Volume 26 Issue 1

January 2012

The Observer

East Valley Astronomy Club

From the Desk of the President

by David Douglass

Happy New Year to all the EVAC members and friends who have the opportunity to read this issue of the Observer. I am very proud and excited that the membership has (re)-elected me to the position of President for 2012. I thoroughly enjoyed my previous two year term (2009-2010), and I look forward to the many adventures and activities of this coming year, and I know that all of the other elected and volunteer leaders of EVAC share in that excitement.

What we need now are some clear skies. This last year has presented many a challenge to us for observing. If the current week is any indication of the future, we may be in luck. I for one, am ready for some good photon collecting.

Saguaro Astronomy Club (SAC) has announced the official dates for the 2012 All Arizona Messier Marathon. It will be the weekend of March 23-24, with the actual marathon on Saturday, March 24th. The location will once again be at the Hovatter Airstrip, located by Exit 53, on I-10. Be sure and mark your calendars for this fun and exciting time.

EVAC dues cover a "calendar year". That is to say, Jan-Dec for the given year. Thus, everyone's dues "come due" on January 1st. There are no "official" invoices, but rather just a few open announcements. If you have not yet visited with the Treasurer, please consider doing so at the January meeting. If you would rather renew your membership via "Pay-Pal" from the evaconline.org web site, that option is still available to you.

I look forward to seeing everyone at the January meeting (Jan 20th). Until then, lets all "Keep Looking Up".

The Backyard Astronomer

Upcoming Events for 2012 *by Bill Dellinges*

According to an arcane Mayan calendar, the world will end December 21st, 2012. So we have a full year to enjoy some very interesting astronomical events.

Venus blazes away in the west through April.

Jupiter sticks around till mid-March.

Earth reaches perihelion (closest point to the Sun in its orbit) January 4th, when it will be only 91,446,900 miles from Sol. It's interesting that we Northern Hemisphere folks experience winter then. You'd think we would be sweating bullets. But no, we're feeling chilly because Earth's axis is pointing away from the Sun during this period. Its rays strike the Northern Hemisphere at a relatively steep angle reducing its energy impact on land masses.

Alert thinkers might ask, "Wait, what about people in the Southern Hemisphere?" Not only is Earth closest to Sun now, but its rays are hitting land there straight on as they would us in the summer. Shouldn't they be reeling under the heat? No, because the Southern Hemisphere has more sea area than the north and that ameliorates a heat buildup as water takes longer to heat up than land. So both hemispheres experience similar temperatures during their seasons.

There will be an annular solar eclipse passing through

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Upcoming Events:

Public Star Party - January 13

Local Star Party - January 14

General Meeting - January 20

Deep Sky Observing Night - January 21

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

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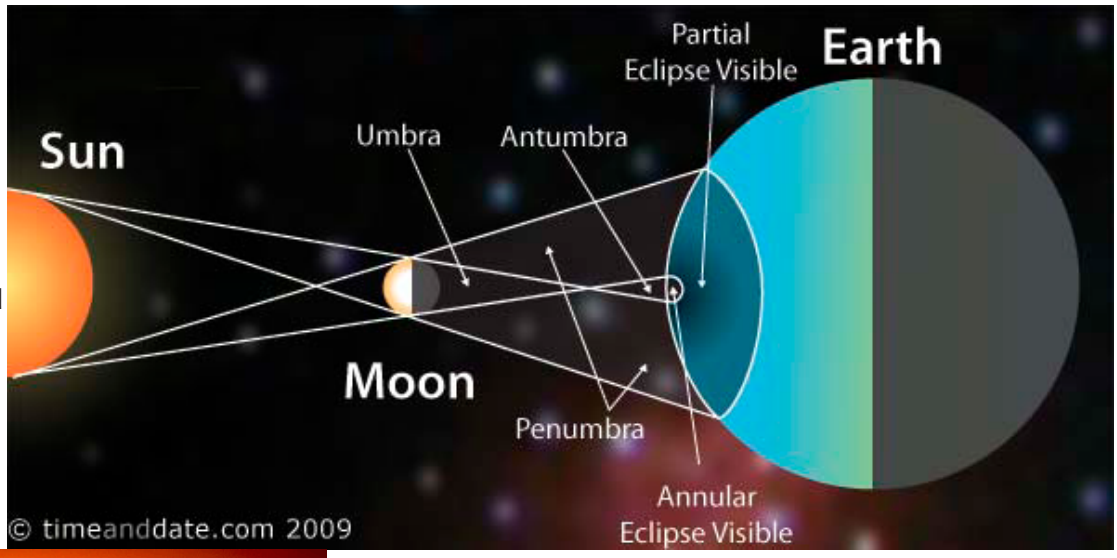
The Backyard Astronomer

Continued from page 1 Arizona May 20th. This will be an excellent chance to see one if you've never experienced an annular eclipse and you won't even have to leave the state.

As a matter of fact, though annularity will be only visible in northern Arizona (the Page, Grand Canyon, Kayenta area), Phoenix will still see an astounding 83% of the Sun eclipsed (at maximum, 6:38 pm). That's not too shabby. If you can live without seeing the annulus ring of sunlight up north, you could forgo travel and still observe a spectacular partial eclipse of the Sun from your west facing porch as you drink a mint julep. Caution: you still need to use a solar filter to safely view an annular solar eclipse! For details of the Arizona annular eclipse, watch for an upcoming article in S&T magazine or check the Net.



