December 2005

The Voyager

East Valley Astronomy Club

Volume 19 Issue 12

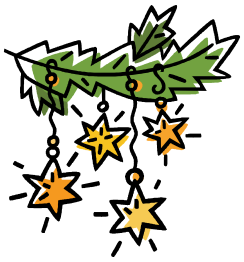
From the Desk of the President
by Steven Aggas, 2005 EVAC President

Happy Holidays everyone!

2005 has been an outstanding year in many regards. I would like to thank the Board of Directors, the entire EVAC Cabinet, and all of our members, as we dealt with many tough issues this year. To bring the year to a close, I would like to invite you to attend the Holiday Gathering on December 16th (Friday) at the Southeast Regional Library (Gilbert Public Library) for a casual night of conversation and fun. Hors D'oeuvres and drinks (non-alcoholic) will be served as we talk telescopes, eyepieces, objects, or seeing conditions. We will have some holiday music playing in the background and I'm putting together a PowerPoint show containing as many digital astronomical images, as captured by our very own members, that will display throughout the evening. If you have some you would like for others to see, send them to me for inclusion.

We will not have a speaker for the December General Assembly meeting, as we will be having the Holiday gathering.

Join us at the Southeast Regional Library (Gilbert Public Library) on Friday, December 16th at 7:30PM. The GPL is located at the Southeast corner of Greenfield and Guadalupe Roads.



The Backyard Astronomer
Sierra Vista Astronomy *by Bill Dellinges*

At the foot of the Huachuca Mountains in southeast Arizona lies the thriving city of Sierra Vista (el. 4,600'). The city is perhaps best known for its connection to Fort Huachuca, established in 1886 to fight Geronimo. In surfing the net for Arizona astronomy clubs, I discovered Sierra Vista has quite an active club of about 70 members who claim to have more observatories per capita (16) of any club over 20 members in the United States! Welcome to the Huachuca Astronomy Club!

When I learned one member, Dave Healy, has an Optical Guidance System 32" F- 7.2 Ritchey-Chrietien telescope in his 16.5' Ash Dome observatory, and after perusing other members' observatories at their web site (http://c3po.cochise.edu/astro/) , I decided I had to get down there and meet these guys. It also occurred to me that it must be pretty dark there to warrant all those observatories being established – how dark would it be?

A few emails later, and thanks to Dave's kind invitation, I was off to their October 22nd club star party at Dave's home and "Junk Bond Observatory" where most of their star parties meet. There is apparently no reason to travel to a dark site - as our club does - because it's simply dark enough already at most members' homes! Could this be?

Sierra Vista's population is about 50,000 and produces its share of light pollution. But most of the club's members reside in an arc to the south and east of the city with a radius of about 15 miles, in Hereford and Palominas. Here, it is indeed pretty dark. I looked up and was stunned by how prominent the Milky Way was. I could easily spot the outline of Capricornus and

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Inside this issue:

December Events:

- *Deep Sky Star Party at Vekol Road - December 3*
- *Sentinel-Schwaar Star Gaze in Sentinel - December 3*
- *Public Star Party in Gilbert - December 9*
- *Holiday Party at Southeast Regional Library - December 16*
- *Local Star Party at Boyce Thompson - December 24*

The Backyard Astronomer

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Aquarius, a good dark sky test in my book. Most deep sky objects that you should be able to see naked eye, such as the Double Cluster, M7, M8, M24 and M31, were visible. I was impressed. This sky was on par with some of the darkest skies I've seen in Arizona; perhaps not as dark as the Grand Canyon, Portal, or Cochise Stronghold, but close. I rate it as slightly superior to our beloved Picket Post site. The light dome from Sierra Vista in the northwest is the biggest problem. But it's rather small and contained in an area in the NW, not a direction we gazers usually pursue. There was a very small light dome to the south from what I believe was Cananea, Mexico (the border is 10 miles south of Dave's home).

There was also a hint of some light pollution to the southeast (Naco) and east (Bisbee and Tombstone) but I did not find it objectionable, certainly no where near as bad as that which we see to the east of Picket Post (Superior, Miami, Globe).

I had the opportunity to view M57, M31, and M15 through Dave's 32". I must say, they didn't look much better than what I'd expect to see in, say, a 20". But sometimes it works that way. Still, maybe the 32" aperture helps him in other ways, like his asteroid hunting program (see his article in the March 2005 issue of Astronomy magazine). Dave also has a LX200 16" in a roll-off roof observatory but it was not open this night. Club members had several large Dobs set up next to the observatory. There was an interesting refractor set up: a Photon Instruments 5" on a Televue Telepod head mounted on a Celestron C8 tripod – quite a mixture of vendors there! My 20x100 Miyauchi's were a hit with the group; apparently they had never seen a pair before.

The next night I twisted an arm and got invited to Doug Snyder's home and observatory nearby. He has a 20x25 foot roll-off observatory with a 20" Obsession Dobsonian and Meade LX200 10". Doug is currently the club president, newsletter editor, and web master – a man of many hats. That night he was only doing imaging in the 10", so he, Keith Mullen (a neighbor) and I shot the breeze about astronomical matters. He told me Gary Myers of Stellarcat and Servo Cat GOTO recently moved to the area and has an observatory on the northeast side of town. Doug also pointed out they're very active in the fight against light pollution; diligently monitoring lighting ordinances and on occasion, replacing offending lighting in the area with full cutoff fixtures.

Amateur astronomy is alive and well in southeastern Arizona.

