June 2005

The Voyager

East Valley Astronomy Club

Volume 19 Issue 6

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

Summer nights… It's great observing here in the desert! No bugs, no dew, just a warm breeze and summer Milky Way! With this observing season upon us, I would like to hear from the membership on what type of observing is done, whether it is solo, small group, star party or somewhere in between, what type of equipment is used, spotting scope, binoculars, or large Dobsonian and where are you most likely to observe, home, Vekol, Boyce-Thompson Arboretum or elsewhere?

This information will help us tailor the EVAC observing programs to what we find after hearing back from you. We currently have two reasonably dark sky locations, one on Vekol Rd. and the other at Boyce-Thompson Arboretum. We also have observing programs to find interesting objects, as well as, programs that will challenge you. We even have a loaner telescope for someone to use for a period of time and then return. If we, EVAC, wanted to do more observing or make observing more pleasurable or fun, what would you suggest? Let me know at: *President@eastvalleyastronomy.org*

As our speaker for the June General Assembly meeting, we will have none other than Dr. John Dobson! Dr. Dobson has specialized in many things such as telescope building, cosmology theories, and touring the US. Join us for a Question and Answer type forum at the Southeast Regional Library (Gilbert Public Library) on Tuesday, June 14th at 7:30PM. NOTE: This is a special night to accommodate Dr. Dobson's schedule. The GPL is located at the Southeast corner of Greenfield and Guadalupe Roads.

The Backyard Astronomer
Accessories: It Never Ends *by Bill Dellinges*

Congratulations, you've bought your first telescope! You scrimped, you saved, you sold your soul to the devil to acquire this magical piece of glass and metal that will allow you to explore the night sky. I hope you have a little money left over because there are a few extra things you'll need.

Before I suggest a few goodies to add to the scope, here are some observing aids you might want to consider to enhance your viewing experience.

1) A plastic Planisphere or Star Wheel to figure out what constellations are out at any given time, $10.

2) A star atlas to help find deep sky objects, $11 (Bright Star Atlas 2000).

3) A table for your laptop and references, $20 (camping table).

4) Chair for above, $15.

5) A red flashlight to read charts by, $18 (Orion #5755).

6) Observing chair at scope, $10 bar stool will do (later a $160 Starbound chair?).

7) A pair of 7x50 binoculars (they will help you in many ways) Orion Ultraviews, $170.

8) A basic Moon map, $4 (#S0003 from S&T).

9) One good how-to book on the hobby of astronomy, $20 (Try David Levy's *The Sky, a user's guide*, Terence Dickinson's *NightWatch,* or Richard Berry's *Discover the Stars*).

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Inside this issue:

June Events:

- *Five Mile Meadow Star Party - June 3 & 4*
- *Deep Sky Star Party at Vekol Road - June 4*
- *Grand Canyon Star Party - June 4 through 11*
- *Public Star Party in Gilbert - June 10*
- *Local Star Party at Boyce Thompson - June 11*
- *Monthly Meeting at Southeast Regional Library - June 14*

The Backyard Astronomer

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10) A large accessory case, $43 (Orion #5952, pluck foam).

Ka-Ching! $321 please!

Now let's take a look at how we can soup up that scope.

1) Upgrade from 6x30 to 8x50 view finder, $48 (Orion #7200).

2) Solar filter, about $100.

3) 1 ¼" Moon filter, $15 (Orion #5662).

4) 1 ¼" Light pollution filter, ~ $70 (Orion UltraBlock #5654).

5) Set of planetary filters, $54 (Orion #5580).

6) Anti-Vibration pads for tripod legs to reduce dampening time, $40 (Adorama).

7) Electric motor to drive scope, ~$100 (Orion #7828 for Orion scopes).

8) DC battery to run scope, $57 (Orion #2305).

9) Two extra eyepieces, ~$150.

10) A Barlow lens, $60.

11) 1 ¼" mirror diagonal replacement for standard prism diagonal, $60 (Orion #8778).

12) An optics cleaning kit, $10.

Ka-Ching! $764 please! Your total for the two categories above is now $1085.

You are now good to go. After a little experience in the field though, you may find you'll want to give a look towards other accessories that while not critical, might have some appeal to you.

1) Dew cap for SCT or Mak telescope, ~$15-$25.

2) For SCT's, a F6.3 focal reducer, $130.

3) A bino-viewer, ~$1000 (ouch!). Two bino-viewer eyepieces ($200-$600).

4) Telrad or red dot finder, ~$40.

5) Focus motor, $?

6) Laser pointer, $150.

7) Polarizing filter, ~$25

8) Lumicon Oxygen 3 filter for nebulae, $100.

9) Lumicon Hydrogen-Beta filter for Horsehead, Cocoon, and California nebulae, $100.

10) Lumicon Comet filter, $100.

11) Various software, $50-$300.

12) A 2" star diagonal and wide angle 2" eyepiece, $200-$600.