Credit & Copyright: Dennis L. Mammana (TWAN)

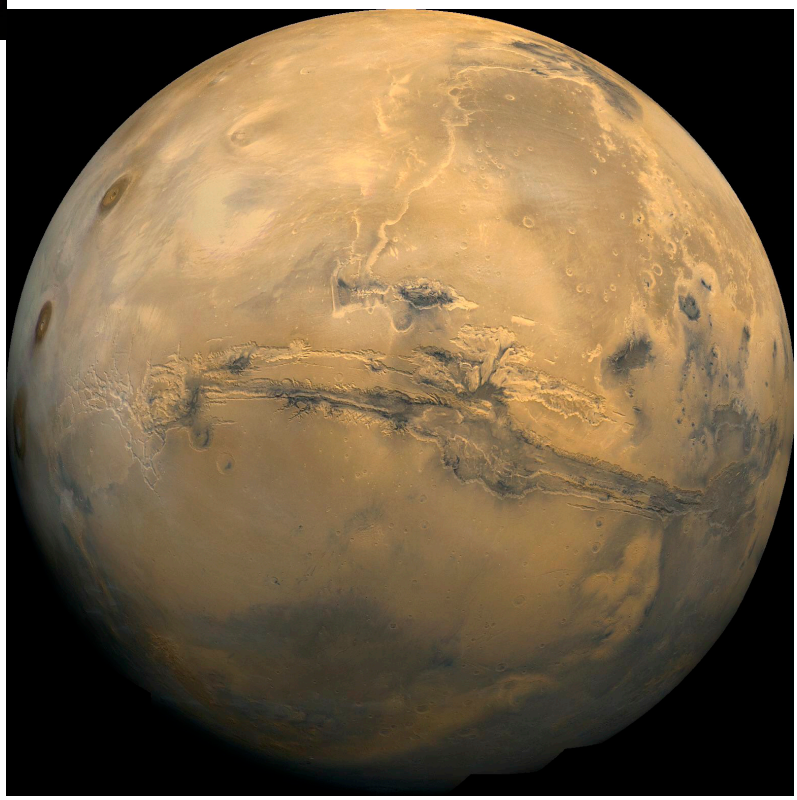
There will be a second total eclipse on November 13th which can be seen in Australia and the south Pacific. Totality will run from about 2 minutes on the continent to 4 minutes at sea.

June 5th offers the last Venus transit across the Sun for 105 years. Unless you're immortal, this is big news. Venus transits occur alternatively every 105 or 121 years. Each transit will repeat after 8 years, so most people will have an opportunity to see two in their lifetimes, 8 years apart. The last Venus transit was in 2004. Dust off (and check) that solar filter as you'll need it for these two impressive events. See the January 2012 issue of S&T for a nice article and details on the transit.

In the same issue, Fred Shaff's column discusses an interesting point: why the winter sky's stars appear brighter than the summer sky's stars. A clear, crisp winter sky isn't the answer. There simply are a disproportionate number of bright stars out in winter compared to the summer night sky.

And finally, Mars is back! Opposition is March 3rd when its disk will max out at 13.9". This is not a great opposition for Mars. Those only happen about every 15 years when its disk's diameter can approach 25". The last one was 2003, the next, 2018. Still, some surface detail on the red planet should be evident in a telescope. See S&T, November 2011, page 50, for details.

"Mars, by virtue of its color alone, must have seized the attention of stargazers from time immemorial, catapulting them into inescapable fantasies." William Sheehan, Stephen James O'Meara, Mars. The Lure of the Red Planet.



Mars in 1980 as seen by the Viking 1 orbiter

LSB Galaxies

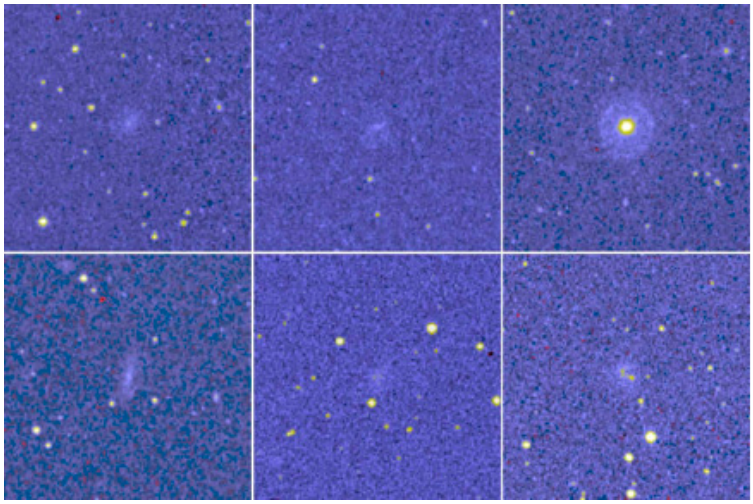
by Henry De Jonge IV

Introduction

A type of galaxy that until recently received little attention and notice is called a low surface brightness galaxy, (LSB galaxy). They are faint, (when viewed from Earth) diffuse galaxies with a visual magnitude lower than the ambient sky. These galaxies because of their low brightness have gone largely unnoticed in most early extragalactic studies and surveys. It is only over the last few decades that they have become more noticed and understood. It is thought that they now play a key role in early galaxy formation and evolution as well as in the chemical evolution of our Universe. They are also believed to be closely tied to DM and in particular DM halos. Here we examine them a bit further.

