November 2005

The Voyager

East Valley Astronomy Club

Volume 19 Issue 11

From the Desk of the President
by Steven Aggas, 2005 EVAC President

Have you considered running for an office? We are still in need of volunteers for President, Vice President, Secretary, and Co-Events Coordinator. If you are interested send me an email and I'll pencil you into the job.

On November 12th, EVAC will once again be picking up trash on the side of US-60. If you are interested in participating, send Gwen or Randy an email at Events@eastvalleyastronomy.org for details. Afterwards we will be meeting for breakfast at the Village Inn in Apache Junction, paid for by EVAC.

As a general announcement, EVAC not only gets together before the meeting for dinner at the Old Country Buffet, but also after the meetings at the Village Inn for coffee or a late bite to eat. Below is a map showing all three locations. Joins us! The eatin' is always good. Please refer to the map on page x for the location.

As our speaker for the November General Assembly meeting, we will have Mr. Stev Coe. Steve is an author and active observer. He will speak about his latest trip to the Outback.

Join us at the Southeast Regional Library (Gilbert Public Library) on Friday, November 18th at 7:30PM. The GPL is located at the Southeast corner of Greenfield and Guadalupe Roads.

Get Involved!

The Backyard Astronomer
Telescope Parameters, Part Two *by Bill Dellinges*

Exit Pupil: The size of the cone of light exiting the eyepiece; sometimes known as the Ramsden Disk. Divide aperture in mm by your magnification. Example: An 8" (~200mm) SCT at 100x: 200/100x = 2mm exit pupil. Or: eyepiece focal length/telescope focal ratio. Example: 20mm/F10 = 2mm. Since your dark adapted eye's pupil opens only to about 7mm at night, it will be "wasting" light from the telescope if the exit pupil is10mm in diameter and if the scope is at 20x. Conversely, some purists speculate an exit pupil of less than 1mm is not desirable based on flaws in the eye. I tend to go along with this based on my experience of noting that a 1mm exit pupil can be had by using a power equal to aperture in mm. That is, an 8" SCT (200mm) at 200x = a 1mm exit pupil and a 14" SCT (355mm) at 355x = a 1mm exit pupil. Almost never am I happy with images in those scopes at those powers. To be fair here though, it should be pointed out that at such powers, seeing may be a bigger problem than exit pupil size. Adhering to exit pupil size is controversial and should not be taken too seriously. Use whatever ep's and powers you like and decide for yourself what works and what doesn't.

A handy rule of thumb to determine your lowest recommended magnification is to multiply your focal ratio by a 7mm dark adapted

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Inside this issue:

November Events:

- *Deep Sky Star Party at Vekol Road - November 5*
- *Public Star Party in Gilbert - November 11*
- *Monthly Meeting at Southeast Regional Library - November 18*
- *Local Star Party at Boyce Thompson - November 26*

The Backyard Astronomer

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pupil (From Dickinson's *Backyard Astronomer's Guide,* p.77). This gives the eyepiece in mm. Example: What is the lowest power I should use in an F11 C-14? 11 x 7 = 77. Now divide 77mm into the telescope's focal length (in mm) to get power: 3910mm/77mm = 50.7x. To check our results, let's see if 50.7x in the C-14 exceeds an exit pupil of 7mm. 355.6mm/50.7x = 7mm. How about that, right on the money. But again, don't let this mathematical approach limit your experimentation with powers. Even Al Nagler of Televue says there is nothing wrong with exceeding the 7mm exit pupil rule if it gets you the larger real field you may desire. Yes, you'll waste some light, but by god you'll get that field!

As an example, I occasionally employ a Lumicon Richfield Telecompressor in my C-14 to get a real field of 1.3 degrees at F6 (normally I'm restricted to about 0.70 degrees). This gives me 38x which means a 9mm exit pupil. The view is just fine. I see no ill effects while enjoying a field allowing me to see the entire Double Cluster (a feat in an F11 SCT) or M31 and its two satellite galaxies (Ditto).

Is there an upper limit for power? There's a wide array of opinions on this but the general consensus is 25x to 30x per inch of aperture assuming good optics and seeing. I'll go along with 25x per inch of aperture based on experience with an 8" (200x) and 14" (350x) SCT. Though I have little experience with Newtonians, 25x per inch of aperture seems a reasonable limit to me (450X for an 18" for instance).

Refractors, in this regard, are a little different. They seem able to break the 25x per inch of aperture limit on magnification (perhaps due to no secondary obstruction). It's nothing for a refractor to handle twice that limit - 50x per inch of aperture! My 3.3" and 5" refractors are certainly not limited to 82.5x and 125x respectively, based on the "25x/per inch " rule. They can easily exceed twice that limit.

Light Gathering Power: The surface area of a circle can be calculated by the formula (pi) (r squared). Thus an 8" mirror has a surface area of 50.24" [(3.14) (16) = 50.24]. To compare two mirrors (or lenses) and determine how much more light one gathers is very easy. You may wish to do this when "aperture fever" strikes you. You're thinking about upgrading from your 8" to a 12". How much more light will you be gaining? Divide 12" by 8" and square the result: 12/8 = 1.5 squared = 2.25. The 12" gathers 225 % *as much* light as the 8" telescope. But we want to know how much *more* light we'd be gaining, so we need to subtract the first 100% represented by the 8". So we say the 12" gathers 125% *more* light than the 8". Another example is a 10" vs. 8": 10/8 = 1.25 squared = 1.56. The 10" gathers 56% *more* light than a 10". It's interesting to note anytime you double aperture, you're gaining four times the light (2 squared = 4).

Resolving Power - Dawes Limit: After experimenting with various apertures in splitting double stars, English astronomer William Dawes (1799-1868) found a 1" telescope could split two 6th magnitude stars separated by 4.56" arc seconds. So "Dawes limit" is still the general rule of thumb to determine the resolving power of telescopes: 4.56/aperture in inches. So an 8" telescope should be expected to split a double star with a separation of 0.57" arc seconds (4.56/8" = 0.57"). This applies to point sources like stars, not extended objects like the moon or a planet. For the latter, telescopes typically do better than Dawes limit as evidenced by the fact that Saturn's Cassini's Division (0.5") was discovered with a 2.5" telescope which, according to Dawes limit, should have a resolution of only 1.8".

Another way to determine resolution is the formula:

1.22 x 0.00055mm/aperture in mm x 206265 where the second number is the wavelength of visible light in mm and 206265 is the number of arc seconds in one radian (Yikes. Don't ask me to explain this, just do the math!). This gives a result of 0.68" arc seconds for an 8", slightly less resolution than Dawes Limit. This point may be moot as our atmosphere seldom allows sub arc seeing.