It gets worse.

13) Astro-Photography camera/CCD equipment, $100 web cam to $5000 for top of the line CCD equipment.

14) Giant binoculars, $300-$3000.

15) A hydrogen-Alpha sun filter, $500-$3000.

16) A small portable grab and go telescope, $500-$4000.

Do you see where I'm going with this? The point is, the stuff flowing down the pike at us never stops. There will always be some new accessory coming out we think we can't live without. It will be the individual's choice where to draw the line. So, good luck to you.

I've been thinking I need a bigger car.

Happy Birthday John!

Most may not know this, but John Dobson will celebrate his 90th birthday this September. Several celebrations are planned: the San Francisco Amateur Astronomers are hosting the AANC conference this August and along with the San Francisco Sidewalk Astronomers are planning a large celebration for JD's birthday to coincide with the conference. Also there will "something special" at RTMC, Stellafane, Yale Observatory and probably whereever JD's speaks this summer.

Please check the www.sidewalkastronomers.us website for more information on these events.

Because of John's hectic traveling schedule, it has proven to be practically impossible to get everyone together in a single location to celebrate his life. Instead, his associates are planning to assemble a commemorative book. This book will likely be available for free or a small donation (free if possible) at all celebrations and for anyone else who would like one but can't attend.

Please send any messages or articles about your experiences with John; his effect on you or your club; your perception on his effect on amateur astronomy; your thoughts on his cosmology – not just birthday wishes. Please be sure to put a complete signature, along with any club affiliation. Provide any relevant dates. You can also attach a couple of photos if you wish – preferably those with you in it. Written contributions may be edited for space considerations, but only after the author agrees. Also don't feel that you need to keep your comments only to telescopes, I'm sure you all know how important cosmology, philosophy and the Vedanta side of "this universe into which we were born" is to John.

Please make your submissions directly to Donna Smith at dsmith1055@earthlink.net

How Heavy Can a Star Get?

by Henry De Jonge

How heavy can a star get? Astronomers have debated this question for decades. We will look at what physical processes may limit the maximum mass a star may have and if these processes differ for different metallicities. We will also examine the empirical evidence to support these claims, and what may be the nucleosnythetic reasons behind this.

Discussion

The mass of a star is a very important factor in stellar evolution, structure, and lifetime. Typical stellar masses range from .08 solar masses to about 150 solar masses. The upper mass limit of main sequence stars, according to current stellar theory is generally in the range of 60-150 solar masses. High mass stars are greater than 10 times the mass of the sun, while stars that are greater than 100 solar masses are called super massive stars. These stars are very rare, [4]. According to the Vogt-Russell theorem a star's properties, (luminosity, radius, temperature, and density) as well as its evolution are determined by its initial mass and chemical composition, [9]. Thus the importance of mass.

What physical processes may limit the size of a star? The initial mass function, (IMF) represents the distribution of stellar masses at birth, which is when nuclear fusion begins in the stars core. Edwin Saltpeter first determined this in 1955. Mathematically it represents the number of stars with mass M at birth, per unit volume of space. However its complete physical interpretation is still a question under debate, [10]. It is determined by stellar counts and is best described by a power law function. In our solar neighborhood it is approximately equal to M^-2.35, [1]. We are interested in the upper mass limit to this function or if there is an upper mass cutoff that would imply a limit to the mass of a star. Theoretically with no cutoff, stellar masses could be as high as 40,000 solar masses! Recent estimates using a universal IMF show an upper mass cutoff of around 120-200 solar masses, [6]. What if the IMF is not universal? What if it is a step function or scaled, (mass, cluster size, metallicity)? These questions are still not answered.

The Eddington limit is the upper limit of the ratio of luminosity to mass that a star can have before radiation pressure overcomes the gravitational force. Modern estimates go as high as 440 solar masses, [1]. This would seem to be one of the most influential factors in keeping a star under a mass limit. The sheer amount of light generated would quickly blow off such enormous amounts of mass that the young protostars would be brought down to a common mass. The degree of metallicity in the protostars ingredients seems to play a role in this limit based upon current theory. Models show that stars forming in the absence of metals can attain masses up to 500-1000 solar masses, [7], [14]. This is because metals absorb radiative momentum more effectively and become accelerated beyond the escape velocity, [15]. The presence of a protostellar disk may also play a role in the effectiveness of radiation pressure on infalling material, (radiation focused through the poles instead) and thus cause it to become less effective in curtailing stellar mass as well, [9]. Convection in a very massive star can also reduce the radiation flux and corresponding pressure, as in some WR stars. It appears the Eddington limit may not dictate the upper mass limit for star formation in all cases, [12].

Mass loss through rotational effects and stellar winds is not well understood in super massive stars and may have a limited effect due to the loss of angular momentum, which slows down the spinning star, [15].