Understanding

In general the physically larger a galaxy is the lower its central surface brightness. In an attempt to begin quantifying the surface of bright spirals, Freeman in 1970 noted that the measured central surface brightness of disk galaxies in the Hubble sequence clustered about visual magnitude 21.7, (technically for the blue wavelength). This became known as Freeman's law. The central disc brightness of a LSB galaxy is well below the Freeman value of 21.7, (higher magnitude) which also makes it well below the usual surface magnitude of most ellipticals and spirals. However this "law" is statistically warped as only the largest and brightest galaxies were the first to be measured. We know now that there are large numbers of fainter galaxies, but this requires more careful observing and better instrumentation. However this simple law is often used to classify LSB galaxies in practice.



SDSS images of 6 LSB galaxies

Slow Discovery

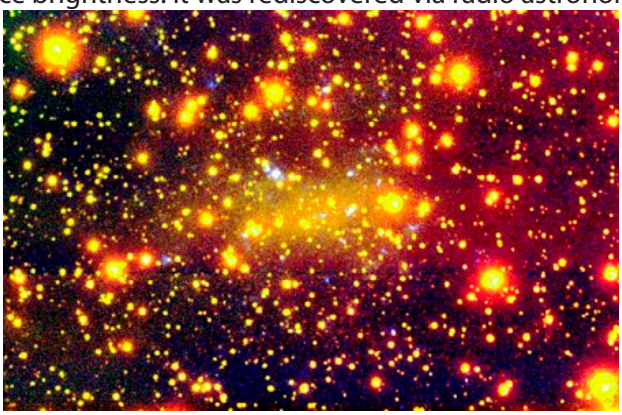
The major detection and discussion of LSB galaxies only began a few decades ago even though Hubble and Shapley mentioned them in the 1930's. In the 1950's Zwicky also commented upon the kinds of galaxies that could be detected in our night sky with its background emission. Thus LSB galaxies, and other unnoticed galaxies like ultra faint dwarfs, DM galaxies, etc. that are part of our galactic Universe today, were left uncounted. It was not until 1963 that the first real catalog of diffuse galaxies appeared, (the DDO Catalog) and many of these were LSB galaxies. The DDO catalog was composed up of low mass galaxies and this helped spread the false rumor that all LSB galaxies were of low mass. Now we know that LSB galaxies are comprised up of all masses and types of galaxies.

These early observed galaxy catalogs were recorded on photographic plates and when astronomers began looking for LSB galaxies in earnest many more LSB galaxies were discovered from existing photographic plates. A good example of this is Malin1, a large and massive spiral, (estimated to have an HI mass of over 100 billion solar masses) behind the Virgo Cluster which was accidently discovered in 1987 by the astronomer David Malin. He began using a method of photographic amplification to find LSB objects and faint debris about normal galaxies and soon discovered large numbers of LSB galaxies all over the plates. They were sometimes called smudge galaxies. This discovery brought the discussion of LSB galaxies into the main stream as well as provided motivation for additional LSB galaxy searches. After this development astronomers went back to their plates and began "discovering" even more LSB galaxies! In about a decade a whole new population of galaxies was discovered.

Today due to their large amount of gas, LSB galaxies are often examined, (and sometimes discovered) and mapped by radio telescopes using the 21cm line of HI. They are also examined and discovered by using multicolor optical CCD surface photometry and the IR. Sky surveys like the SDSS have much raw data but need a lot of specific work in terms of algorithm optimization to really pick up LSB galaxies, (and other faint objects) that are known to exist. SDSS has confirmed to date some new large spiral LSB galaxies.

In our Local Group due to the obscuration of dust along the Galactic plane and their general faintness it is estimated that there are still many LSB galaxies yet to be discovered. We expect to discover in the future even more extreme LSB galaxies that are outside of our present detection limits.

Cepheus 1, a 20 Mly distant spiral galaxy is another example of an LSB galaxy that was initially overlooked due to its low surface brightness. It was rediscovered via radio astronomy.



LSB Galaxy Cepheus 1 c/o APOD 12/1/98

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LSB Galaxies

Continued from page 3

Properties

LSB galaxies are usually smaller than average yet can range from dwarfs to very luminous and large galaxies including giant spirals. They normally contain fewer stars than usual and generally have these stars spread out over a larger area. They are dust and metal poor, but tend to be very gas, (HI) rich. However this gas is spread out and of a lower than average density when compared to regular disk galaxies. As we will see this affects the SFR, (star formation rate) of a galaxy.

In main Hubble sequence, high surface brightness (HSB) galaxies, most stellar formation occurs in giant molecular clouds, (GMC). This leads to many massive stars and stellar clusters which plays a dominate role in the chemical evolution of galaxies. This star formation is related to the distribution of HI gas as a function of radius in the disk and needs a minimum value to form these GMCs. In LSB galaxies this minimum value is not achieved and thus they have a much lower SFR than HSB galaxies, (usually at least an order of magnitude less) especially in the disk. LSB galaxies have less massive stars in general, have a lower production of metals, and evolve much slower than most regular galaxies. They also will tend to have far fewer AGN than regular disk galaxies. Perhaps they suffer from this delayed stellar formation due to their low densities? This may be a property of their distribution since they are found predominantly in low density environments.

LSB Galaxy UGC 6614-a large disk LSB galaxy, diameter about 150 Kpc and central magnitude of 24.28. This LSB galaxy also shows AGN activity with a jet aiming directly towards Earth.

How did they form? There is a theory that is tied to angular momentum though has its limitations. Dark matter (DM) halos which are thought to be a key building block of galaxy growth may exhibit higher angular momentum in the formation of LSB galaxies while for the typical HSB galaxy the angular momentum of the DM halos would be considerably less. This "spin parameter" of a galaxy has been shown to scale inversely with the surface brightness, that is the higher angular momentum systems evolve towards LSB galaxies. This relationship has also been correlated with other parameters such as disc scale length and absolute disc magnitude. The 2MASS NIR all sky survey has collected LSB galaxy data that supports this model.