Limiting Magnitude: To determine how faint a star your telescope can be expected to reach, use the following formula: 2.7 + 5 log D (D = aperture in mm). Example for an 8" (203.2mm): 2.7 + 5 x 2.3079 = 2.7 + 11.5395 = 14.2, your limiting magnitude.

Magnitude gain with increased aperture: How much fainter magnitude can you reach with a larger telescope? -2.5 log B (B = brightness gain of aperture). Example: 12" vs. 8". First determine the increased light gathering factor. 12/8 = 1.5 squared = 2.25. If you "log" 2.25, you get 0.352. Then -2.5 x 0.352 = -0.88. You will gain 0.88 magnitudes by going from an 8" to a 12" telescope. Note the minus in our result of -0.88 indicates we have made a gain in brightness. If we went the other way for a loss of brightness (8/12), the result would be +0.88 indicating we went in the direction of a dimmer magnitude.

The ideas discussed in this article will arm you with most of the basic knowledge and formulae necessary in understanding what to expect in the performance of telescopes and eyepieces. I hope I made these concepts clear enough such that you will not pull the hair out of your head (like I did) when I first encountered them.

The Cosmic Microwave Background
by Henry De Jonge

In the standard theory of the Big Bang, (BB) as the universe expanded and cooled, the highly ionized baryonic matter decoupled from the radiation and neutral atoms began to form once the temperature of the Universe fell below about 3000 K, (atomic H and He gas). After this recombination, (about 400,000 years after the BB at z ~1000 and before any stars or galaxies existed) the photons were able to move freely in the universe and beam outwards, still reaching us today. This is also called the time of last scattering. These CMBR photons we see today, carry information on the conditions of their last scattering and the conditions which they traveled through prior, [2].

The CMBR has some very interesting properties. The measured CMBR spectrum follows that of a blackbody to within 50 ppm at the largest deviation. This blackbody temperature measures to be 2.725 +/- 0.002 degrees K. The energy density of the CMBR peaks at a wavelength of about 1mm and is the largest, (about 99%) cosmic radiation field in the universe, [1]. It is sort of like being in a universal microwave oven, although not very hot. The CMBR radiation frequency ranges from 0.3 GHz to 630 GHz and peaks at 160.4 GHz which corresponds to the 2.725 K degree temperature. The anisotropy of the CMBR, (the difference in intensity of the radiation from point to point in the sky) is the same in every direction to one part in 100,000. This high degree of homogeneity is also seen as validation for the Cosmological Principle, [3].

The CMBR was actually predicted to exist in 1947-48 by Gamow, Alpher, and Herman and was first seen indirectly in 1939, (via the rotational excitation of the interstellar CN radical) although this observation was not understood as being related to the prediction when it was first derived. The "discovery" of the CMBR by Penzias and Wilson in 1965 really brought it to light. This is the familiar Nobel Prize story of the two scientists seeking a cause for the interference they continually had with their communications antenna system. In every direction of the sky they saw this background "noise" and all their attempts to eliminate it were in vain. After this discovery other scientists made measurements at different wavelengths and found the blackbody connection. Since all these measurements were ground based, (water absorbs microwave radiation) there was still room for error, (about 10% or more from the BB spectrum, especially at mm wavelengths). Thus scientists began to use balloons and to do even more sensitive measurements from the ground, [1].

In 1989 the Cosmic Background Explorer, (COBE) satellite was launched. It carried an instrument called the Far Infrared Absolute Spectrophotometer, (FIRAS) to look for spectral distortions and a Differential Microwave Radiometer, (DMR) to look for anisotropy. This space-based metrology was able to show with certainty in 1990-92, the anisotropy and BB characteristics of the CMBR. It measured the CMBR fluctuations on an angular scale of 10 degrees or larger, [1].

In 2001 the Degree Angular Scale Interferometer, (DASI), and BOOMERANG, (Balloon Observations of Millimetric Extragalactic Radiation and Geophysics) data from hundreds of small regions, (less than 1 angular degree) showed tiny variations, (to about 100 millionth of a degree) in the temperature of the CMBR. These small spots of variance in the CMBR correspond to small density power fluctuations in the early universe. This distribution of power fluctuations is called the power spectrum of the CMBR. This data reinforces the idea that the universe grew from a tiny subatomic region in a classical, (with inflation) BB scenario, [1].

DASI also first detected the polarization of the CMBR in 2002 at degree and sub degree scales. It is a 13 element interferometric array of antennas operating in ten 1 GHz bands from 26-36 GHz located in the South Pole, [9]. This data is also consistent with the standard BB model.

In 2001 NASA launched the Microwave Anisotropy Probe, (MAP) satellite. It was renamed the Wilkinson MAP in honor of David Wilkinson in 2002. It is far more sensitive than COBE, and also detected polarization anisotropy of the CMBR [3]. See Figure 1.

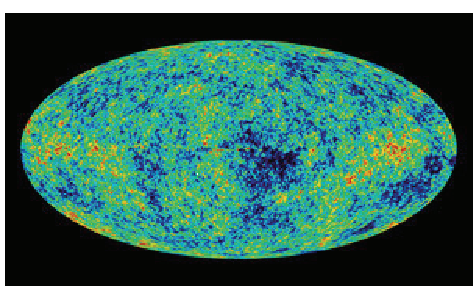

Figure 1: A WMAP picture of the CMBR anisotropies with the solar system motion effects and Galaxy emissions removed, [3]

The Cosmic Background Imager, (CBI) a microwave telescope array high in the Andes, has been detecting the polarization of the CMBR with high resolution since 2000. This polarization is due to the Thomson scattering of the photons and electrons. It is thought that the details of this light reveal the motions of the seeds of galaxy clusters, since the polarization peaks and valleys has the opposite correspondence to the peaks and valleys of the total CMBR intensity, (caused by the acoustic oscillations) which indicates motion of the material, [5]. This anti correlation between polarization and temperature is also evidence for inflationary cosmological models, [2].

For all cosmological models and galaxy formation models, the origin and properties of the CMBR and anisotropies play a major role. There are also many sources for these properties and anisotropies.