Normal stars are stable to small radial pulsations, for as the star contracts the interior heats up and increases the rate of energy generation, which in turn provides the necessary pressure increase to restore equilibrium. For super massive stars Newtonian gravity is not accurate for this understanding and the effects of general relativity must be taken into account. In this case the pressure of such stars makes an additional contribution to the gravitational field. A small contraction of a super massive star leads to a pressure increase, which increases the gravitational effect and causes further contraction. This causes the super massive star to become unstable. A typical timescale for this is about 10^7 years. Some mass loss may be expected from such pulsations but that is estimated to be about the same as through radiation pressure, [9]. Other means of support against gravity such as a turbulent magnetic fields or rapid stellar rotation may play a role in delaying the star from collapsing completely, but eventually it will collapse and form a black hole, [2]. Thus the fate and lifetime of super massive stars seems assured.

How could super massive stars form? One way is by accretion. During the early universe in the post recombination epoch, the primordial gas clouds were very large, on the order of 10^3 solar masses. The protostar cores that initially formed are thought to be about 10^-2 solar masses. Due to the large supply of gas the cores would continue to grow by accretion. The lack of dust grains, (low metallicity) in this early mixture of H and He, and the high mass accretion rate due to the high ambient temperature, would have the effect of lowering the efficiency of radiation pressure and increasing the momentum of the in falling flow. Thus large, primordial, super massive stars, with masses up to 300 solar masses may be able to form in this manner, [5].

During the protostar phase of such massive, accreting stars, nuclear burning would be postponed, due to the shorter gravitational contraction time scales, and p-p and

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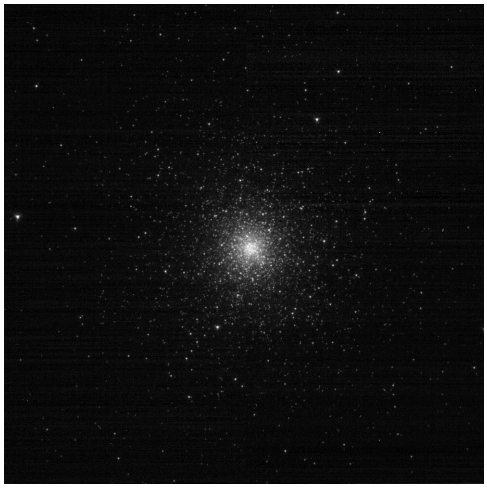
Deep Impact: The Inside Scoop

From Mission Scientist, Lucy McFadden

Just after our trajectory correction maneuver on May 5, the mission entered its approach phase (the time period from 60 days to 5 days before impact). We are observing the comet repeatedly in this phase to detect the nucleus and to refine knowledge of the positions of both the spacecraft and the comet. We can see the comet in our imagers now and are monitoring how its brightness changes with time. Observations are limited to about 15 minutes every 4 hours because of the position of the Sun with respect to the comet. (We can't allow the sun to shine on the instruments.)

On Tuesday, May 10, the Deep Impact mission successfully ran the first day of the May Science Calibration, obtaining good calibration data through all filters with the HRI-VIS and MRI-VIS on the stars i Car, Beta Hyi, Canopus, and Achernar. After additional calibration testing and work, the crowning achievement of the first day of calibration was an ITS mosaic of the open cluster NGC 3114.

Don Hampton, one of our instrument engineers, reports the following: "As part of the May science calibration we took an MRI image (actually there are 6) of 47 Tucanae (also NGC 104), which is a bright globular cluster near the Small Magellanic Cloud. The MRI images were to help determine where we were pointed during an IR scan of the cluster. However, the cluster image is very pretty, so I fixed one up to send out. This is a logarithmic stretch so that all the little dim stars are visible as well as the brightest stars."



The science team spent Sunday, May 15th, reviewing their sequences for E-8 to E-1 days. (The sequences define the observations that the spacecraft and instruments make. See Sequence Symphony on the mission website at: http://deepimpact.jpl.nasa.gov/science/observations-sequence.html. Part of the team's current work is deciding where to point the telescope and how many exposures should be made to meet our science objectives. Time presents the greatest challenge that we face in this task. (We always want more than there is time for.)

Right now the spacecraft is busy collecting daily images of the comet every 4 hours, and maintaining itself on course for impact on July 4th. Our plans include daily release of images beginning in a week or two.

Project members clearly feel the speed at which the comet is moving through the Solar System—10 km/s (23,000 mph)!

New Moon on June 6 at 14:55

First Quarter Moon on June 14 at 18:22

Full Moon on June 21 at 21:14

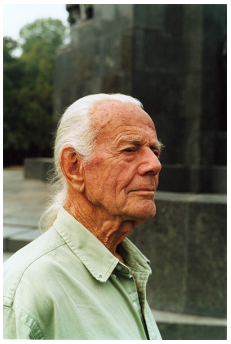
Last Quarter Moon on June 28 at 11:23

Get Well Wishes

Special *get well* wishes go out to Greg Crinklaw, noted deep sky observer and author of the SkyTools observing software, who is recovering from complications of his recent surgery.