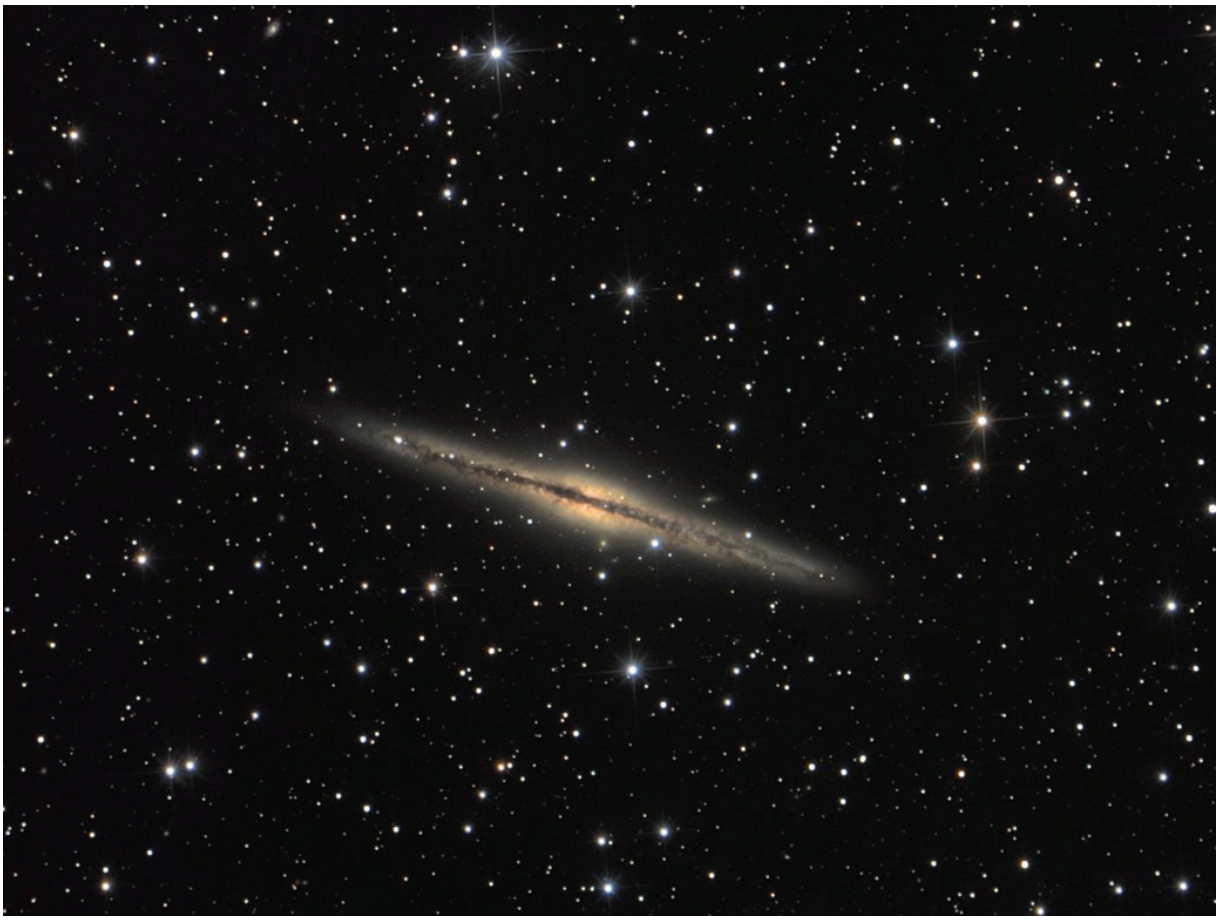


Image of NGC 891 in Andromeda by Jon Christensen

Image taken on November 5-6, 2005 at the Deep Sky Star Party at Vekol Road with 12.5 inch RCOS RC at F/9 and SBIG STL 11000 camera. 250 Minutes Luminance; R40, G30, B40.

See page 14 for a sky chart of this barred spiral galaxy, the December Deep Sky Object of the Month.

Special Announcement: 2006 EVAC Memberships

Over the past several years EVAC has operated relatively flat financially, with gross income only slightly exceeding expenses each year. Each of the last few cabinets have wrestled with this dilemma of trying to keep expenses in check while still providing value to the membership. It's not an easy task in an era of ever-increasing costs.

Recently the Board of Directors approved two proposals to restructure the dues assessed for membership. These proposals were ratified by the members in attendance at the October general meeting, according to voting guidelines established in the club's bylaws. Each will take effect on January 1, 2006.

The first proposal established two classes of membership:

Individual membership with annual dues of $30

Family membership with annual dues of $35

Both memberships will be prorated quarterly, as has been our policy in the past.

All memberships will continue to expire on December 31.

Current members may renew for 2006 at the current rate of $20 if payment is made prior to the end of this year. This is a great opportunity to renew early and delay the rate increase until 2007. Until the end of this year other interested people may join EVAC and pay $25 dues for 2006.

The second proposal levies a $10 annual surcharge to those members who elect to have the monthly newsletter mailed to them. In essence, this allows for a 50/50 split of the actual expense between the club and the member. Each newsletter costs about $1.60 to print and mail, which equates to $19.20 per year.

It is never an easy decision to raise the cost of membership, and EVAC was able to delay its first increase until its nineteenth year of existence. In addition to our existing expenses, we are projecting increases related to rental fees for property storage, increased guest speaker honorariums, improving the All-Arizona Star Party, and establishing educational programs at the Riparian-Rotary Observatory.

The governing body of EVAC is committed to continuous improvement and thanks you for your support.

Keep looking up!

2005 EVAC Administration

The East Valley Astronomy Club wishes you all the joys of the Holiday Season!

Health, happiness and friendship in the new year!

Happy Holidays!

The Chandrasekhar Limit
by Henry De Jonge

We will discuss the pivotal role of the Chandrasekhar limit in stellar astrophysics theory. We will examine the then current thinking about white dwarfs and stellar evolution, the development of the limit by Chandrasekhar, the tumultuous relationship between Eddington and Chandrasekhar, and the eventual acceptance of the Chandrasekhar limit into mainstream stellar astrophysics.

WHITE DWARF HISTORY

In the 1930 and 1940's era the energy source of stars on the main sequence HR diagram was understood and accepted as the burning of nuclear fuel, [1]. Astronomers were focusing more on how stars evolve and what happens near the end of a star's life when the nuclear fuel is exhausted.

One known ending of a star's life was that a star would become a white dwarf. A white dwarf star would have a density of over 3000 times that of rock and be incredibly hot as well, with all of its mass compressed into a ball the size of the earth. A teaspoon of such material would weigh 5 tons, [9]! The incredible density of such a star would mean that all the atoms would have to be stripped of their electrons and this mass of electrons and nuclei would all be crammed together. This could only happen if the star vas very hot, on average about twice as hot as the sun. On the other hand it was thought that over time the star would cool off and eventually the electrons would return to their normal positions about the nuclei and the star would have to expand. Yet the question remained, as to how a cooling star could expand against the tremendous force of gravity that would accompany such mass.

Arthur Stanley Eddington, (1882-1944) commented on the paradox of how could a body continually lose heat but not grow cold?. Eddington was one of the world's best-known astrophysicists at the time, and had been the leader of the expedition to Brazil to test general relativity during the 1919 eclipse. He had written "The Internal Constitution of the Stars" in 1926, which was a classic text in understanding fusion and the properties of stars. Some have called him the father of modern theoretical astrophysics, [4]. He was also a pioneer in the early study of relativity theory and was widely respected as one of the few who could understand it when it first appeared, [4]. He had also tried unsuccessfully to merge relativity theory and quantum mechanics in the 1930's, [3].

Using the Newtonian theory of gravitation scientists of the time could explain stellar evolution of the main sequence band in the HR diagram but the white dwarf ending and its position in the lower left hand corner away from the main sequence band, was a bit harder, [7]. The incredible densities and small sizes indicated and required some new understanding.

In 1926 Ralph Howard Fowler attempted to explain this extraordinary stellar state by using quantum mechanics. He suggested that the mistake was in assuming that the electrons would return to their usual state of orbiting around nuclei as the star cooled over time. According to the Heisenberg Uncertainty Principle, since the electrons were tightly confined to their positions in such a dense state of matter, their momentum, (or velocity) would have to be correspondingly higher as a result, [1]. This is because a small uncertainty in position results in a large uncertainty in momentum and this creates the pressure. In fact their velocity would be too fast for them to recombine with the nuclei and therefore the star would not swell up at all. Fowler also explained that according to the Pauli exclusion principle, two particles like electrons, (which are in a class called Fermions with spin of 1/2), could not be in the same place at the same time, (or share the same quantum state) so that the electrons would strongly resist this high level cramming and form a pressure of their own. This new type of pressure was called degeneracy pressure. Therefore the degeneracy pressure would counteract the crushing gravity and would be independent of temperature, [7], [1].

This new type of pressure also has nothing to do with the fact that electrons are negatively charged. This is additional resistance to collapse above and beyond electrical repulsion, [2]. It occurs at densities, which are about a million times that of water and were thus not familiar to our ordinary experience.

Electron degeneracy pressure can also be understood as a consequence of the wave/particle duality of matter, [11]. According to quantum mechanics each particle can sometimes behave like a wave and each wave can sometimes behave like a particle. They are essentially the same "thing". In the super dense state of matter in a white dwarf the short wavelength of the electron combined with its high energy, (confining the electron to a small shell due to the Pauli exclusion principle) give it a rapid motion and thus generated the pressure.

These new concepts in quantum mechanics and relativity theory were very hard to accept in the early developmental days of stellar evolution, and before the acceptance of black holes and neutron stars. In fact many astronomers thought it was impossible, [1].

The astronomical mainstream and especially Eddington eventually accepted this explanation though. Ordinary stars would exhaust their nuclear fuel and shrink to white dwarfs, slowly fading away to dark cold balls, held up by degeneracy pressure. This was an excellent initial application of the new quantum mechanics merged with stellar astrophysics.