According to the standard BB, when the universe was 0.1% of its current size the temperature was 1000 times higher than we see today, (about 2725 degrees K), the number of photons was 10^9 times larger, and the energy density was 10^{12} times higher than current. This is the exact energy density proportional to the T^4 law for a blackbody. The energy density of the CMBR today is about 410 photons per cm^3. Thus the expansion of the universe from this blackbody state preserves this characteristic of the radiation with only the temperature changing, [1]. If the observed redshift was due to a tired light effect then we would see the same number density of photons in the CMBR, (which would be higher than measured) and only the energy of the photons would change. This blackbody nature of the CMBR eliminates tired light cosmological models of the universe, [1]. The blackbody characteristics and small anisotropies of the CMBR implies that the large scale

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The Cosmic Microwave Background

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structure of the universe was mainly formed by the gravitational effects of cold dark matter, (CDM) with dark halos around galaxies, and ruled out most hot dark matter theories, [2]. The main cause in temperature fluctuations for large angular sizes is from gravitational red shift, when the dense regions cause the CMBR photons to lose energy as they travel away, [1]. This is called the Sachs-Wolfe effect

The small, (ppm) anisotropic features of the CMBR also tell a story of the very beginnings of the BB and make limitations on all cosmological and galaxy formation models. In particular the idea of inflation makes some definite predictions about these small variations in the CMBR, which were measured with the DMR. It is thought that quantum fluctuations with a size of about 10^{-33} m grew exponentially during inflation, (when the universe grew at least 10^{30} times) and produced the variances we see in the CMBR on small angular scales. These quantum density fluctuations traveled as acoustic waves in the early photon/baryonic fluid of the universe and interfered both constructively and destructively. These interactions up until recombination, formed the anisotropy of the CMBR. Thus the CMBR, although quite homogeneous, is thought to actually show the structure of the universe immediately after the BB itself through its measured variations, [1]. The physics that connects these initial quantum fluctuations in the early universe to the measured anisotropies of the CMBR is fairly well defined and involves linear perturbation theory. This connection allows these CMBR anisotropies to be a very good probe of the initial fluctuations of the BB, cosmological parameters, and the resulting geometry of the universe, (galaxy structure and origins), [2]. I wonder if fractal mathematics and/or chaos theory plays a part in the relationship of CMBR to structure we see today?

Another external factor in the small-scale anisotropy is due to the Sunyaev-Zel'dovich effect in which a cloud of high-energy electrons, (in galactic clusters) scatters the radiation and transfers some energy to the CMBR photons. This is a form of Compton scattering and may also cause polarization effects, [4]. It is thought that primordial magnetic fields may also contribute to this effect, [7]. Some of these ideas may be clarified with further, higher resolution polarization studies in the near future, [2].

On the other hand there are cosmological models that produce these anisotropical effects through topological defects acting after recombination, like cosmic strings. In some models of inflation the large scale polarization effects detected can also be caused by gravitational waves, [2]. Quintessence models have also been developed to explain the CMBR peaks and valleys, [6]. These models are still open to discussion.

According to the standard BB cosmology, the CMBR anisotropy shows indirectly, the gravitational potential at the time of recombination. To make the galactic patterns we see today in the universe, gravitational forces would have to have acted upon the matter in the universe. Ordinary , baryonic matter could not move freely until after recombination, (as the radiation would dominate it prior) and the CMBR is the imprint of this pattern of matter distribution. This also shows that DM, (which is not influenced by radiation, only gravity) would have dominated the gravitational influence on structure prior to recombination. After recombination, CMBR properties would determine the properties of both the gravitational potential and density fluctuations as they would continue to form the large-scale structure of the universe we see today. Thus the CMBR power spectrum establishes the initial conditions for future formation.

In conclusion, we have seen that the CMBR is of fundamental importance in understanding cosmology, the overall structure of the universe, and the origins of galaxies. Its properties must be integrated in all such theories and currently seem to fit the standard BB origin of the universe quite well. We know that the large-scale structure of galaxies is seen to have structure, (voids, filaments, clusters) and there seems to be a large amount of evidence of vast amounts of DM associated with this galactic structure. The CMBR has structure and properties that seems to point to DM existence. If the CDM model proves to be true then the universe would form galaxies and their structure through gravitational instability, in a hierarchical manner, (small things first then into larger things). There are still questions in the details of the large galactic scale structure versus the small galactic scale structure that are still not completely answered in any model today, [8].

The launching of the PLANCK satellite in 2007 should help greatly in determining the CMBR parameters to very high accuracy, (1% or less) and enable us to fine tune the cosmological and galactic formation models. The smaller scales would correspond to understanding galactic structure itself as only about 5% of galaxies are in clusters. More data on the fine anisotropies and complementary studies will lead to a better understanding of the CMBR. There are more ground based and space studies being developed for future measurements. Studies looking at the HI distribution, (21cm line) at high red shift also may shed some light on the CMBR temperature fluctuations and galaxy formation, and are being conducted. There are even studies using gravitational lensing, (small scale polarization measurements) to better understand the CMBR and DM, [8]. Studies like the SDSS should provide observational evidence for any galaxy origin models developed in conjunction with the CMBR

We have several theories about how the CMBR and its anisotropy came

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November Guest Speaker: Steve Coe

Steve Coe has been watching the deep sky from locations in Arizona for almost 20 years. During that time he has accumulated a wealth of knowledge, observations, hints and tips that will help every deep sky observer, regardless of experience. Much of this information was made available in his first book, Deep Sky Observing - The Astronomical Tourist. Steve is also a regular contributor on the Cloudy Nights website with his 'What's UP' series of observing articles.

Steve will regale us with tales of his most recent trip to the southern hemisphere: an observational journey to Australia in preparation for an upcoming book.

Third Annual Trivia Quiz
by Bill Dellinges

Oops, there was no quiz last year. Previous trivia quizzes can be found in the September 2002 and March 2003 club newsletters, which currently may be 60 feet down in your local landfill. The questions are listed below. Answers follow - no peeking ahead!

1) Who named the 1997 Mars Pathfinder's "Sojourner" rover?

2) Claudius Ptolemy's Almagest (Arabic: "The Greatest") was originally titled what?

3) Questar was established 1950. First S&T ad was June 1954. What was the price?

4) What was the last moon in the solar system discovered visually from Earth?

5) A teaspoon of neutron star material would weigh how much on Earth?

6) What was the predecessor company name of Celestron?

7) What colors were pre-1970 Celestron telescopes?

8) What star atlas first used equatorial rather than ecliptic coordinates for right ascension and declination?

9) Who named the two Mars rovers, Spirit and Opportunity?

10) Who named the planet Pluto?

11) What was the first object photographed by the 200" Palomar telescope?

12) Celestron has been on S&T's back cover since January 1972. Whom did they bump from that space?