This model assumes that the star formation rate changes smoothly over time. However we know that this is not always true and that irregular and often brief but intense star burst periods can happen in galaxies. This irregular behavior may occur more often in LSB galaxies since they usually have such a low density of gas and dust and the events that aid star formation, (like SN, galactic interactions, etc.) would thus occur less often in LSB galaxies.

However LSB galaxies do have SN and some LSB galaxies have even been discovered by observing SN that seemingly have no known host galaxy (until observed). An example of this is an irregular dwarf LSB galaxy named N271 discovered by SN2009Z, (a Type II SN). Definitely more LSB galaxies will be discovered as we observe such "lone" SN explosions.

Many giant LSB galaxies also have AGN activity (such as UGC 6614, Malin 2, and UGC 1922). UGC 6614 has a central SMBH of about 3.8 million solar masses and at least one jet like ejection from the central bulge. It is well established that the central BH mass in galactic bulges corresponds to both the bulge velocity dispersion and bulge luminosity. This is also true for LSB galaxies.

The recent 2MASS NIR all sky survey has discovered many more LSB galaxies of all types which has aided our understanding of their nature and evolution. Their role in galactic evolution and chemistry is still being debated and understood.

Cosmic Significance

The gaseous components of LSB galaxies do not behave like regular spiral galaxies at all radii. They are thought to be DM dominated at all radii as well as over the all the baryonic matter, unlike regular spirals with less dense yet more extended DM halos. Thus their DM profile is different, (as well as many of their physical properties) even though overall they may look similar in structure. Interestingly this DM domination is also seen in galaxy clusters. Are there some cosmic properties that these two objects share? Despite their usually smaller size and low density LSB galaxies may contribute to a large fraction of the total mass in Galaxy Clusters. This is still TBD more precisely.

Research is being conducted to better determine the role LSB galaxies play in QSO, (quasar) absorption lines besides the usual HI clouds and other objects that contribute. Perhaps this study can lead to a better understanding LSB galaxy distribution and evolution? Exactly when LSB galaxies appear in the Universe and where they are most numerous is still an unknown.

Continued on page 13

January Guest Speaker: Tom Polakis

We are pleased to have Tom Polakis returning as the guest speaker to kickoff the new year. Tom is a member of both SAC and EVAC. This will be the 10th time we have had Tom as a guest speaker, and each presentation is always both interesting and entertaining.

Tom has been an amateur astronomer since he saw the Perseid meteor shower in 1977. He has written a number of deep-sky observing articles for Sky & Telescope and Astronomy magazines. While his main interest is visual observing, he has become skilled in lunar and planetary photography.

Tom's talk is entitled *Atacama Astronomy - Where the Sky is Rarely Cloudy*.

Tom has been south of the equator seven times, most recently to Chile. There you'll find infrequent clouds, good transparency, good seeing, dark skies and access to northern and southern hemispheres. Chile is due south of Boston, along the west coast of South America.

Tom observing from Chile in 2011

Canon EOS 50D
240s f/4.0 at 8.0mm iso800

◐ **First Quarter Moon on December 31 at 23:15**

● **Full Moon on January 9 at 00:30**

◑ **Last Quarter Moon on January 16 at 02:09**

○ **New Moon on January 23 at 00:40**

Upcoming Meetings

January 20
February 17
March 16
April 20
May 18
June 15

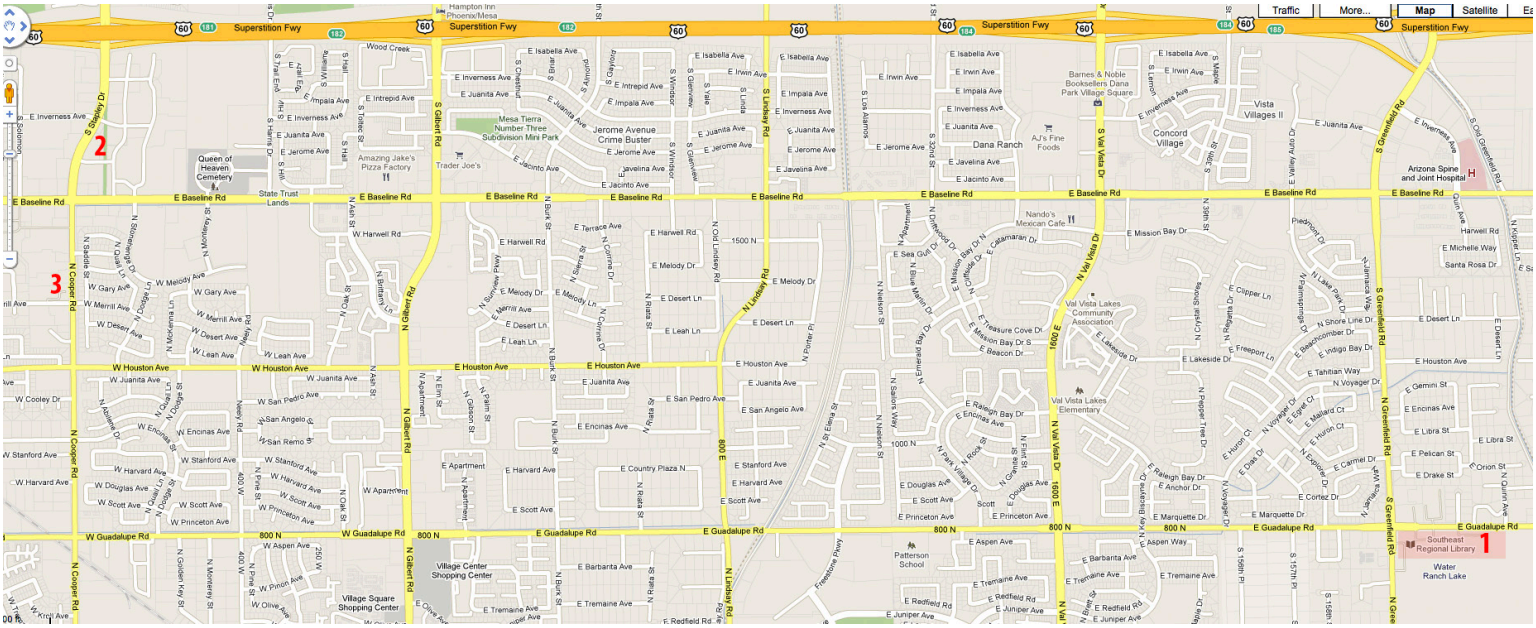
The monthly general meeting is your chance to find out what other club members are up to, learn about upcoming club events and listen to presentations by professional and well-known amateur astronomers.