(Continued on page 16)

EVAC Holiday Party

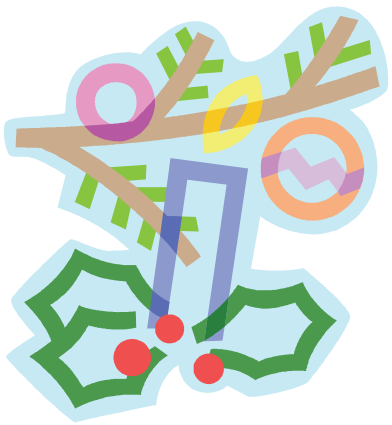
Each year at this time the club hosts a Holiday party for its members. This event is in lieu of a general monthly meeting… in fact, it is scheduled for the regular monthly meeting date at the regular monthly meeting site.

Please plan on attending the 2005 EVAC Holiday Party on Friday, December 16, beginning at 7:30 PM. The location is the Southeast Regional Library in Gilbert.

Given the festivities, there will be no scheduled pre-meeting dinner on this date.

The club will provide various finger-foods and soft drinks. Alcoholic beverages are not permitted at this facility.

Please feel free to bring along your favorite holiday baked goodies or desserts.



Telescopic Targets for December Nights
by Bill Dellinges

Star color comparison: Deneb

A *white* hot (18,000° F) supergiant star in Cygnus, 1,600 light years away. 60 times the size of our sun and 60,000 times brighter. Compare it to **Aldebaran**, an *orange* (6,600° F) giant star in Taurus 65 light years away.

Double star: Albireo, a beautiful blue and yellow star that orbit one another, 400 light years away in Cygnus (34.4"). **Mesarthim in Aries**, nice equal magnitude double star 160 light years away (7.6"). The two stars are 380 Astronomical Units distant from each other.

Triple star: Iota Cassiopeiae, a 3 star system 180 light years away (AB 2.8", AC 7.3"). A somewhat challenging triple star!

Open star clusters: M45, the "Pleiades" or "Seven Sisters". A group of about 200 stars 440 light years away in Taurus. **M35**, 120 stars 2,600 light years away in Gemini.

The Double Cluster in Perseus, two magnificent open star clusters almost touching. 7,000 light years away.

Globular Star Cluster: M15 in Pegasus. Spherical collection of several hundred thousand stars in orbit about our galaxy, 40,000 light years away.

Planetary Nebula: N.G.C. 7662 in Andromeda (The Blue Snowball nebula), a dead sun-like star shedding its outer material. 1,800 light years away. **N.G.C. 2392 in Gemini (The Eskimo Nebula),** 1,400 light years away.

Supernova remnant: M1, the "Crab Nebula". Another dead star - different demise however. The Chinese saw this star explode in 1054 A.D. It could be seen at daytime for a month. These large stars don't bother with a planetary nebula end as above, they simply implode violently when they run out of fuel - **Ka-boom!** Leaves behind a Neutron Star (density = 100 million tons per square inch) or sometimes a Black Hole.

M42, The Orion Nebula. A cloud of gas and dust, a virtual "stellar nursery", where hundreds of stars are being created from hydrogen gas. 1,600 light years distant. Visible to the unaided eye as a fuzzy star in the "sword" of Orion. There is enough gas here to make 10,000 Suns.

Galaxy: M31, the great galaxy in Andromeda. Our nearest galactic neighbor, 2 million light years away. Similar in nature to our Milky Way galaxy. A 100 billion stars in a flat rotating system about 100, 000 light years in diameter. In a dark sky, it can just be glimpsed by the naked eye. Most distant thing thing you can see without optical aid.

N.G.C. 253 in Sculptor, another galactic neighbor 9 million light years away. I call it the "cigar" galaxy; check it out and see why.

One light year = 6 trillion miles

Astronomical Unit [AU] = 93 million miles

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. Steal this scope for only $315 -- that's less than $32 per inch of aperture! Will take cash, check or PayPal. Will deliver in metro Phoenix area.

Peter Argenziano

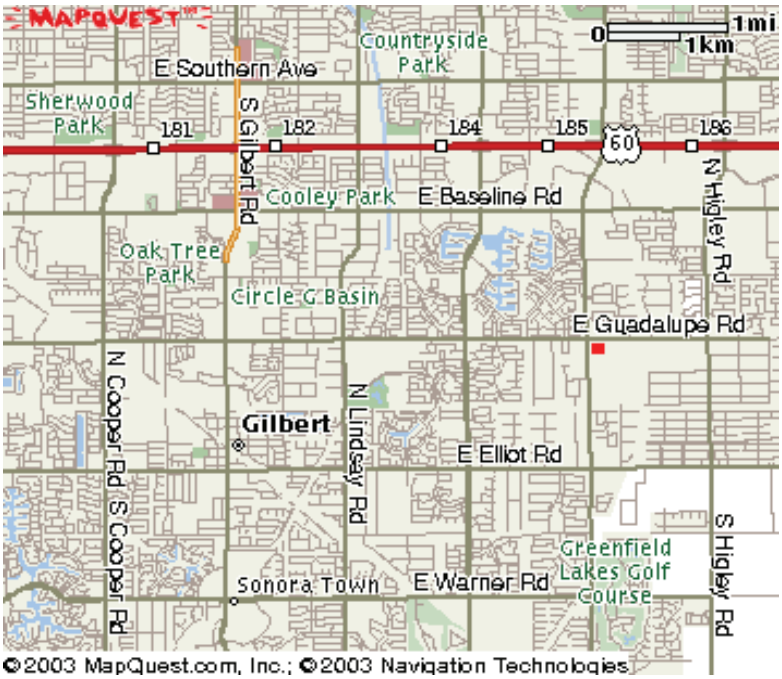
480-633-7479

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.

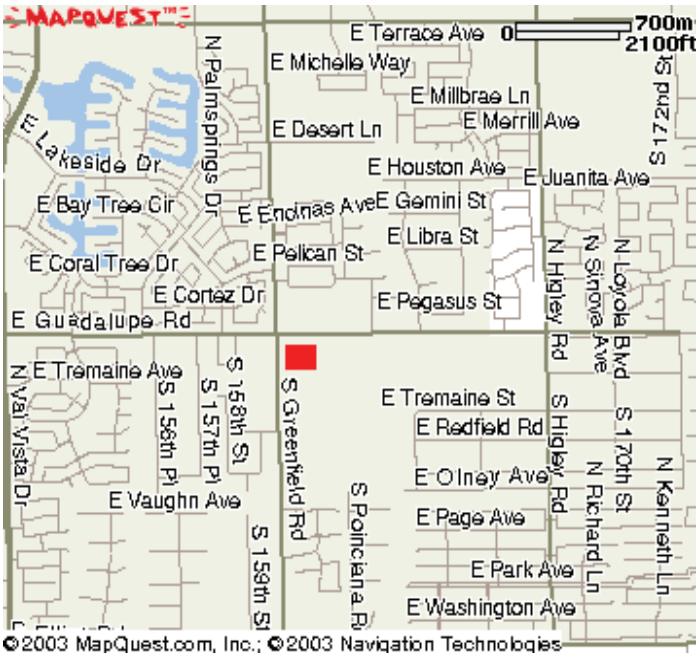
Our meetings are held on the third Friday of each month, at the Southeast Regional Library in Gilbert. The library is located at 775 N. Greenfield Rd., on the southeast corner of Greenfield and Guadalupe Roads. Meetings begin at 7:30pm.

Visitors are always welcome!