Answers on page 12

Cosmic Microwave Background

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into being and have influenced our universe, but there is still no clear, final answer. Future studies could bring clarification. Most astronomers believe the data so far supports the standard model of the BB and CDM galactic origin model with gravitational instabilities dominating in hierarchical galaxy formation.

References

[1] Wright, E. " Cosmic Microwave Background" Encyclopedia of Astronomy & Astrophysics 2001

[2] Subramanian, K. "The Physics of CMBR Anisotropies" arXiv:astro-ph/0411049 v1 2 Nov 2004

[3] Michon, Gerard "Cosmology 101" http://home.att.net/~numericana/answer/cosmos.htm

[4] "Cosmic Microwave Background Radiation" Wikipedia, the free encyclopedia http://en.wikipedia.org/wiki/Cosmic_microwave_background_radiation

[5] "CBI Reveals Motion in the Remotest Seeds of Galaxy Clusters in the Very Early Universe" Caltech Press Release 10/17/04 http://pr.caltech.edu/media/Press_Releases/PR12595.html

[6] Domenico, D. Rubano, C. Scudellaro, P. "Testing a quintessence model with CMBR peaks location" arXiv:astro-ph/0209357 v1 18 Sep 2002

[7] Subramanian, K. Seshadri, T. Barrow, J. "Small scale CMB polarization anisotropies due to tangled primordial magnetic fields" arXiv:astro-ph/0303014 v2 14 Jul 2003

[8] Sellwood, J. "What is the evidence for Dark Matter" arXiv:astro-ph/0401398 v2 22 Jan 2004

[9] Leitch, E. Kovac, J. Halverson, N. Carlstrom, J. Pryke, C. Smith, M. "DASI Three year CMB polarization results" arXiv:astro-ph/0409357 v1 15 Sep 2004

Election Day

November 18

Classified Advertisements

Your

Ad

Here

16" f4.5 Meade Starfinder Eq. Mount

Optics remounted into a new tube, built by Pierre Schwarr with a JMI focuser. Includes 7, 12.5, 17, 20, and 32mm eyepieces plus 2.8 Klee Barlow, laser collimator and an Olympus OM1 camera.

Many extras! I have $5200 invested in this telescope package, but will sell for $2000

Dave Rainey 602-980-0582
drainey7@cox.net

10" f5 Hardin Dob

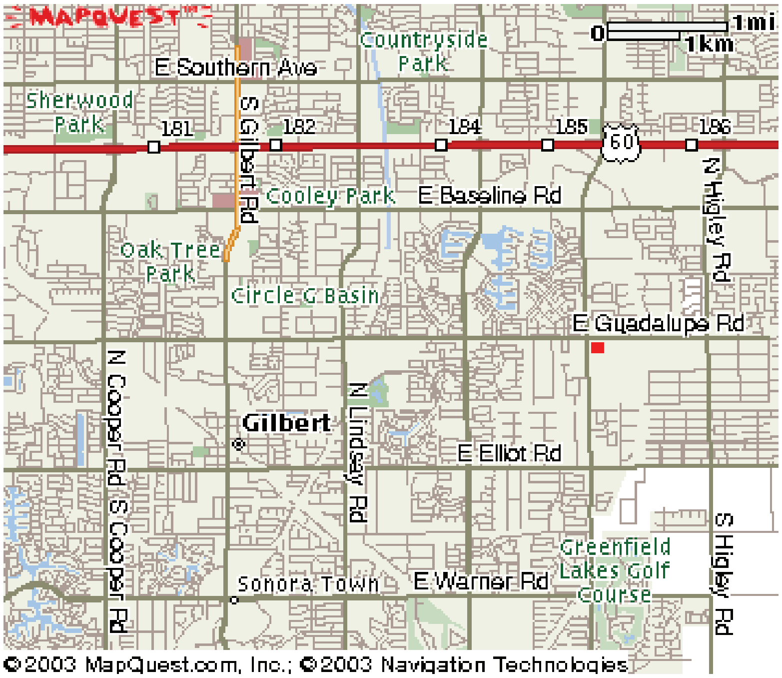
Deep Space Hunter 10 with 10" parabolic mirror made from BK-7 glass. Focal length is 1250 mm. Secondary is 2.6". Includes a smooth 2" Crayford focuser with 1¼" adapter, 8x50 finder scope, Telrad base (no Telrad), 2" 32mm eyepiece, 1¼" 9 mm eyepiece, cooling fan on mirror cell. White metal tube with black base. Excellent condition. First $350 takes it. Will take cash, check or PayPal. Will deliver in metro Phoenix area.

Peter Argenziano
news@eastvalleyastronomy.org

Advertisements for astronomical equipment or services will be accepted from current EVAC members only. Ads will be published as space permits and may be edited. Ads should consist of a brief text description and must include a current member name and phone number. You may include your email address if you wish. Ads will be published until canceled (as space allows), so please inform the editor when your item has sold.

Ads should be emailed to: news@eastvalleyastronomy.org

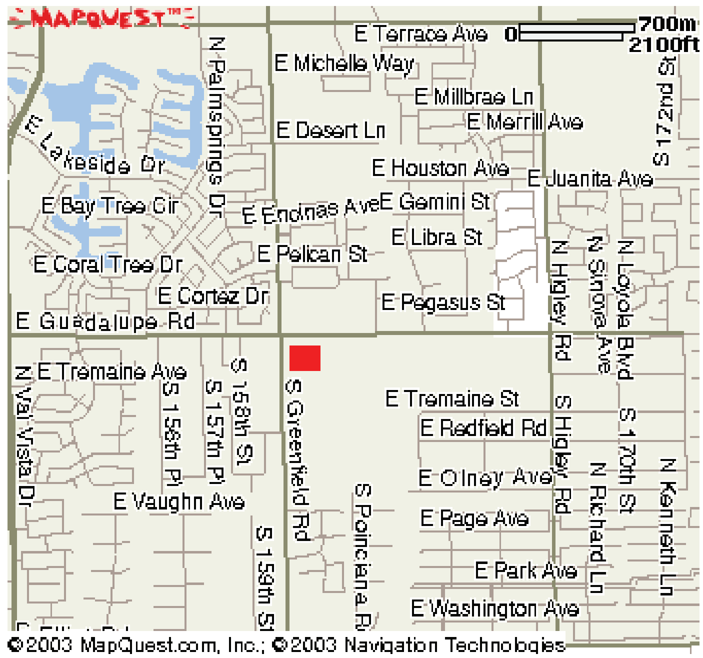
Support your local telescope



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 Rd., on the southeast corner of Greenfield and Guadalupe Roads. Meetings begin at 7:30pm.