Greg had a cancerous tumor on his kidney which necessitated the kidney being removed. In the subsequent surgery, his large and small intestines were perforated and became very infected. Luckily the surgeons operated in time, but Greg's condition was very touchy for a few weeks and he is extremely lucky to be alive. He is recovering well, but he has a long and difficult road to recovery. Greg is now recovering at his home in Cloudcroft, New Mexico.

June Guest Speaker: John Dobson



Born in China, educated in California, three decades as a monk, and three decades gazing at stars on sidewalks, we are pleased to present the inventor of the 'Dobsonian' telescope mount and co-founder of the Sidewalk Astronomers, John Dobson.

John Dobson's scientific musings are very thought provoking and, like Einstein's Relativity, require us to re-examine many of our long-held views. His theories in physics and cosmology boldly break new ground and significantly challenge the scientific orthodoxy.

Please note the special night for this meeting: Tuesday, June 14th.

EVAC Observing Programs

Are you a novice observer who is unsure of where to aim your telescope? Have you located a few of the brighter deep sky objects, but are not sure where to go from there? Tired of spending good clear nights wandering aimlessly among the stars or viewing the same objects over and over? If this describes you, then the EVAC observing programs may be just what you're looking for! Whatever your level of observing expertise, EVAC has a program to suit you. Everyone benefits from participation in an organized observing program!

By successfully completing any of these programs, you will earn a certificate and small plaque from EVAC. Additionally, you will be immortalized in the EVAC Observing Program Page of Fame.
http://www.eastvalleyastronomy.org/pageoffame.html

The EVAC Observing Programs offer a great way to sharpen your observing skills while learning more about the night sky. The process also provides structure and challenge in your observing sessions.

Getting started on any of the EVAC Observing Programs is as easy as 1--2--3

Select the program in which you would like to participate, click on the link and print out the information.

Observe all objects on the list and record your visual observations on a log form. Include as much detail as possible. When you have finished the list, submit the notes (or a copy thereof) to the EVAC Observing Programs Coordinator, Peter Argenziano. After verification, you will receive a certificate and a small plaque suitable for mounting on your telescope.

Currently the club offers the following programs:

1.) Messier Program

2.) EVAC 200 Program

3.) Binocular Messier Program

4.) Lunar Program

5.) NGC Finest Program

6.) Herschel 400 Program

7.) Double Star Program

8.) Globular Cluster Program

9.) Planetary Nebulae Program

10.) Open Cluster Program

11.) Galaxies Program

12.) Palomar Globular Cluster Program

13.) Barnard Dark Nebulae Program

14.) Hickson 100 Program

15.) Berkeley Open Cluster Program

16.) Andromeda Globular Cluster Program

17.) Arp Galaxy Observing Program

The following table lists those members who have completed EVAC observing programs. The table lists the name, program and year completed.

Mike Sargeant	Messier	1996
Ben Davidson	Messier	1998
Joe Goss	Messier	2000
Joe Goss	EVAC 200	2001
Chris Adamson	EVAC 200	2001
Dawn Schur	Messier	2002
Joe Goss	EVAC 500	2002
Harold Judson	EVAC 200	2002
Joe Goss	Galaxies	2003
Joe Goss	Open Clusters	2003
Peter Argenziano	Lunar	2004
Joe Goss	Planetary Nebulae	2004
Peter Argenziano	Globular Clusters	2004
Bill Dellinges	Double Stars	2004
Joe Goss	Finest NGC	2005

Classified Advertisements

Meade ETX-70

with Meade 9mm and 25mm eyepieces, Autostar, and flex focus. $150.00
Damion Pauksta (602) 240-5421
damionbow@aol.com

NexStar 11 GPS

Carbon fiber model purchased from Astronomics late 2003, unused due to illness. Included with all standard accessories are Feathertouch focuser, 2" AP visual back, JMI Wheely Bars with extra-large wheels and complete Celestron 'gift' set of eyepieces and filters in case. Cost well over $3600 -- will sell for $2000 firm. Prefer local sale.
Norm Rubenstein (623) 322-6464

Meade Pictor 416XT CCD

All components, filters, manuals, adaptors, autoguider and CCD camera are still in their original factory sealed condition and plastic wrap. Why? Well, the Pictor and it's software are intended for use with a Windows computer and I never got around to buying a Windows laptop -- sounds silly -- but that's the fact. The Pictor 416XT uses the Kodak KAF-0400 CCD chip with the extended blue response. As a CCD camera, it's considered among the best available under $5000! The autoguider and camera will connect directly to the control panel jacks of Meade LX50, LX90 (APM) and LX200 telescopes (and probably others with similar electronic relay autoguider ports). See a current ad for this unit at: http://telescopes.net/ccd__cameras.html

The Pictor 416XT normally sells for about $2000 (I paid $2035 with tax), but I'll sell it for $1299 (brand new!!).