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.

Likewise, all are invited to meet for coffee and more astro talk after the meeting at Denny's on Cooper (Stapley), between Baseline and Guadalupe Roads.

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

3 Denny's
1368 N. Cooper
Gilbert, Az. 85233

January 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				

January 7 - Az Museum of Natural History Solar Party

January 10 - Centennial Middle School Star Party

January 13 - School Solar Event at GRCO

January 13 - Public Star Party & SkyWatch at Riparian Preserve

January 14 - Local Star Party at Boyce Thompson

January 18 - Kyrene Middle School Star Party

January 19 - Settlers Point Elementary School Star Party

January 20 - General Meeting at SE Library

January 21 - Deep Sky Observing Night

January 24 - CTA Freedom School Star Party

January 26 - CTA Independence School Star Party

January 27 - Girl Scout Troop 1109 Star Party

January 28 - Veteran's Oasis Park / Environmental Center Star Party

February 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			

February 1 - Navarette Elementary School Star Party

February 9 - Riggs Elementary School Star Party

February 10 - Public Star Party & SkyWatch

February 11 - Local Star Party at Boyce Thompson

February 16 - Pomeroy Elementary School Star Party

February 17 - General Meeting at SE Library

February 18 - 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):

☐ **$30.00 Individual** January through March

☐ **$35.00 Family** January through March

☐ **$15.00 Individual** July through September

☐ **$17.50 Family** July through September

☐ **$22.50 Individual** April through June

☐ **$26.25 Family** April through June

☐ **$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.

Liability Release Form

In consideration of attending any publicized Star Party hosted by the East Valley Astronomy Club (hereinafter referred to as "EVAC") I hereby affirm that I and my family agree to hold EVAC harmless from any claims, liabilities, losses, demands, causes of action, suits and expenses (including attorney fees), which may directly or indirectly be connected to EVAC and/or my presence on the premises of any EVAC Star Party and related areas.

I further agree to indemnify any party indicated above should such party suffer any claims, liabilities, losses, demands, causes of action, suits and expenses (including attorney fees), caused directly or indirectly by my negligent or intentional acts, or failure to act, or if such acts or failures to act are directly or indirectly caused by any person in my family or associates while participating in an EVAC Star Party.

My signature upon this form also indicates agreement and acceptance on behalf of all minor children (under 18 years of age) under my care in attendance.

EVAC only recognizes those who are members or invitees and who also have a signed Liability Release Form on file as participants at an EVAC Star Party.

Please print name here ***Date***

Please sign name here

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

Dawn Takes a Closer Look

by Dr. Marc Rayman

Dawn is the first space mission with an itinerary that includes orbiting two separate solar system destinations. It is also the only spacecraft ever to orbit an object in the main asteroid belt between Mars and Jupiter. The spacecraft accomplishes this feat using ion propulsion, a technology first proven in space on the highly successful Deep Space 1 mission, part of NASA's New Millennium program.

Launched in September 2007, Dawn arrived at protoplanet Vesta in July 2011. It will orbit and study Vesta until July 2012, when it will leave orbit for dwarf planet Ceres, also in the asteroid belt.

Dawn can maneuver to the orbit best suited for conducting each of its scientific observations. After months mapping this alien world from higher altitudes, Dawn spiraled closer to Vesta to attain a low altitude orbit, the better to study Vesta's composition and map its complicated gravity field.

Changing and refining Dawn's orbit of this massive, irregular, heterogeneous body is one of the most complicated parts of the mission. In addition, to meet all the scientific objectives, the orientation of this orbit needs to change.

This full view of the giant asteroid Vesta was taken by NASA's Dawn spacecraft, as part of a rotation characterization sequence on July 24, 2011, at a distance of 5,200 kilometers (3,200 miles). Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

These differing orientations are a crucial element of the strategy for gathering the most scientifically valuable data on Vesta. It generally requires a great deal of maneuvering to change the plane of a spacecraft's orbit. The ion propulsion system allows the probe to fly from one orbit to another without the penalty of carrying a massive supply of propellant. Indeed, one of the reasons that traveling from Earth to Vesta (and later Ceres) requires ion propulsion is the challenge of tilting the orbit around the sun.