Visitors are always welcome!



Upcoming Meeting Dates

November 18

December 16

January 20

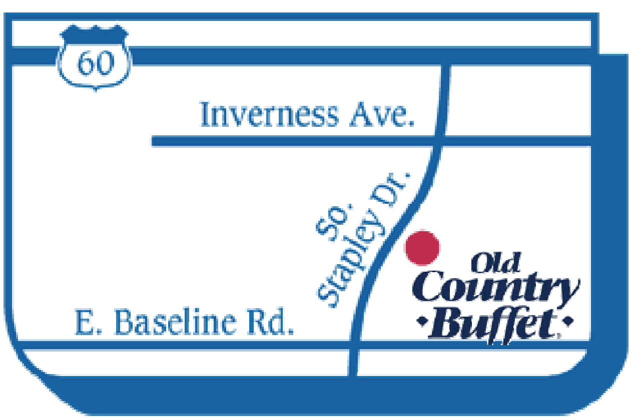
February 17

March 18

Southeast Regional Library

775 N. Greenfield Road

Gilbert, AZ 85234



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, (near the Walmart Supercenter) just south of US 60.

Old Country Buffet 1855 S. Stapley Drive in Mesa

NOVEMBER 2005

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		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			

Schedule of Events

- *November 5 - Deep Sky Star Party at Vekol Road*
- *November 11 - Public Star Party at Riparian Preserve in Gilbert*
- *November 18 - General Meeting at Southeast Regional Library in Gilbert*
- *November 26 - Local Star Party at Boyce Thompson Arboretum State Park*

Minutes of October Board of Directors Meeting

Meeting date: Tuesday, October 11, 2005

Attending: President Steven Aggas; Vice President Howard Israel; Secretary Peri Cline; Treasurer Wayne Thomas; Event Coordinator Randy Peterson; Properties Director Dave Williams; Webmaster Marty Pieczonka; Directors Joe Goss, John Holmquist, Chuck Crawford and Dave Shafer

Not Attending: Newsletter Editor Peter Argenziano, Event Coordinator Gwen Grace; Director Martin Bonadio.

Discussion opened with the Budget. Our third quarter is actually in the red overall. The Treasurer, Wayne Thomas, requested that all members who are in charge of areas that are covered by the budget submit projected expenses for the next year. This will allow him to submit a more accurate budget to the board and the membership.

The suggestion of a donation can for the snacks at the meetings to offset the cost of the snacks was defeated in light of the discussion about increasing the membership dues.

The dues for the membership in EVAC have been unchanged for many years, while the cost of providing services to members has risen. Many different points were discussed and it was generally agreed that while membership was a bargain, we need more operating capital to maintain the level of services we wish to offer. One big expense is the newsletter. Most of the members receive it electronically, but for about 50 members newsletters must be printed and mailed at a cost of approximately $80.00 per month. A surcharge to receive the newsletter mailed was proposed and defeated. A proposal of $30.00 per member, $35 per family was offered and accepted. Renewals made before January 1, 2006 will be at the old rate of $20.00. This proposal will be brought to the membership for ratification. If ratified, the increased rates will be used to cover more equipment, books and to support the All Arizona Star Party.

The New Observatory Manager is an appointed position and the President and current Manager nominated two possible replacements to serve as Co-Managers. The merits of Silvio Jaconelli and Chuck Crawford were discussed and the Board chose Chuck Crawford as the 2006 Manager.

In an effort to encourage future astronomers, a program for kids that attend the meetings has been proposed. This program would be offered during the 15 minute break at regular meetings. While all are in favor of programs to youth that promote astronomy, it was decided that at this time to table the discussion for the future. It is hoped that the opening of the Observatory will attract more members and families. A program for youth might be more in line with program offerings of the Observatory.

Open Discussion:

The All Arizona Star Party was reasonably successful despite the promised canopy never arriving. Several smaller canopies were set up together and worked out very well. Because of the difficulty in storing tables, canopies and other club properties, the idea of a rental/storage unit was discussed. The matter will be looked into and arrangements with the new Property Directors will be discussed. Unfortunately the days turned out to be a little warm and uncomfortable, and the bugs were out in force. Because this star party falls at the same time in general as the Lowell star party, and the heat and the bugs, the idea of moving the party to a later time was discussed. As long as it is not the same weekend as Thanksgiving, most agreed that a mid November date was attractive.

East Valley Astronomy Club -- 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 (select according to the month you are joining the club):

☐ **$20.00** January through March ☐ **$15.00** April through June

☐ **$10.00** July through September ☐ **$25.00** October through December

Includes dues for the following year

Renewal (current members only):

☐ **$20.00** January - December

Magazine Subscriptions (include renewal notices):

☐ **$34.00** Astronomy ☐ **$33.00** Sky & Telescope

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

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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) ☐ US Mail

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.eastvalleyastronomy.org

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 my family and I 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

NASA's Space Place

A Wrinkle in Space Time

by Trudy E. Bell

When a massive star reaches the end of its life, it can explode into a supernova rivaling the brilliance of an entire galaxy. What's left of the star fades in weeks, but its outer layers expand through space as a turbulent cloud of gases. Astronomers see beautiful remnants from past supernovas all around the sky, one of the most famous being the Crab Nebula in Taurus.

When a star throws off nine-tenths of its mass in a supernova, however, it also throws off nine-tenths of its gravitational field.

Astronomers see the light from supernovas. Can they also somehow sense the sudden and dramatic change in the exploding star's gravitational field?

Yes, they believe they can. According to Einstein's general theory of relativity, changes in the star's gravitational field should propagate outward, just like light—indeed, at the speed of light.

Those propagating changes would be a gravitational wave.

Einstein said what we feel as a gravitational field arises from the fact that huge masses curve space and time. The more massive an object, the more it bends the three dimensions of space and the fourth dimension of time. And if a massive object's gravitational field changes suddenly—say, when a star explodes—it should kink or wrinkle the very geometry of space-time. Moreover, that wrinkle should propagate outward like ripples radiating outward in a pond from a thrown stone.

The frequency and timing of gravitational waves should reveal what's happening deep inside a supernova, in contrast to light, which is radiated from the surface. Thus, gravitational waves allow astronomers to peer inside the universe's most violent events—like doctors peer at patients' internal organs using CAT scans. The technique is not limited to supernovas: colliding neutron stars, black holes and other exotic objects may be revealed, too.