John Matthews (602) 952-9808
john-cathy@cox.net

16" f4.5 Meade Starfinder with Equatorial 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! Call or e-mail me for a list. I have $5200 invested in this telescope package, but will sell for $2000

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

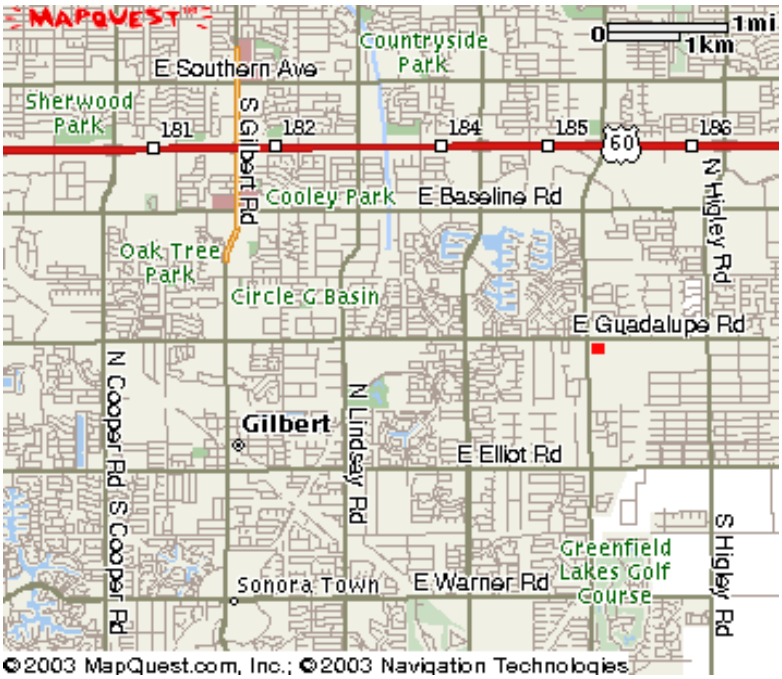
Wanted

2" TV Everbright or equivalent quality diagonal with compression clamp. Must be in excellent condition.

Contact Silvio 480-926-8529 silvioj@msn.com

Only non-commercial advertisements for astronomical equipment will be accepted from current EVAC members. 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 run until canceled or until they have appeared in three issues of the newsletter (whichever occurs first). Ads should be emailed to: news@eastvalleyastronomy.org

Support your local telescope dealer!



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!

2005 Meeting Dates

June 14

July 15

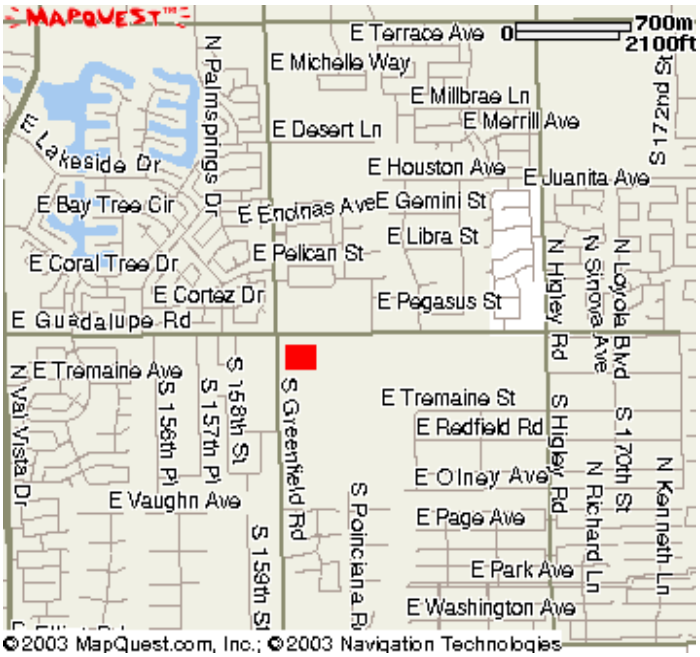
August 20

September 16

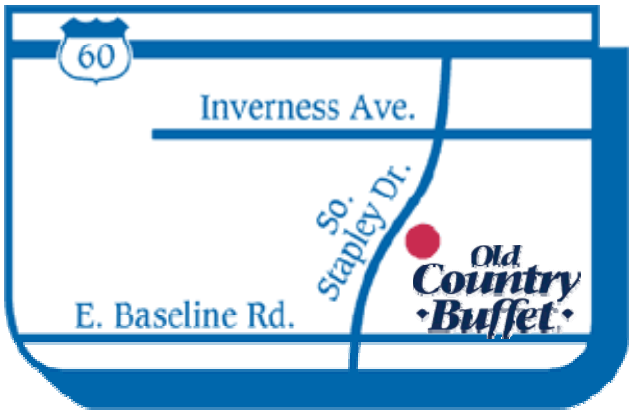
October 21

November 18

December 16



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

June 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

- *June 3 & 4 - Five Mile Meadow Star Party*
- *June 4 - Deep Sky Star Party at Vekol Road*
- *June 4 through 11 - Grand Canyon Star Party*
- *June 10 - Public Star Party at Riparian Institute in Gilbert*
- *June 11 - Local Star Party at Boyce Thompson Arboretum*
- *June 14 - June General Meeting at Southeast Regional Library in Gilbert*