Although the ion propulsion system accomplishes the majority of the orbit change, Dawn's navigators are enlisting Vesta itself. Some of the ion thrusting was designed in part to put the spacecraft in certain locations from which Vesta would twist its orbit toward the target angle for the low-altitude orbit. As Dawn rotates and the world underneath it revolves, the spacecraft feels a changing pull. There is always a tug downward, but because of Vesta's heterogeneous interior structure, sometimes there is also a slight force to one side or another. With their knowledge of the gravity field, the mission team plotted a course that took advantage of these variations to get a free ride.

The flight plan is a complex affair of carefully timed thrusting and coasting. Very far from home, the spacecraft is making excellent progress in its expedition at a fascinating world that, until a few months ago, had never seen a probe from Earth.

Keep up with Dawn's progress by following the Chief Engineer's (yours truly's) journal at http://dawn.jpl.nasa.gov/mission/journal.asp. And check out the illustrated story in verse of "Professor Starr's Dream Trip: Or, how a little technology goes a long way," at http://spaceplace.nasa.gov/story-prof-starr.

This article was provided courtesy of 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

January 2012

Celestial events (from Sky & Telescope magazine, Astronomy magazine, and anywhere else I can find information) customized for Prescott, Arizona. Remember, the Moon is ½ degree or 30 arcminutes in diameter. All times are Mountain Standard Time.

Comet C/2009 P1 (Garradd), which has been with us for months, goes from being an evening to a morning object. It is still bright enough to be visible with binoculars.

Comet P/2006 T1 (Levy) puts on a show through binoculars this month. See Astronomy, January 2012, p. 50 for details and a finder chart. Note that an anti-tail is visible the first few days of the month.

On Tuesday, January 3, you can see some events (including a double shadow transit) with Jupiter's moons. Here is the schedule:
5:32 PM Sunset
5:46 PM Ganymede moves in front of Jupiter.
5:59 PM Civil twilight ends (dark enough to find Jupiter, 60 degrees up in the southeast).
7:53 PM Ganymede moves from in front of Jupiter.
8:54 PM Europa moves in front of Jupiter.
10:36 PM Io moves behind Jupiter.
11:05 PM Ganymede's shadow falls on Jupiter (1 shadow).
11:22 PM Europa moves from in front of Jupiter.
11:26 PM Europa's shadow falls on Jupiter (2 shadows).
12:50 AM (Jan 4) Ganymede's shadow leaves Jupiter (1 shadow).
2:03 AM Io emerges from Jupiter's shadow (too low to observe).
2:04 AM Jupiter sets.

The night of Tuesday, January 3, you might see some Quadrantid meteors. The radiant rises about 11:00 PM. The shower peaks about 12:30 AM (Jan 4). The Moon sets about 3:30 AM. Astronomical twilight starts about 6:10 AM. See Sky & Telescope, Jan 2012, p. 50 for details. Named after a constellation which no longer exists, it's the best meteor shower you have never heard of. Is it going to be cold out there? Do you need to dress warmly? Does the Earth go around the Sun?

On Thursday, January 5, at 8:31 PM, Jupiter will appear to have 2 moons. 5 minutes later and additional 2 will have appeared to the celestial east of the planet. They will have come out of Jupiter's shadow.

On the night of Friday, January 6, at about 1:00 AM (January 7), you might see a grazing occultation of the 5th magnitude star Omicron Tauri. This will be a difficult observation. First, the star is hidden by a brightly lit portion of the almost full Moon. Use as big a telescope as you can and high magnification. Second, the timing and duration of this event is very dependent on the position of your observing site. The Moon might miss the star altogether (worst case), skim the star with the star winking out and in behind mountains on the Moon's limb (best case), or disappear and reappear once. A good planetarium program with your exact latitude and longitude entered will point to the probable result.

On Sunday, January 8, at 5:23 PM (13 minutes before sunset), the full Moon rises, spoiling any chance of seeing faint fuzzies for the whole night.

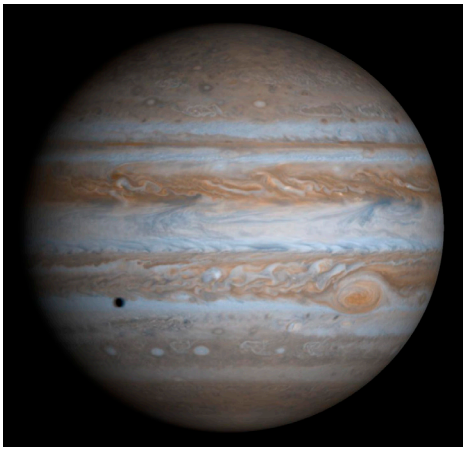
On Tuesday, January 10, you can see a near repeat of January 3rd's Jupiter events, only it happens later so Jupiter sets before the 2 shadows. Here is the schedule:
9:43 PM Ganymede moves in front of Jupiter.
11:27 PM Europa moves in front of Jupiter.
11:46 PM Ganymede moves from in front of Jupiter.
12:29 AM (Jan 11) Io moves behind Jupiter.
1:38 AM Jupiter sets.

On Thursday, January 12, you can see a near repeat of January 5th's Jupiter events. The time between the events is greater but the distance is less. Io appears at 10:27 PM, Europa at 11:10 PM.

On Sunday, January 15, the Moon is at last quarter phase and rises at 12:54 AM (January 16).

On Sunday, January 22, it is new Moon and you have all night to hunt for faint fuzzies. At 7:05 PM (just when it is really dark) Algol will be at it's minimum brightness (magnitude 3.4). It should brighten to magnitude 2.1 as the evening progresses.