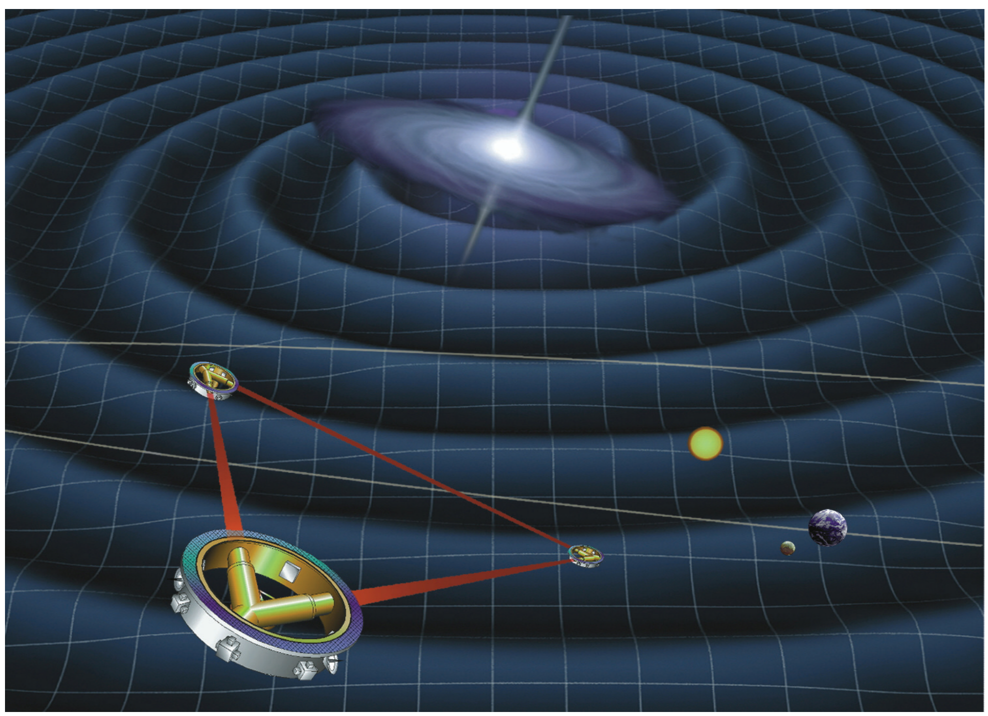
NASA and the European Space Agency are now building prototype equipment for the first space experiment to measure gravitational waves: the Laser Interferometer Space Antenna, or LISA.

LISA will look for patterns of compression and stretching in space-time that signal the passage of a gravitational wave. Three small spacecraft will fly in a triangular formation behind the Earth, each beaming a laser at the other two, continuously measuring their mutual separation. Although the three 'craft will be 5 million kilometers apart, they will monitor their separation to one billionth of a centimeter, smaller than an atom's diameter, which is the kind of precision needed to sense these elusive waves.

LISA is slated for launch around 2015.

To learn more about LISA, go to http://lisa.jpl.nasa.gov. Kids can learn about LISA and do a gravitational wave interactive crossword at http://spaceplace.nasa.gov/en/kids/lisaxword/lisaxword.shtml.

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



LISA's three spacecraft will be positioned at the corners of a triangle 5 million kilometers on a side and will be able to detect gravitational wave induced changes in their separation distance of as little as one billionth of a centimeter.

If it's Clear...
by Fulton Wright, Jr.
Prescott Astronomy Club

November 2005

Shamelessly stolen information from Sky & Telescope magazine, Astronomy magazine, and anywhere else I can find info. When gauging distances, remember that the Moon is 1/2 a degree or 30 arc minutes in diameter. All times are Mountain Standard Time unless otherwise noted.

Now is the time for observing Mars. Here is a table to help you plan for a few months. The altitude at the best time will be about 70 degrees the whole 4 month period. (see Sky and Telescope, September 2005, p. 67 for more detail.)

DATE	BEST TIME	SIZE
Sep 1	4:30 AM	14"
Oct 1	3:15 AM	18"
Oct 30	1:00 AM	20" (closest to earth)
Nov 7	12:15 AM	20" (opposition)
Dec 1	10:10 PM	17"
Jan 1	8:15 PM	12"

On Tuesday, November 1, it is new Moon so you have dark skies for all night observing if you like.

On Friday, November 4 through Tuesday, November 8 the north pole of the Moon will be tipped toward us by libration. So when you are checking out the Moon with your telescope in the early evening, you will have a chance to see the extreme northern part at its best.

On Saturday, November 5, look for the crescent Moon and Venus low in the southwest about 6:30 PM. They will be about

3 degrees apart.

On Monday, November 14, all evening, you can see the almost full Moon and Mars about 2 degrees apart.

On Tuesday, November 15, at 5:06 PM (20 minutes before sunset), the full Moon rises. Forget the faint fuzzes tonight and check out the rays and other albedo features on the Moon.

On Wednesday, November 16, after about 8 PM, the Moon's libration gives us a good chance to see the southeast (lower right with north at the top) part of the Moon at its best.

The next day should be good, too.

Answers to Third Annual Trivia Quiz

1) Twelve year old Valerie Ambroise in a JPL contest.

2) Syntaxis Mathematike.

3) $795.

4) Jupiter's Amalthea by E. E. Barnard in 1892 with the Lick 36" refractor.

5) About three billion tons.

6) Tom Johnson's "Valor Electronics."

7) White tubes, blue forks and clock drives.

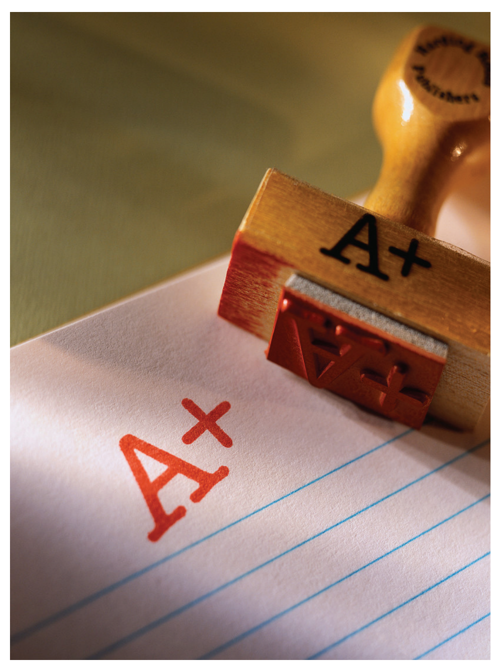
8) John Flamsteed's Atlas Coelestis (1729).

9) Nine year old Sofi Collis out of 10,000 NASA entries.

10) Eleven year old Venetia Burney of Oxford, England.