Minutes of May General Meeting

Meeting date: Friday, May 20, 2005

Meeting location: Southeast Regional Library in Gilbert

The meeting was opened by President Steven Aggas. The club officers were asked to introduce themselves to the membership. Visitors were introduced and welcomed by the membership. The treasurer, Wayne Thomas, gave his report; we spent more money than we received. The membership was reminded that the only income the club has is from memberships.

The next Public Star Party will be held June 10, 2005 at the Riparian Center as part of the Sky Watch Program. The public programs at the schools were very successful and a sheaf of thank-you notes was received from the students at Sanborn School. There was also an article in the East Valley Tribune about our programs at the schools.

The Arizona Science Center is holding a Star Party/ Meeting. Volunteers for manning an information booth were requested. This is an opportunity to publicize the club.

The Grand Canyon Star Party is June 4 through 11, information and reservations may be made at the website.

Peri Cline answered a request for a volunteer to fill the open position of Secretary. The nomination was seconded by the membership and passed by a hand vote.

Recognition for published Photos by Joe Orman and Chris Schur was given. These excellent photos were published in *Astronomy* and *Sky and Telescope* Magazines.

The board met and made the following recommendations:

- A 20' X 40' canopy, tables and water dispensers to be used at the All Arizona Star Party are to be purchased. This will afford some protection from the sun and provide a central gathering point for the participants. The cost is approximately $500.
- At this time there is no cost for the All Arizona Star Party. All participants are invited to join the group. It was suggested that a $5.00 donation could be asked from the participants. This would be voluntary and cover the weekend.
- The Observatory that is being built at the Riparian Institute will need a manager to coordinate the paperwork and the volunteers. It was part of the agreement that allows EVAC to use the meeting room that EVAC would provide that person. It was proposed that this position be listed as an officer of the club, no term limits and to be appointed by the board. Steve Aggas will serve as the first observatory manager.
- A waiver form to protect the liability of the club is to be incorporated into the membership form.
- Occasionally a former member returns wishing to rejoin EVAC. Currently the by-laws require that all prior years dues be paid. This requirement tended to discourage the membership being renewed. A change of designation of Member Since… for continuous membership and Astronomer Since… for a returning member was offered as a change.

All items were unanimously ratified by the attending members.

Our next meeting will be held on a special night, Tuesday, June 14th, at the Southeast Regional Library to accommodate a very special guest speaker. John Dobson, legendary telescope maker and founder of the San Francisco Sidewalk Astronomers, will speak in a question and answer forum.

A break for socialization and discussion was followed by Dr Kevin Healy from ASU lecturing on Low Mass Star Formation and his discoveries and breakthrough publications.

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):

☐ **$29.00** 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? _____

One membership includes all family members residing at the same address.

All financial matters can be addressed with the Treasurer (Wayne Thomas) at: treasurer@eastvalleyastronomy.org

How Heavy Can a Star Get?

(Continued from page 3)

Deuterium burning will have little effect on their evolution. H burning due to the CN cycle will begin at about 80 solar masses. These super massive stars are expected to lose mass in their surface layers due to radiation pressure winds, but due to the low metalicity the radiative force is not capable to reverse the infalling until a very large protostellar mass is achieved, [5], [9].

Super massive stars may have also formed through mergers of two or more massive stars into one super massive star, especially in the very dense cores of emerging, embedded, clusters, [11].

It is thought that the normal process of gradual, spherical, cloud contraction without accretion or disk formation may have an upper limit of stellar mass at about 100 solar masses due to the Eddington limit. Thus other processes are thought to be used in their formation to minimize the effects of dominating radiation pressure, [11].

These first stars with negligible or no metals are called Pop III stars and are expected to have both a structural and evolutionary difference from those of later Pop II and Pop I stars. The main difference lies in the mechanism of nuclear energy generation in which the CNO cycle becomes the dominant energy source rather than the traditional p-p chain. This is due to the very high temperatures reached in the central regions of these stars, which produces C more effectively and quicker through the 3 alpha reaction over the p-p chain reaction, while still on the main sequence. The higher the initial mass of the star, the earlier the 3 alpha occurs, [14]. The role of convection, (metal transport) rotation, winds, and radiation pressure in the formation of these stars is still under debate, but overall the effects are much less than for higher metal stars, and their probability of formation and survival are realistic, [15].