On Monday, January 30, at 9:11 PM the Moon is at first quarter phase and sets at 1:20 AM (January 31).



A composite Cassini image of Jupiter. The dark spot is the shadow of Europa.

LSB Galaxies

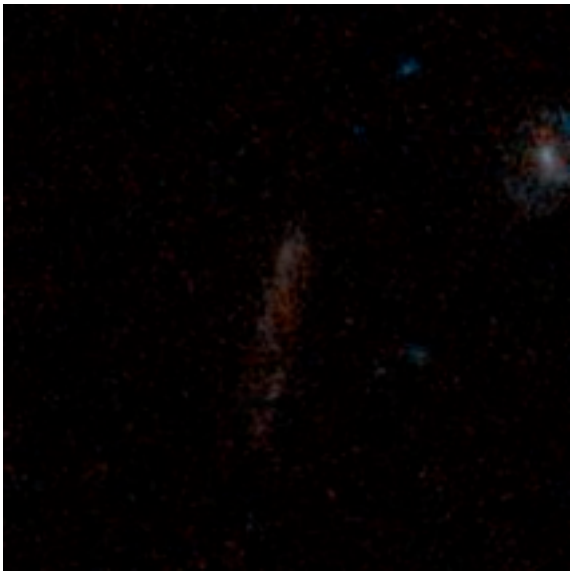
Continued from page 4

Usually galaxies fade and redden as they age but little evidence of this exists in the observations of LSB galaxies. They often look blue yet without the usual SFR that tends to make HSB galaxies blue. This may be another selection effect of galaxy observations. It is thought that LSB galaxies are not just the faded remains of HSB galaxies after their star formation has ended. It is interesting to note that astronomers will attempt to model a galaxies color by modeling stellar populations and distributions with varying degrees of success. The exact reason for the color distribution of LSB galaxies is still unknown.

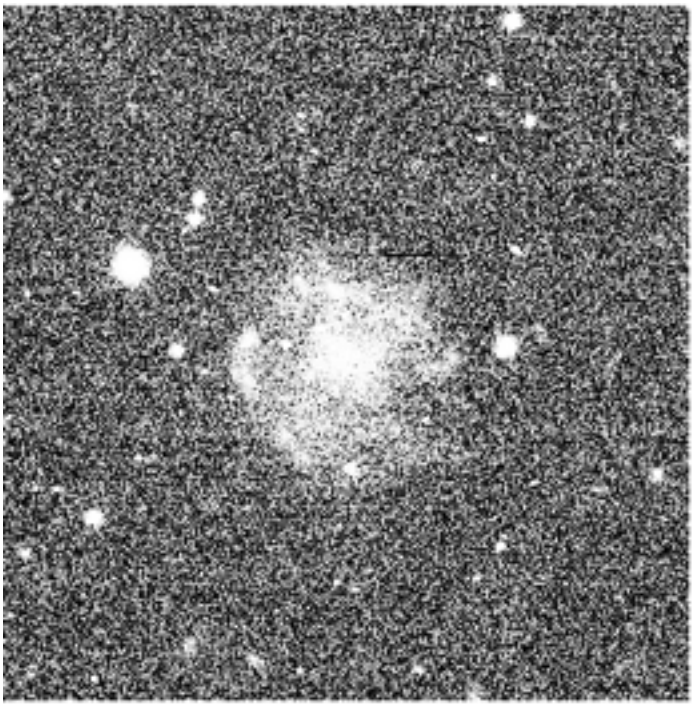
In another vein of thought the cosmological principle asserts that any other observers of galaxies in the Universe should come up with the same numbers and distribution we do and LSB galaxies must be included in any such catalog which is yet incomplete. Are they better mass points for determining the mass distribution of the Universe, (despite their being relatively isolated as so far observed)? So far they are not usually seen at the edges of vast cosmic voids but are found more often at the edges of galaxy clusters and distributions. Do they mainly form in isolation? Do they experience fewer tidal interactions with other galaxies since they have such a low SFR and fewer GMCs? There is still much uncertainty in any galactic catalog, even with respect to our local galaxy population.

Conclusions and Future Research

We have seen that although LSB galaxies are somewhat rare they do contribute greatly to the galaxy collection in the Universe and help us understand DM and galaxy evolution. They are more numerous than originally thought and there are undoubtedly more waiting to be discovered since historically only the brighter galaxies have been largely recorded and studied. They span the entire range of galactic masses, have a different star formation scenarios, experience far fewer massive stars and SN, are embedded in different DM halos, and evolve more slowly than usual galaxies. LSB galaxies are a class unto themselves even though they do possess some properties of HSB galaxies, dwarf galaxies, and gas rich irregulars. However they are still poorly characterized as a population.