11) Hubble's Variable Nebula, NGC 2261, January 26, 1949.

12) Unitron Instrument Company.



EVAC Financial Snapshot

What follows is a brief glimpse of the financial status of the club, as depicted by our budgetary performance through the third quarter of 2005.

Total membership stands at 228.

The 2005 revised budgeted income is $12,085 versus budgeted expenses of $12,361. Our income performance through September was 57% on actual income of $6,873. Expense performance for the same period was 53% on actual expenses of $6,586.

EVAC relies on membership dues for almost all of our income. We do earn a small profit on the sales of miscellaneous items (calendars, handbooks, software, nametags, clothing, etc.).

Membership dues income was $4,104 thru the third quarter, performance of 84% of plan.

Magazine subscriptions were budgeted at $3,776, but these funds simply pass from the member to the publisher and do not affect our financial status.

Miscellaneous items (calendars, handbooks, software, nametags, clothing, etc.) were budgeted at $4,105 with actual expenses of $3,641 (88%).

Thanks to our President, Steven Aggas, the single biggest expense (meeting site rental) has been eliminated this year.

Other expenses include the following, and are listed as budgeted amount and (year-to-date performance):

Newsletter printing and postage was budgeted at $757 (70%).

Speaker honorariums $925 (97%)

Dinner with guest speakers $110 (43%)

All-Arizona Star Party $250 (57%)

Messier Marathon Awards $90 (185%)

Holiday party $125 (0%)

Meeting refreshments $365 (61%)

Adopt-a-Highway brunches $257 (50%)

Website and listserver $200 (218%)

Post Office Box $38 (100%)

Insurance $428 (76%)

Properties $500 (13%)

Through the first three quarters of 2005, the club had actual income of $6,873 versus actual expenses of $6,586 for a surplus of $287.

As you can probably surmise, raising dues was virtually inevitable given this level of solvency. The Board of Directors met in October and voted on a proposal to increase membership dues - the club's sole source of sustainable income. This proposal was ratified by the membership in attendance at the October general meeting (according to the club's bylaws).

Time to Renew

In accordance with the bylaws, the Board proposed an increase in the annual membership dues to be effective January 1, 2006. The measure was ratified by the membership at the October club meeting. The new rates are $30 for individuals or $35 for a family. An additional $10 is also levied for those who want a printed newsletter mailed to them.

Act now to avoid the rate increase! All members who renew their membership BEFORE December 31, 2005 can do so at the current rate of $20… but payment must be made prior to the end of the year.

The new dues structure, which takes effect January 1, 2006, is as follows:

Individual memberships are now $30 annually.

Family memberships are now $35 annually.

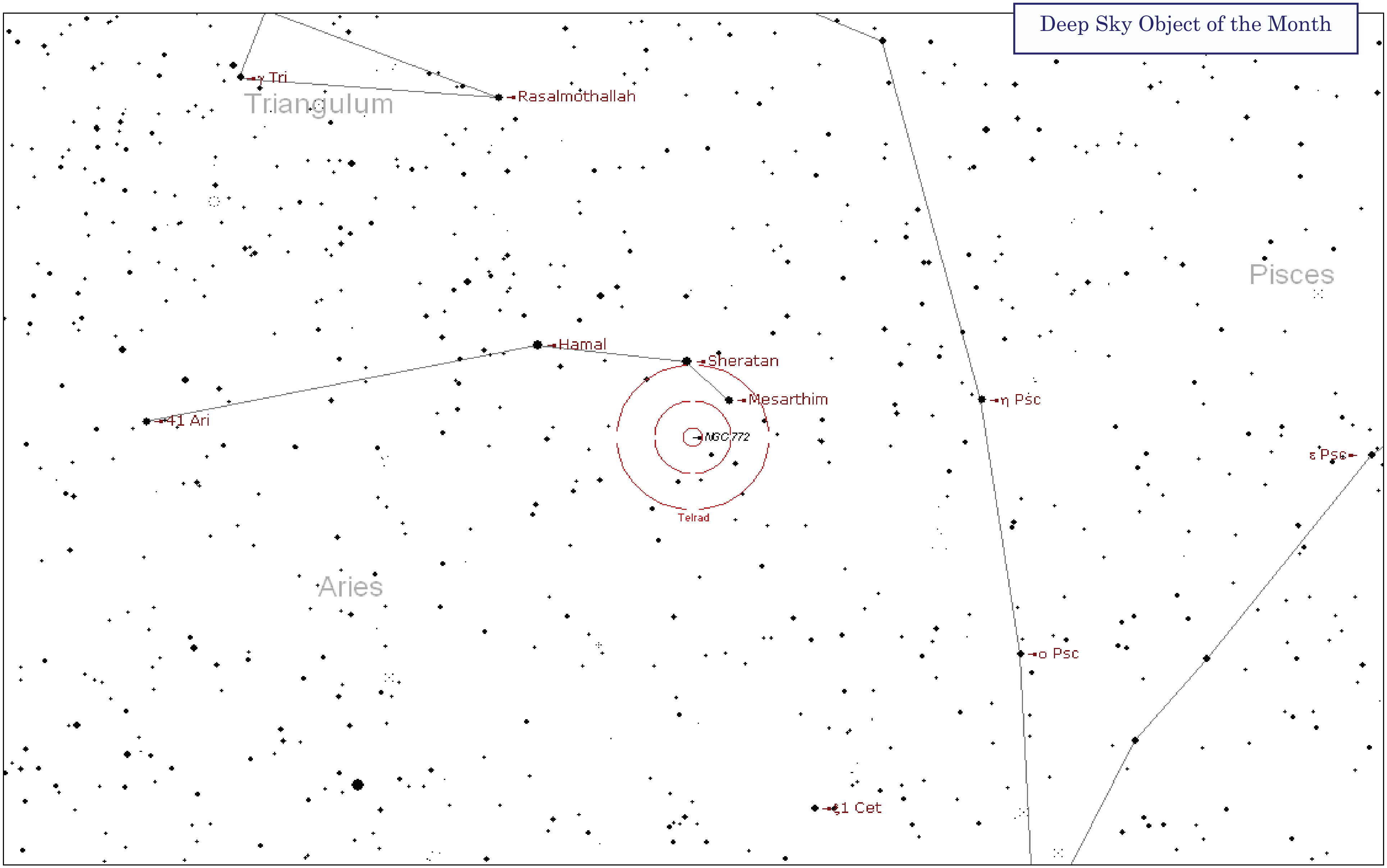
Those members requesting a printed newsletter be mailed to them will be assessed a $10 annual surcharge.