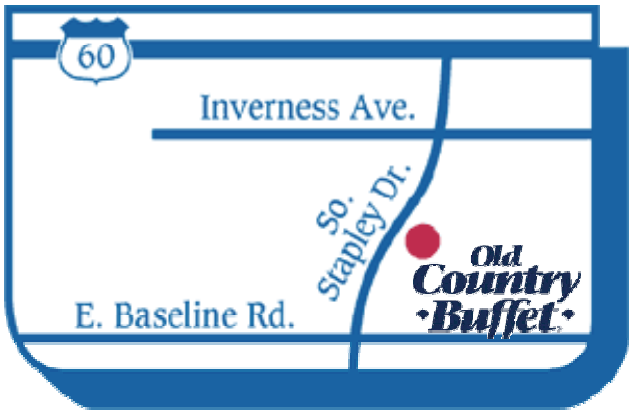
Upcoming Meeting Dates

December 16
Holiday Party

January 20
February 17
March 17
April 21



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

December 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	31

Schedule of Events

- *December 3 - Deep Sky Star Party at Vekol Road*
- *December 9 - Public Star Party at Riparian Preserve in Gilbert*
- *December 16 - EVAC Holiday Party at Southeast Regional Library in Gilbert*
- *December 24 - Local Star Party at Boyce Thompson Arboretum State Park*

Happy Holidays

Minutes of November General Meeting

Meeting date: Friday, November 18, 2005

Meeting location: Southeast Regional Library in Gilbert

The meeting was opened at 7:30 pm by President Steven Aggas. Officers Howard Israel, Peri Cline, Wayne Thomas, Gwen Grace, Randy Peterson, Dave Williams, Peter Argenziano, Marty Pieczonka and Chuck Crawford stood and introduced themselves.

Announcements were made by Events Coordinator Randy Peterson about various activities including upcoming school star parties and public Mars viewing sessions. The dates for all club events are listed on the calendar on the web site.

Treasurer Wayne Thomas provided a brief financial report and indicated the club currently has 252 members. We were reminded that membership dues paid before January 1, 2006 are $20.00; they will increase to $30.00 for individuals and $35.00 for families after the end of this year.

Recognitions were made for Joe Orman for his photo in Astronomy Magazine, Chris Schur for a photo used in a NASA Science publication, and Bill Dellinges for his completion of the Lunar 100 observing program.

Events Coordinator Gwen Grace announced that the Holiday Party will take the place of the December meeting. Please bring deserts to share, finger food will be provided. Be prepared to have a good time and spend time with other members. No alcoholic beverages please.

Elections for the 2006 governing body were held before the break. The 2006 Board was elected by acclimation. Serving for 2006 will be:

President: Steven Aggas

Vice President: Silvio Jaconelli

Secretary: Tom Polakis

Treasurer: Wayne Thomas

Event Coordinators: Randy Peterson and Butch Miller

Property Directors: Geneieve and Phillippe Normand

Newsletter Editor: Peter Argenziano

Webmaster: Marty Pieczonka

Board of Directors: John Holmquist, Howard Israel, Martin Thompson, Claude Haynes and Dave Williams

The guest speaker was noted author and accomplished amateur astronomer Steve Coe. Steve gave a presentation on his recent trip to Australia in preparation for an upcoming book on novae.

East Valley Astronomy Club Membership Application 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.

Please note that this form may only be used during the month of December 2005

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):

☐ **$20.00 Last chance to renew at this rate!**

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) Included with membership ☐ US Mail **Please add $10 to the total paid to cover printing & postage costs**

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

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 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

Voices From the Cacophony

by Trudy E. Bell and Dr. Tony Phillips

Around 2015, NASA and the European Space Agency plan to launch one of the biggest and most exacting space experiments ever flown: LISA, the Laser Interferometer Space Antenna.

LISA will consist of three spacecraft flying in a triangular formation behind Earth. Each spacecraft will beam a laser at the other two, continuously measuring their mutual separation. The spacecraft will be a mind-boggling 5 million kilometers apart (12 times the Earth-Moon distance) yet they will monitor their mutual separation to one *billionth* of a centimeter, smaller than an atom's diameter.

LISA's mission is to detect gravitational waves—ripples in space-time caused by the Universe's most violent events: galaxies colliding with other galaxies, supermassive black holes gobbling each other, and even echoes still ricocheting from the Big Bang that created the Universe. By studying the shape, frequency, and timing of gravitational waves, astronomers believe they can learn what's happening deep inside these acts of celestial violence.

The problem is, no one has ever directly detected gravitational waves: they're still a theoretical prediction. So no one truly knows what they "sound" like.

Furthermore, theorists expect the Universe to be booming with thousands of sources of gravitational waves. Unlike a regular telescope that can point to one part of the sky at a time, LISA receives gravitational waves from many directions at once. It's a cacophony. Astronomers must figure how to distinguish one signal from another. An outburst is detected! Was it caused by two neutron stars colliding *over here* or a pair of supermassive black holes tearing each other apart in colliding galaxies *over there*?

"It's a profound data-analysis problem that ground-based astronomers don't encounter," says E. Sterl Phinney, professor of theoretical physics at the California Institute of Technology in Pasadena.

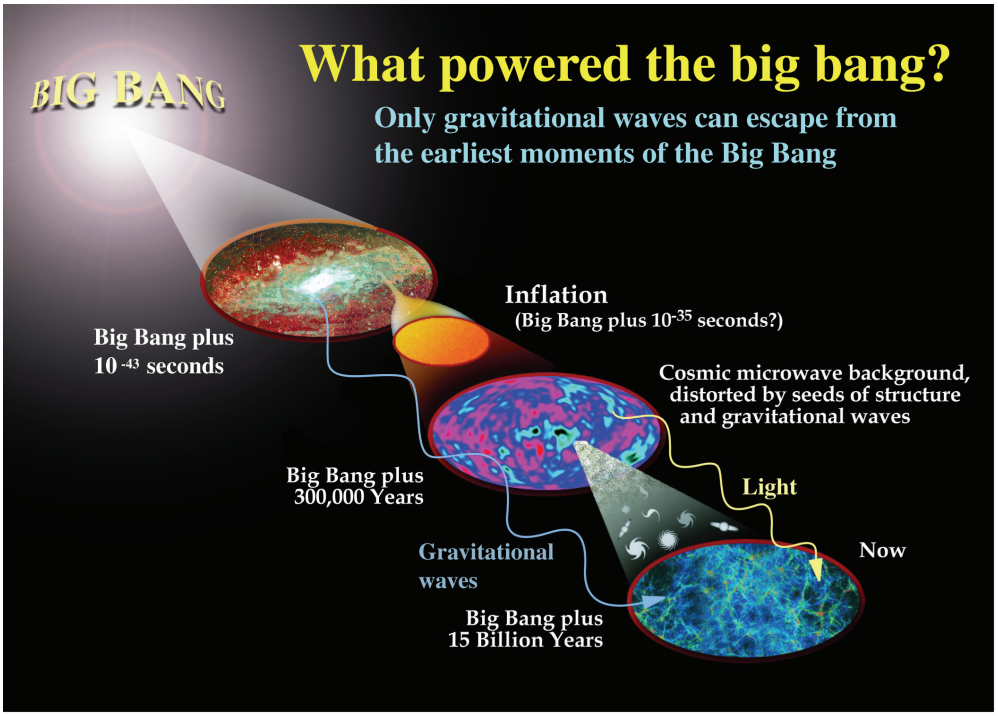
Profound, but not hopeless: "We have lots of good ideas and plans that work—in theory," he says. "The goal now is to prove that they actually work under real conditions, and to make sure we haven't forgotten something."

To that end, theorists and instrument-designers have been spending time together brainstorming, testing ideas, scrutinizing plans, figuring out how they'll pluck individual voices from the cacophony. And they're making progress on computer codes to do the job.

Says Bonny Schumaker, a member of the LISA team at the Jet Propulsion Laboratory: "It's a challenge more than a problem, and in fact, when overcome, a gift of information from the universe."

For more info about LISA, see **lisa.nasa.gov** . Kids can learn about black holes and play the new "Black Hole Rescue!" game on The Space Place Web site at **http://spaceplace.nasa.gov/en/kids/blackhole/** .