The production of the first metals, mainly CNO elements by such stars plays an important role in the formation of later stars, as according to some models, lower mass stars need a minimum metal content to be able to form and thus these Pop III stars could have provided the seeds for future stellar birth, [13].

What evidence do we have of super massive stars? Massive star formation is observed in a wide range of conditions such as in giant molecular clouds, high-pressure galactic centers, and in OB associations, [12]. A star of over 120 solar masses would be expected to live about 2-3 Myr, [9]. Therefore most super massive stellar masses are measured in young , (typically less than 2-3 Myr old) OB associations, using spectroscopic classification. OB associations are large collections of gas and young stars typically found in the disk of spiral galaxies and thus perfect breeding grounds for the location of young super massive stars, [8]. One must be careful though, as most O type stars have more than one companion, [11]. What if the spectral classification model does not apply in a linear fashion? Could we be making errors in mass estimates by using such a scale on super massive stars?

Recently, in examining a dozen OB associations, astronomers have statistically shown that an upper mass limit of about 120-200 solar masses is observed, [6]. The largest empirical mass estimates for individual stars is about 200-250 solar masses, an example of this being the Pistol star near the Galactic center and about 120-200 solar masses for the most massive stars in the LMC, [6]. There are still discussions as to whether or not the Pistol star is one star, a binary system, or even a short-lived merger between two massive stars, [7]. Some of the most massive main sequence stars we know are about 155 solar masses and are found in the R136 cluster, in the 30 Dorados Nebula, of the LMC, [1].

Prior to the HST stars with masses of 1000 solar masses and above were thought to be observed, but were later resolved and found out to be groups of stars. As OB associations and star formation regions in general are areas rich in gas and dust the use of near IR wavelengths for observations is usually applied. Also stars with masses greater than about 100 solar masses do not have their maximum luminosity in the optical bands and are not easily seen by telescopes or via conventional photometry, [11].

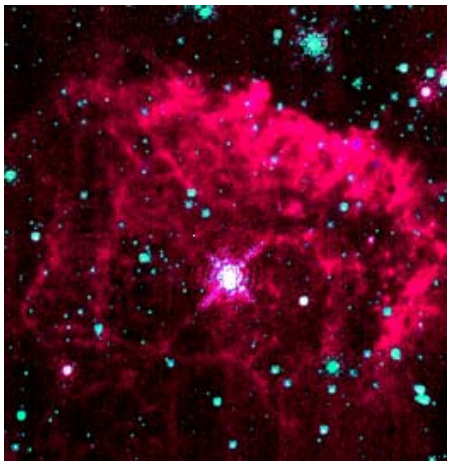


Figure 1: Here is a near IR HST image Of the Pistol star, [7].

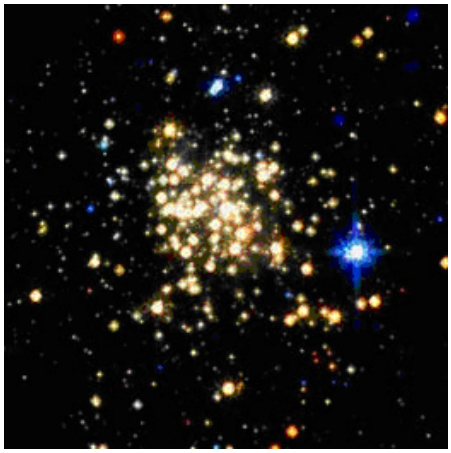


Figure 2. This is an HST near IR image of the Arches Cluster, an OB association near our Galactic Center with more than a dozen stars of over 100 solar masses, [7].

Conclusion

We have seen that the mass of a star is the most influential parame-

(Continued on page 15)

Seeing in the Dark with Spitzer

by Patrick Barry and Tony Phillips

Have you ever gotten up in the middle of the night, walked to the bathroom and, in the darkness, tripped over your dog? A tip from the world of high-tech espionage: next time use night-vision goggles.

Night vision goggles detect heat in the form of infrared radiation—a "color" normally invisible to the human eye. Wearing a pair you can see sleeping dogs, or anything that's warm, in complete darkness.

This same trick works in the darkness of space. Much of the exciting action in the cosmos is too dark for ordinary telescopes to see. For example, stars are born in the heart of dark interstellar clouds. While the stars themselves are bright, their birth-clouds are dense, practically impenetrable. The workings of star birth are thus hidden.

That's why NASA launched the Spitzer Space Telescope into orbit in 2003. Like a giant set of infrared goggles, Spitzer allows scientists to peer into the darkness of space and see, for example, stars and planets being born. Dogs or dog stars: infrared radiation reveals both.

There is one problem, though, for astronomers. "Infrared telescopes on the ground can't see very well," explains Michelle Thaller, an astronomer at the California Institute of Technology. "Earth's atmosphere blocks most infrared light from above. It was important to put Spitzer into space where it can get a clear view of the cosmos."

