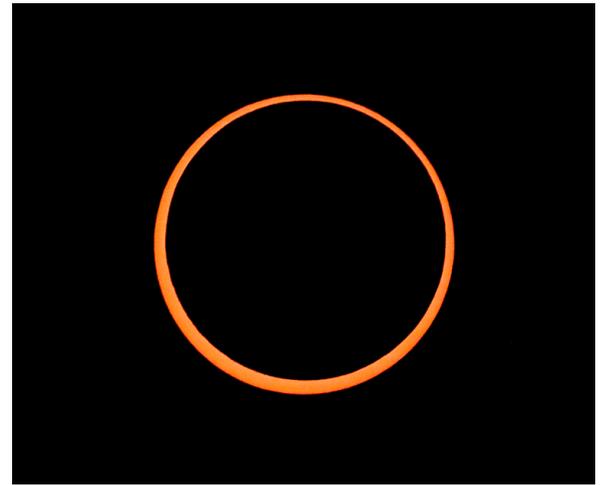
Looking for that perfect weekend activity?

Why not resolve to getting involved?

Contact Dave Coshow to join the staff at GRCO

Email: grco@evaonline.org

Annular Eclipse Photos



Photos courtesy of EVAC members

Frank Pino
Chris West
Rachel Waite
Sid Leach
Bruce Mason
Ray Heinle
Ed Thomas

Annular Eclipse Photos by Don Nakano



Pre-Eclipse



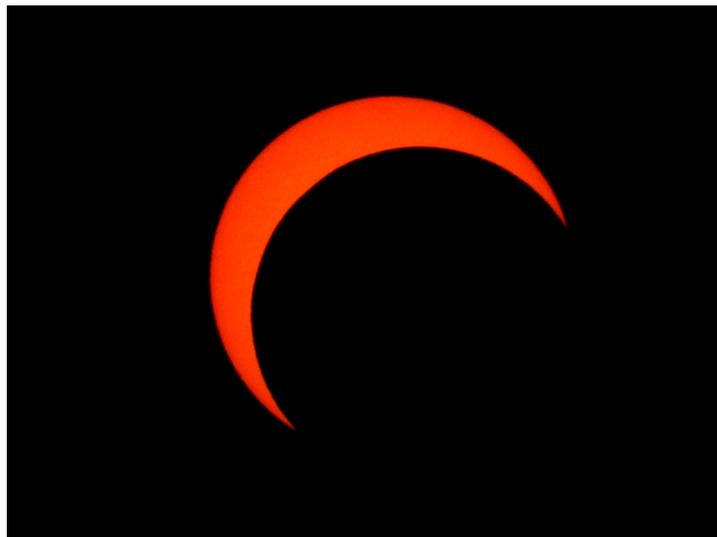
Early Eclipse

Crescent Sun

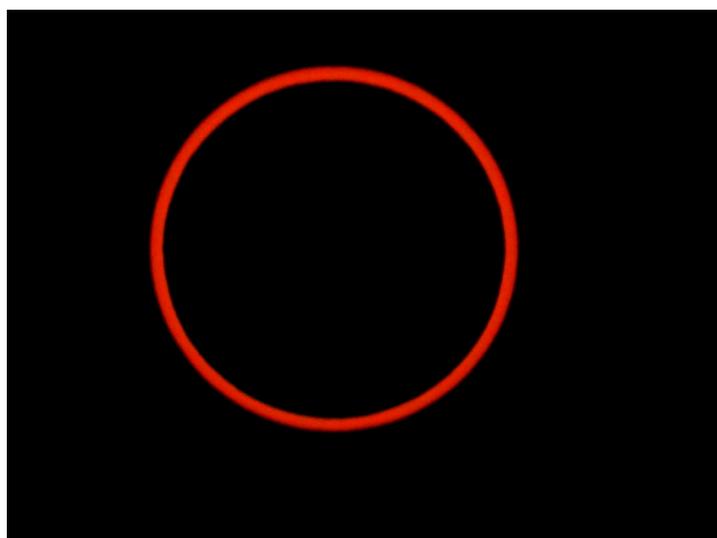
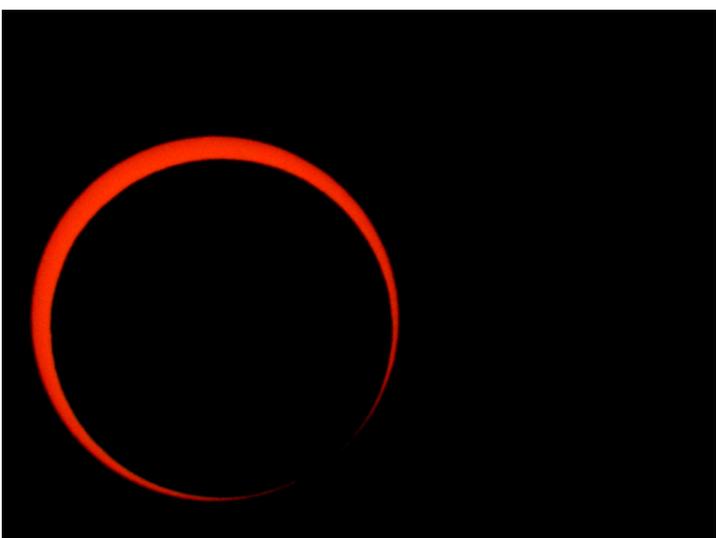
Late Crescent



First Annular



Full Annular



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