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



LISA will be able to detect gravitational waves from as far back as 10^{36} second after the Big Bang, far earlier than any telescope can detect.

If it's Clear...

by Fulton Wright, Jr.
Prescott Astronomy Club

December 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 ½ a degree or 30 arc minutes in diameter. All times are Mountain Standard Time unless otherwise noted.

Last chance for good observing of Mars. It's apparent size decreases from 17 to 12 arc seconds during the month. It is conveniently placed for observation in the early evening.

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

On Sunday, December 4, about 6:30 PM, you can see the Moon and Venus together low in the southwest. With a small telescope (3") you can see that Venus is also a crescent, but a fatter phase than the Moon. Compare this with a similar view on January 1 when Venus's phase has evolved to a thinner sliver.

On Monday, December 5, about 6:30 PM, you can see the first of three easily observable faults on the Moon. With a medium telescope (6") look for the small crater, Cauchy, just north of the Moon's equator and a few degrees in from the terminator. South and west of it run Rupes Cauchy, visible as a dark, diagonal line. (A rill runs parallel to the fault, on the other side of the crater.)

On Tuesday, December 6, about 6:30 PM, you can see the second of three easily observable faults on the Moon. With a medium telescope (6") look for a medium sized, deep crater, Burg, just south of the dark area, Mare Frigoris, near the north end of the terminator. South and west of the crater is the Lacus Mortis fault. (There are some rills and other features in the area.)

On Thursday, December 8, about 10:00 PM, you can see the third of three easily observable faults on the Moon. With a medium telescope (6") look about 1/3 of the way from the Moon's equator to the south pole for Rupes Recta, the famous "straight wall". The sun angle should be very low so the fault should be a fairly wide dark line, very near the terminator. It might be fun to start observing earlier in the evening and watch the wall appear as the terminator shifts.

On Sunday, December 11, about 9:30 PM, you can see the Moon pass less than one degree from Mars.

On Thursday, December 15, at 5:16 PM (4 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 Monday, December 19, after about 10:00 PM, you can see a star near a planet. With a small (3") telescope look above and to the right of the Moon for Saturn. A 7th magnitude star is about 1 arc minute to Saturn's left.

On Sunday, December 25, at about 6:35 AM, the Moon passes within 4 arc minutes of the first magnitude star, Spica. If you are near the four corners area, you can see the Moon cover and uncover the star. Merry Christmas.

On Sunday, January 1, about 6:00 PM, you can see the Moon and Venus, with about the same slim crescent phase, low in the southwest. If you have REALLY sharp eyes, you might be able to make out the shape of Venus with your unaided eyes, but binoculars or a small (3") telescope will make life easier. Happy New Year!

● New Moon on December 1 at 08:01

◐ First Quarter Moon on December 8 at 02:36

○ Full Moon on December 15 at 09:16

◑ Last Quarter Moon on December 23 at 12:36

● New Moon on December 30 at 20:12

The Vote's In… Introducing the 2006 EVAC Governing Body

First and foremost, I'd like to recognize the 2005 cabinet for all of their hard work! Thank you, ladies and gentlemen!

President Steven Aggas
Vice President Howard Israel
Treasurer Wayne Thomas
Secretary Peri Cline
Event Coordinator Randy Peterson
Event Coordinator Gwen Grace
Property Director Dave Williams
Webmaster Marty Pieczonka
Newsletter Editor Peter Argenziano
Director Dave Shafer
Director John Holmquist
Director Chuck Crawford
Director Martin Bonadio
Director Joe Goss
Observatory Manager Steven Aggas

In accordance with the club's Constitution and Bylaws, nominations for office in 2006 were officially opened in October. After the usual sluggish response to the pleas for wider member involvement, volunteers stepped forward. The good news is that the next cabinet contains some members new to governing positions. The bad news was that, once again, we barely had enough members stepping forward to fill the vacant positions, negating the need for any voting except to ratify the current crop as the EVAC governing body for 2006. The members present at the November

general meeting unanimously voted to accept those nominated to office.

So it is with great pleasure that I introduce the 2006 EVAC Cabinet:

President: Steven Aggas
Vice President: Silvio Jaconelli
Secretary: Tom Polakis
Treasurer: Wayne Thomas
Event Coordinators: Randy Peterson and Butch Miller
Property Directors: Geneieve and Phillippe Normand
Newsletter Editor: Peter Argenziano
Webmaster: Marty Pieczonka
Observatory Manager: Chuck Crawford
Board of Directors: John Holmquist, Dave Williams, Martin Thompson, Claude Haynes and Howard Israel.

Please join me in thanking these fine folks in advance for their commitment to the East Valley Astronomy Club.

I would invite each member to reflect upon club membership, both what you like and what you dislike. If you cannot take on the responsibility of a future cabinet position, please take an active role in helping EVAC grow as an astronomy club that consistently exceeds the expectations of its members.

If you have ideas that you believe will help the club move forward, please share them with your President and with the members of the Board. They are the officers who formulate club policy.

Got an idea for a great guest speaker or topic for an upcoming general meeting? Share those thoughts with the Vice President, as he is the one responsible for scheduling speakers.

Need some questions answered about the club's financial position? Ask the Treasurer.

Got ideas or suggestions for the website or newsletter? Share them with the Webmaster or Newsletter Editor respectively.

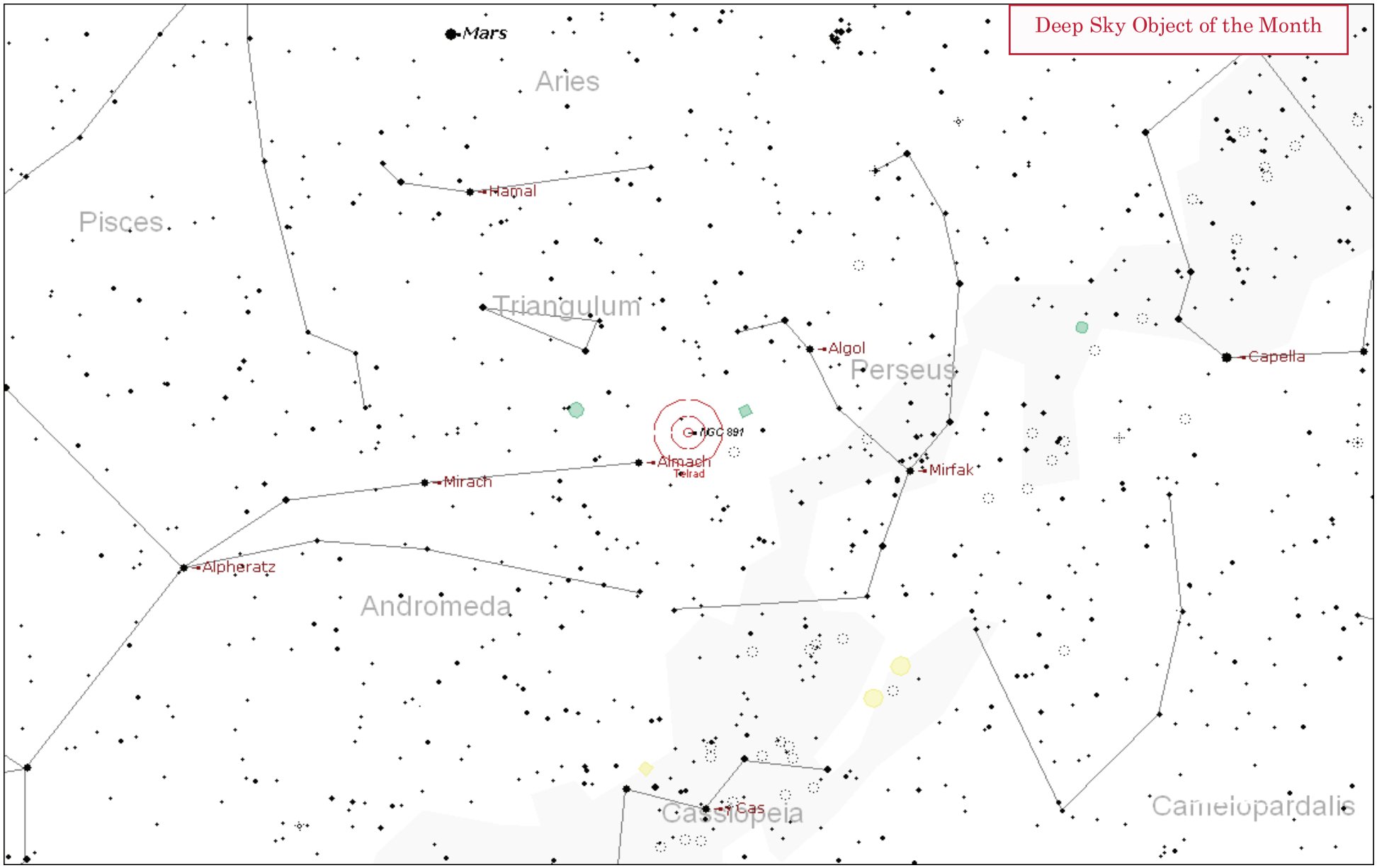
Have some suggestions regarding the club's library or its loaner equipment? Ask the Property Directors.