All new memberships shall be prorated throughout the year.

All memberships expire on December 31.

Yearend Balance	*Income*	*Expenses*
2004 $4446.77	$8978.56	$11,334.05
2003 $6802.26	$11,115.50	$10,340.97
2002 $5949.73	$8,681.70	$7,377.46
2001 $4651.02	$7,796.80	$7,470.28
2000 $4308.49	$2,735.00	$2,215.00

Deep Sky Object of the Month



NGC 772 Face-On Barred Spiral Galaxy in Aries

Magnitude: 11.2 Size: 7'.1 x 4'.0

RA 01h 59m 19.1s Dec +19° 00' 28" Mean Surface Brightness: 23.5 Mag/Arc-Sec^2

2005 Sentinel-Schwaar Star Gaze

Saturday, December 3rd

The Sentinel-Schwaar Star Gaze is a chance for astronomers to meet at an Arizona dark sky site. It is sponsored by the Deep Sky Group of the Saguaro Astronomy Club in memory of Pierre Schwaar. There is no registration and no fee to attend, just show up and enjoy the night sky. In the past, folks have arrived on Friday, for two nights of observing. There are no facilities at the site; it is just a large flat area in the middle of the desert southwest. It gets both hot and cold, depending on the whim of the weather, so bring cool water and warm clothes. Please be courteous about white light, many observers and photographers are going after very dim objects.

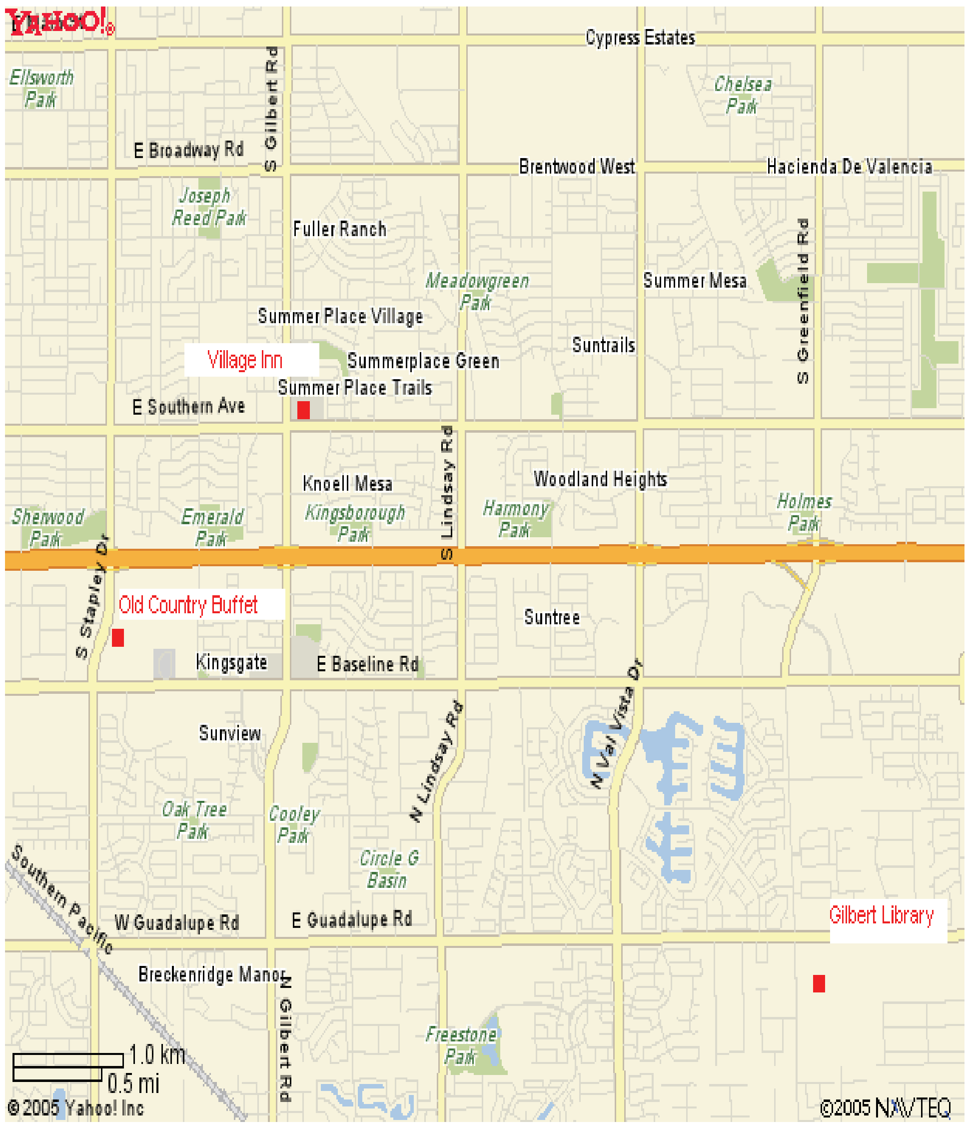
To get to the site, drive to Gila Bend, AZ. and get on the I-8 freeway going west toward Yuma. The Sentinel exit is #87, about 30 miles west from Gila Bend. Take the exit and go south, across the railroad tracks. Go straight south on the dirt road and drive 2 miles until you see a large, flat area of the desert to your left, white rocks mark the site. It is before a cattle guard. YOU ARE THERE!

New Moon on November 1 at 18:25

First Quarter Moon on November 8 at 18:57

Full Moon on November 15 at 17:58

Last Quarter Moon on November 23 at 15:12



Map showing location of pre-meeting dinner (Old Country Buffet), meeting site (Southeast Regional Library), and post-meeting gathering spot (Village Inn).

Star Party Disclaimer

The East Valley Astronomy Club (EVAC) is not responsible for the property or liability of any star party participant, nor will the club be held liable for their actions or possessions. EVAC is not responsible for any vehicular damage, theft, or mechanical difficulties that may occur while attending a star party. EVAC strongly recommends adherence to the doctrine of 'safety in numbers' when it comes to remote observing sites. In the interest of safety it is recommended that you don't go to remote sites alone and that someone knows where you have gone each time you go out observing.

The Voyager is published monthly by the East Valley Astronomy Club and made available electronically (PDF) the first week of the month. Printed copies are available at the monthly meeting.

Please send your contributions, tips, suggestions and comments to the Editor (Peter Argenziano) at: news@eastvalleyastronomy.org

Contributions may be edited.

www.eastvalleyastronomy.org

Keep Looking Up!

East Valley Astronomy Club

PO Box 2202

Mesa, AZ 85214-2202