HST image of a LSB Galaxy

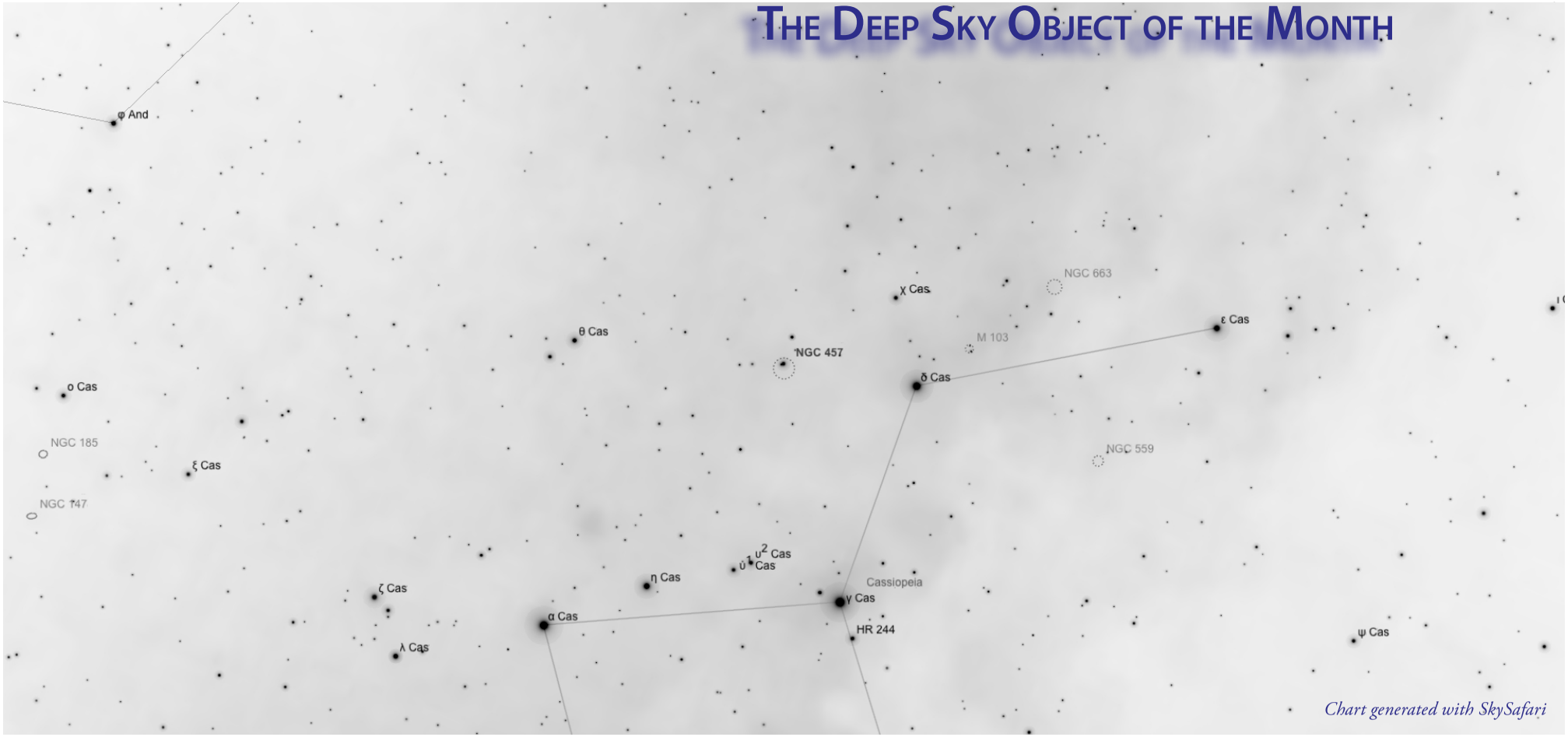


LSB Galaxy F561-1 discovered by visual inspections from the New Palomar Sky Survey, mag 23.0, diameter of 2.5 Kpc and another sample of a previously undetected galaxy.

Basically for every LSB galaxy now known there are probably multiples of those still awaiting discovery. It is estimated that they may comprise up to 30-50% of the total galaxy population. Their baryonic matter contribution to the Universe is also significant despite their faintness. It is estimated that our own Milky Way galaxy alone has as many as 500 undiscovered galaxies orbiting it within a radius of 1 Mly, some of which are LSB galaxies. LSB galaxies offer us a new pathway into the understanding of galactic evolution. We are now just beginning to see all of what is really out there.

Looking for that perfect New Year's resolution?
Why not resolve to getting involved?
Contact Martin Thompson to join the staff at GRCO
Email: grco@evaconline.org

The Deep Sky Object of the Month



NGC 457 is one of the finer star clusters in Cassiopeia. It was discovered by Friedrich Wilhelm Herschel in 1787. Besides its official name, NGC 457 is also known as the "Owl cluster" or the "ET Cluster". Two bright stars, 5th magnitude φ1 Cas and 7th magnitude φ2 Cas can be imagined as eyes. Scattered rows of faint stars make up the arms, and the rest of the cluster forms a body.

NGC 457 contains over one hundred stars. It is bright, large, quite rich, and somewhat triangular-shaped with three streams of stars protruding NNW, SW, and eastward from a moderately compressed center. It has at least fifty 8.5 to 12th magnitude stars, and thirty 13th to 14th magnitude stars sprinkled within its boundaries. A gathering of bright stars is south, and a dark patch north, of the cluster center. A red star lies at the northern edge. The beautiful yellow and blue double Phi Cassiopeiae is on the SE edge.

NGC 457 is a young star cluster about 9,700 light years away. The bright star φ1 Cas is on the SE end of the group, but its membership is unlikely. If it is a true member, this star would have a luminosity of 275,000 suns.

NGC 457 (ET Cluster) Open Cluster in Cassiopeia

RA: 01h 20.4m Dec: +58° 21′ Size: 20.0′ Magnitude: 6.40 Distance: 2.4 kpc

As one of the many benefits to becoming an East Valley Astronomy Club member, we have an 8 inch Dobsonian reflector with eyepieces available for monthly check-out to current EVAC members. Have any questions, or interested?

Call or see David Hatch, EVAC Properties Manager
480-433-4217

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