Need to know about the club's involvement in the community or how to arrange a public star party? Pose your questions to the Event Coordinators.

Questions about the club's affiliation with the Gilbert Rotary Observatory? Ask the Observatory Manager.

The bottom line is this: EVAC is your club. It is only as good as its members want it to be. Get involved!

Officer Email Addresses	
President	president@eastvalleyastronomy.org
Vice President	vp@eastvalleyastronomy.org
Secretary	secretary@eastvalleyastronomy.org
Treasurer	treasurer@eastvalleyastronomy.org
Event Coordinators	events@eastvalleyastronomy.org
Property Directors	properties@eastvalleyastronomy.org
Webmaster	webmaster@eastvalleyastronomy.org
Newsletter Editor	news@eastvalleyastronomy.org
Board of Directors	board@eastvalleyastronomy.org
Observatory Manager	observatory@eastvalleyastronomy.org



NGC 891 Barred Spiral Galaxy in Andromeda

Magnitude: 10.8 Size: 14'.1 x 3'.1 Edge-On PA: 22°

RA 02h 22m 32.9s Dec +42° 20' 46" Mean Surface Brightness: 23.5 Mag/Arc-Sec^2

Star Party Decorum

With the monsoon season behind us, we are once again able to get out under the stars on a more frequent basis. For many this is a return to a familiar activity, for others it is a whole new experience. Whether you're a seasoned veteran or a new stargazer it never hurts to review those habitual nocturnal social behaviors that we evaluate according to conventional standards of politeness… otherwise known as star party etiquette.

One can hardly discuss such a topic without mentioning white light, so that's where we'll begin. Exposure to white light, even for a second, ruins the observer's night vision. Remember that full dark adaptation takes at least thirty minutes. For this reason there should be no white light after dark. Attendees are required to use a dim red flashlight. Take a moment to think of all sources of white light which may be inadvertently introduced: vehicle dome lights, trunk lights, headlights, laptop computers. Please take the necessary steps -- in advance -- to prevent these sources of light pollution during a star party.

Plan on arriving at the star party site well before darkness. This allows you to safely navigate a potentially unfamiliar site while not violating the white light rule. Choose your position on the observing field according to how long you plan to stay. If you will be leaving an hour after darkness, park near the entrance to the site with your vehicle positioned facing the point of egress. Alternately, if you're spending the night, proceed to the back of the field and set up there.

All good things must come to an end, and so it is with a night under the stars. When you are all packed and ready to leave, make an announcement to your fellow stargazers. This allows everyone to shield their eyes to preserve their night vision. Talk to your neighbors and try to coordinate early departures so as to minimize the negative effect on those still observing. Nothing is worse than a steady stream of departures all night long.

Star parties are for observers. Small children and pets generally do not enjoy these events. If at all possible leave them at home.

All attendees are responsible for the behavior of their guests.

Some people enjoy music while observing, others prefer solitude. Please be considerate of your neighbors with regards to noise.

Cell phones are a good way to stay in touch with family members at home, but be aware that you may not have coverage at remote observing sites.

Consumption of alcoholic beverages is prohibited at club-sponsored events. Besides, alcohol has a negative effect on nighttime visual acuity.

If you smoke, please be aware of those around you who don't. Also, don't forget to take those cigarette butts with you.

Please pack out all trash. If you brought it with you, take it with you.

Proper hydration is necessary, even when stargazing. Bring plenty of cool water, fruit juice, hot coffee, cocoa or tea. A late night snack isn't a bad idea either. Consider some fresh fruit, trail mix or an energy bar.

Dress appropriately. Check the weather forecasts and bring extra clothing, if necessary.

The last two people on the observing field should communicate to coordinate their departures. Leaving together ensures that no one is stranded with a disabled vehicle.

For many, this list is just common sense; to others it may get the gray matter working. Let's all get out under the stars real soon!

Coming in January… our guest speaker will be internationally known author, artist and scientist Dr. William K. Hartmann of the Planetary and Science Institute in Tucson.

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 Chandrasekhar Limit

(Continued from page 4)

THE CHANDRASEKHAR LIMIT AND WHITE DWARFS

While on a sea voyage in 1930 from India to study as a graduate student at Cambridge in England, Subrahmanyan Chandrasekhar, (1910-1995) worked out an upper limit to the size of a white dwarf. This is the maximum mass above which the degeneracy pressure would not counter the gravitational forces. He did this by combining the results of Eddington and Fowler, with the new special theory of relativity and special statistical quantum mechanics, [1]. In his investigation of the internal structure of white dwarfs he soon realized that if the mass became sufficiently large and with the incredibly small space of confinement for the electrons, (especially in the center of the star) this would result in a very fast velocity for the electrons, (due to the principles explained above) and could actually cause relativistic effects which had not previously been taken into account. This was due to the very high, near light speed of the electrons. Therefore he utilized both special relativity and a special form of quantum statistical mechanics called Fermi-Dirac statistics in his models, [7].

Fowler had previously taken into account quantum mechanics but had not taken into account relativity theory in his calculations. Chandrasekhar had shown that above a certain mass limit, (modern day calculations show it to be about 1.44 solar masses) there existed no solutions to his revised equations, [1]. It implied that stars above this critical mass would continue to collapse inward, although to what no one knew at the time. This idea challenged the then common scientific notion, that after burning up their nuclear fuel, all stars became white dwarfs. Chandrasekhar showed that there were other final possibilities for stellar evolution.

Chandrasekhar also found out that a large, massive star could continue shrinking in size and disappear to a point, which was mind boggling at the time, (and still is!), [7]. Thus he helped lead the way to neutron stars and black holes. In fact later in his career Chandrasekhar wrote a book on the mathematics of black holes, [7].

The most massive white dwarf we know of today is RE J0317-853 with a mass of 1.35 solar masses, [6]. Most white dwarfs have masses close to that of the sun with radii close to that of the earth. A white dwarf will continue to shine by radiating internal heat, eventually evolving into a black dwarf, [6]. A famous white dwarf star known to Chandrasekhar, Eddington, and Fowler, is the companion of the bright star Sirius called Sirius-B. It was not visibly noted until 1862 but was predicted in 1844 from the motion of Sirius. It is smaller than the earth with a radius of about 4200 km, (about 1% of that of the sun) with a black body temperature peaking at 110 nm, corresponding to a temperature of 26,000 degrees Kelvin! Chandrasekhar calculated that the degenerate electrons in Sirius-B were moving at about 57% the speed of light, and thus contributed relativistic effects, [11]. In more massive white dwarfs this speed would be even higher and more meaningful.

It is also known that most stars larger than the 1.44 solar mass Chandrasekhar limit, even stars with masses from 2-5 solar masses, are able to lose enough mass in their nebula stages to leave behind white dwarfs of mass less than the Chandrasekhar limit, [8].

We also now understand that a Type I supernovae is caused when a white dwarf suddenly collapses after accreting mass from a binary companion and grows to exceeds the Chandrasekhar limit, [7].

Although the Chandrasekhar limit refers strictly to white dwarfs, the limiting mass for neutron stars is also loosely called the Chandrasekhar limit due to the fact that they turn out to be almost the same, [10]. It turns out that neutrons also have a degeneracy pressure for the same reasons. Beyond this limit black holes are thought to form, [10]. There is also new work being done on showing an upper mass limit for compact quark stars, (which have not been observed)! Just like for white dwarfs and neutron stars, it is thought that such a limit close to the Chandrasekhar limit exists for such stellar oddities and can also be derived from fundamental constants, [10]. It appears that the Chandrasekhar limit may be truly a universal phenomenon.

CHANDRASEKHAR AND EDDINGTON

Upon his arrival in England, Chandrasekhar showed his work on this white dwarf mass limit to Fowler. Both Fowler and Eddington were his heroes and he was very excited and honored to be working at the same university where they taught and researched, [11]. Chandrasekhar had turned in two papers, one of which Fowler sent in for publication, but the second one, specifically pertaining to the white dwarf maximum mass, he held back and attempted to consult with others for a better understanding [11]. Chandrasekhar, after waiting patiently for months, sent it to America to the Astrophysical Journal for publication. It was initially rejected until Chandrasekhar could supply more mathematical proofs and then a year after he had first submitted it, it was published. Chandrasekhar was a bit befuddled by the silence so he continued to study and research, and in 1933 he was awarded his PhD. He was then elected a fellow of Trinity College where Fowler and Eddington were faculty members, [1]. He and Eddington became friends and spent

(Continued on page 17)

The Chandrasekhar Limit

(Continued from page 16)

much time together, with Eddington often reviewing his work. During this time Chandrasekhar also calculated the internal structure, total mass, and circumference of 10 white dwarf candidates and showed that each one satisfied his new limit. Thus he was able to use experimental data on stars to back up his assertions, [11].

In 1935 Chandrasekhar presented his work on the white dwarf upper mass limit in a meeting of the Royal Astronomical Society. If a star had a mass above a certain limit it could not end up as a white dwarf but would continue to collapse. Immediately after his talk Eddington spoke and started to question and disrupt Chandrasekhar's presentation and logic. He particularly attacked his mathematics, the combination of special relativity theory with quantum mechanics, and the implied notion of further stellar collapse into who knows what, [11]. Here was a shocking, surprise blow, by one of the most famous astronomers in the world to what had been years of work in Chandrasekhar's life! Could Eddington be right?

Chandrasekhar expressed no public bitterness to this assault from Eddington. Chandrasekhar wrote letters to his friend Leon Rosenfeld, also a friend of the famous Neils Bohr, requesting some help. Their reply was that he was correct and that Eddington was wrong! Even Wolfgang Pauli later agreed that Chandrasekhar was correct in his thinking and that Eddington was incorrect, [1]. The arguments Eddington had used to attack Chandrasekhar's theory were realized to be largely nonsensical and often contradictory, [5].

Nonetheless Eddington continued to publically denounce Chandrasekhar's work on this new limit and his use of relativity to arrive at this conclusion. After this continued for four years Chandrasekhar quit the argument, wrote a book to express his thoughts on the matter, and began to pursue other activities he was interested in. Astrophysicists continued to think for many decades, (supported by the voice of Eddington and the lack of voices from others) that most likely, massive stars would be able to eject off enough matter throughout their life to end up at or below the 1.44 solar mass limit and enter a safe, (?) death.

Some sources that I have read indicate that Eddington later admitted that many of Chandrasekhar's ideas had been correct, but this I was not able to document this securely. In 1937 Chandrasekhar moved to the United States and the University of Chicago, Yerkes Observatory, where he remained until his death in 1995 doing lots of other good work in the meantime…

CONCLUSION

It is clear to me that Chandrasekhar was caught up in a variety of circumstances that made his early discovery of the Chandrasekhar limit much more difficult to become commonly accepted. He obviously went against the establishment grain by his early self-instruction and solitary work. He had Eddington and his vocal, (but not necessarily logical) objections, to contend with, and this helped stir up confusion and unease among the astronomical community and many other people. He was also one of the first to combine relativity theory and quantum mechanics together with the current mainstream astrophysical science. Each of these new ways of thinking was by itself a major paradigm shift at the time and difficult enough for most at the time to understand and even accept.

He later had the social politeness to not embarrass Eddington in public and to ride out the public pressure that accompanied Eddington, whom he had admired since an early age. Thus it took about 20 years before his ideas on a white dwarf upper mass limit became widely accepted and understood, [1]. In 1983 Chandrasekhar was awarded the Nobel Prize in Physics, (jointly with William A. Fowler no less) for this pioneering work.

It would be hard to guess at the reasons for the long-standing public disagreement between Eddington and Chandrasekhar. Both Eddington and Einstein argued against the existence of black holes until the 1950's, [4]. Still this ongoing feud did not keep the two apart. They continued to correspond and Chandrasekhar even spoke warm and respectfully at his funeral, [1].

Once the Chandrasekhar limit was understood and accepted by the astronomical community, the idea of mass was realized to be the controlling factor in the life of a star. The Chandrasekhar limit plays a crucial role in the study of stellar evolution. It opened up the discussions to other stellar fates besides white dwarfs including neutron stars, black holes, quark stars, and supernovae.

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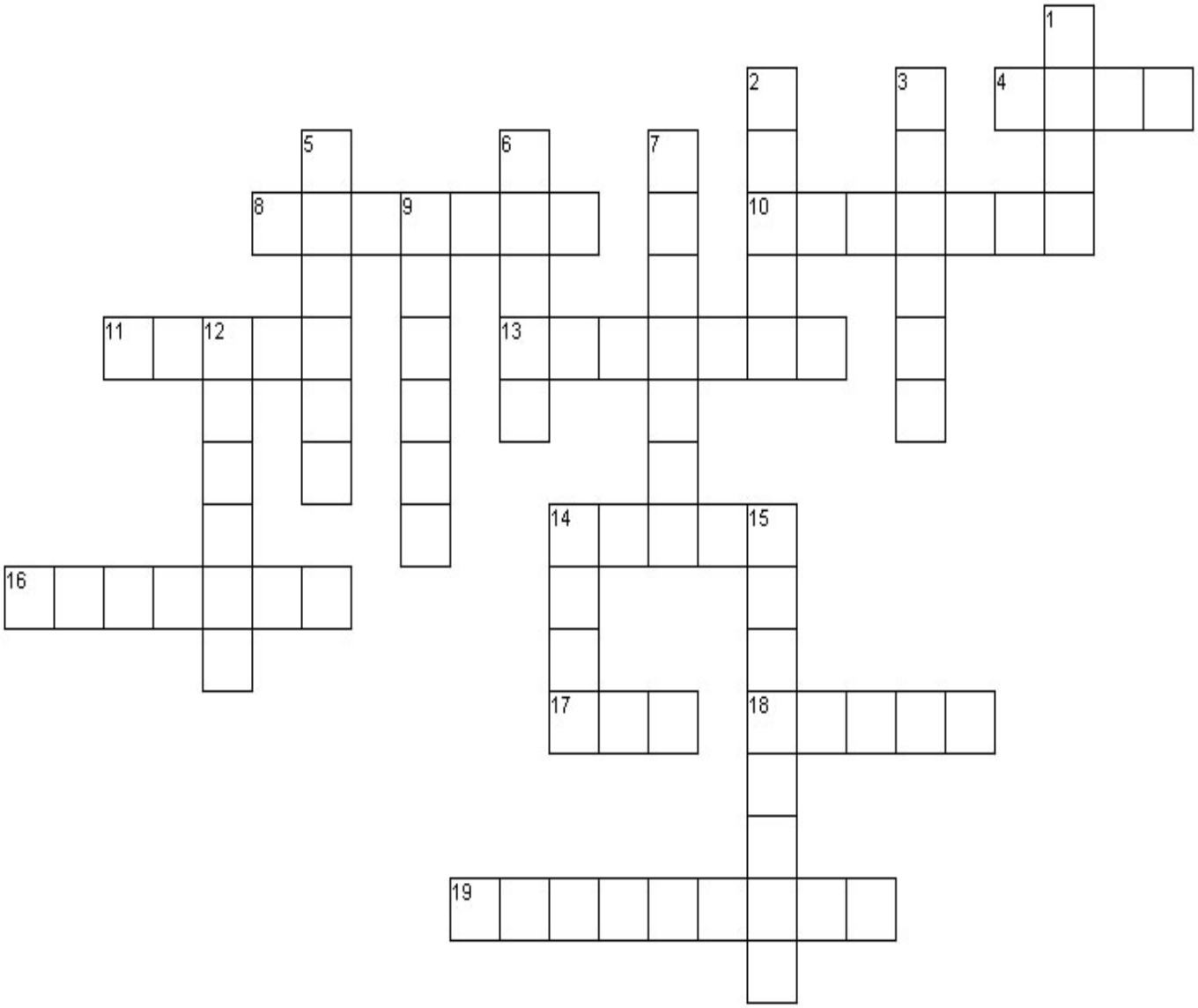
Astronomy Crossword Puzzle

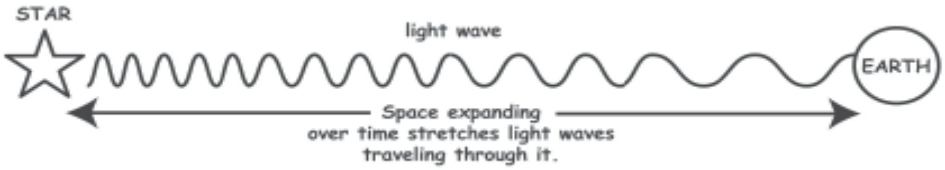


Across	Down
4. Major cause of tides on Earth	1. At the center of planets and stars
8. Blemish on the surface of the Sun	2. The hottest planet
10. Sometimes the furthest planet from the Sun	3. Bright streak in the sky
11. Smallest planet in the solar system	5. Beautiful displays of light
13. The passing of one celestial body in front of another	6. Icy visitor to the solar system
14. Dark smooth seas on the Moon	7. Largest planet in the solar system
16. Closet planet to the Sun	9. would float in a bathtub
17. Lies at the center of the solar system	12. Rotates at 90 degrees
18. Only hospitable planet in the solar system	14. Has two moons Phobos and Deimos
19. Another name for a planet's moon	15. Also known as a minor planet

Kids Corner - Clues from Ancient Light

Some people are good at telling other people's ages. They can look at you and know you are 9 years old or 22 or 49 or 99. How? They read the clues: your size, shape, proportion, gray hair (or no hair), wrinkles, how you talk, and how you act.

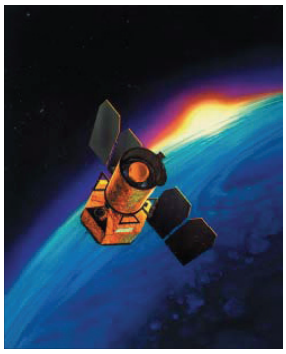
Astronomers know how to tell the ages of the stars — or least the ages of the stars' light. What clues do they use? Light changes as it travels through space and time. It's as if, like aging humans, the light gets "tired." Light that has been traveling a long, long time (say, billions of years) starts looking pretty tired! Astronomers say that the light is red-shifted, because red light has the least energy of all the colors of the light we can see with our eyes. No matter how "old and tired" light is, it always travels at the same speed in space: 300,000 kilometers (or 186,000 miles) per second (in round numbers). That means it takes some amount of time—a little or a lot—for light to get anywhere. The distance light can travel in one Earth year is called a light year. A light year is very long distance: around 9 trillion kilometers (6 trillion miles).



Light travels in waves, just as energy traveling through the ocean pushes the water into waves. But as light waves travel through space, they gradually get stretched out. That is because, along with the universe, space itself is expanding and stretching the distances between things.

GALEX Looks Back in Time

GALEX (short for Galaxy Evolution Explorer) is a space telescope that was launched into orbit around Earth in 2003. From space, GALEX gets a great view of the ultraviolet light from stars, without Earth's atmosphere getting in the way.



GALEX is now looking at most of the galaxies in the Universe. A galaxy is a grouping of stars. All but a few stars in the universe live in galaxies. Our Sun is just one of at least 200 billion stars in our own Milky Way Galaxy. GALEX sees starlight that has been traveling for just a few years from stars that are "only" a few trillion kilometers away. But it also sees really "tired" starlight that has been traveling over 10 billion years! That is more than two-thirds of the age of the whole Universe! So GALEX is seeing galaxies as they were 10 billion years ago, as well as how the nearby galaxies looked just a few hundred thousand years ago. Just as you look younger in a picture of you from several years ago, GALEX sees pictures of galaxies when they were much younger than now. So astronomers can look at the young galaxy pictures from far away (and long ago), compare them with pictures of older galaxies nearby (very recent) and see how galaxies and their stars are born, age, and die over time. They can learn how galaxies evolve.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract NASA.

Solution to astronomy crossword puzzle on previous page

Across

4. Moon
8. Sunspot
10. Neptune
11. Pluto
13. Eclipse
14. Maria
16. Mercury
17. Sun
18. Earth
19. Satellite

Down

1. Core
2. Venus
3. Meteor
5. Aurora
6. Comet
7. Jupiter
9. Saturn
12. Uranus
14. Pluto
15. Asteroid

How to Assist Your Treasurer

1. Fill out a membership renewal form along with your payment. My accounting system is paper. I use the membership renewal form as my tracking document. If you don't fill one out, I must do one for you. If nothing has changed in the past year, include your name, and the amount paid along with a signed release form (if you have not already signed one).
2. If paying for magazines or mailed newsletters or name badges, please include the total amount on the renewal form. If you are renewing a magazine subscription and have a renewal notice from the publisher, include that along with the return envelope they sent to you. That saves me time.
3. Be aware that the current annual rate for Sky & Telescope is $33.00 and for Astronomy magazine is $34.00. Only Astronomy magazine offers a multi-year rate which is $60.00 for two years. I cannot submit your renewal unless you have paid the correct amount (unless of course you over pay).
4. Also, submit your subscription renewal at least four months prior to the magazine subscription expiration date. (I received my January 2006 issue of S&T on November 21, 2005. If my subscription were to expire with the January issue and I had not already renewed my subscription a couple of months ago, I would miss the February issue.)
5. If you change your address, phone number, internet provider, or name; please fill out another membership application with the "address change" box checked and submit it. No money required for this type of application. To submit it electronically, simply e-mail to Treasurer@EastValleyAstronomy.org

With the 2006 renewal rush coming, following these guidelines will make my job a bit easier.

Thanks in advance for your assistance!

Treasurer Wayne Thomas

EVAC PO Box 2202 Mesa, AZ 85214-2202

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