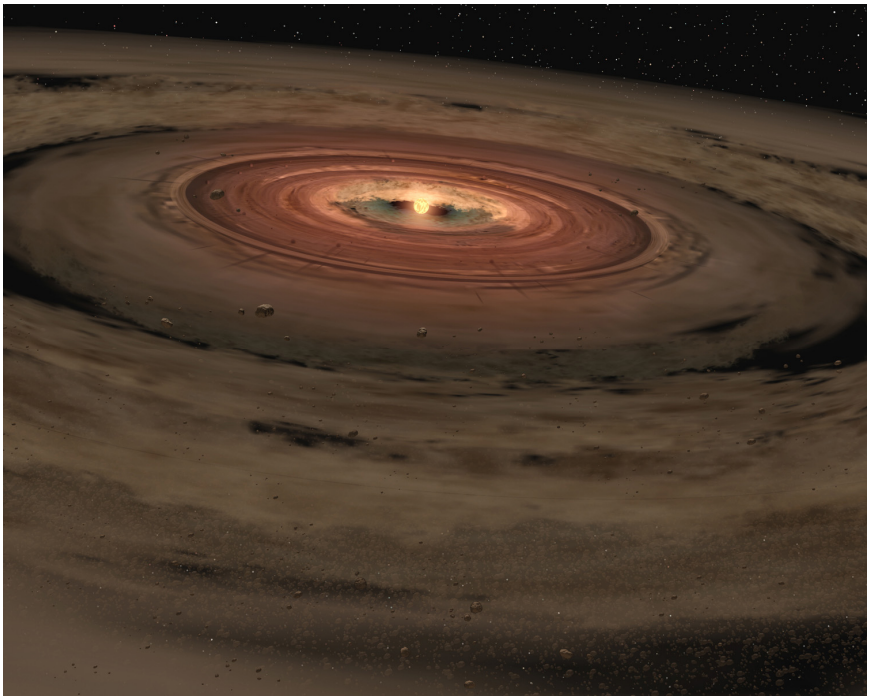
The clear view provided by Spitzer recently allowed scientists to make a remarkable discovery: They found planets coalescing out of a disk of gas and dust that was circling—not a star—but a "failed star" not much bigger than a planet! Planets orbiting a giant planet?

The celestial body at the center of this planetary system, called OTS 44, is only about 15 times the mass of Jupiter. Technically, it's considered a "brown dwarf," a kind of star that doesn't have enough mass to trigger nuclear fusion and shine. Scientists had seen planetary systems forming around brown dwarfs before, but never around one so small and planet-like.

Spitzer promises to continue making extraordinary discoveries like this one. Think of it as being like a Hubble Space Telescope for looking at invisible, infrared light. Like Hubble, Spitzer offers a view of the cosmos that's leaps and bounds beyond anything that came before. Spitzer was designed to operate for at least two and a half years, but probably will last for five years or more.

For more about Spitzer and to see the latest images, go to http://www.spitzer.caltech.edu/spitzer. Kids and grown-ups will enjoy browsing common sights in infrared and visible light at the interactive infrared photo album on The Space Place, http://spaceplace.nasa.gov/en/kids/sirtf1/sirtf_action.shtml.

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



Artist's rendering of brown dwarf OTS44 with its rotating planetary disk.

If it's Clear...

by Fulton Wright, Jr.
Prescott Astronomy Club

June 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.

In the early evening, all month, you can have a good look at Jupiter in the southwest. A small (3 inch) telescope will show cloud belts and up to 4 satellites. A bigger scope will show more detail.

On Tuesday, June 2, you can see some interesting events with Jupiter's moons. Here is the schedule of events:

7:38 PM the Sun sets

~8:30 PM Jupiter ready for observation, high in the south

Europa is just (celestial) west of Jupiter

Europa's shadow is on Jupiter

Io is in front of Jupiter

8:34 PM Io's shadow falls on Jupiter (2 shadows!)

9:38 PM Io moves from in front of Jupiter

10:22 PM Europa's shadow leaves Jupiter (1 shadow)

10:44 PM Io's shadow leaves Jupiter (0 shadows)

On Sunday, June 5, at 10:58 PM you can see Callisto pass over the north pole of Jupiter. Io and Europa are close to each other (celestial) east of the planet.

On Monday, June 6, it is new Moon so you have dark skies for all night observing if you like.

On Thursday, June 9, you can see some interesting events with Jupiter's moons. Here is the schedule of events:

9:18 PM Io moves in front of Jupiter

(Europa is already in front of Jupiter)

10:20 PM Europa's shadow falls on Jupiter (1 shadow)

10:29 PM Io's shadow falls on Jupiter (2 shadows!)

(watch the 2 shadows race each other across the planet)

10:35 PM Europa moves from in front of Jupiter

11:29 PM Io moves from in front of Jupiter

12:39 AM Io's shadow wins the race and leaves Jupiter (1 shadow)

12:59 AM Europa's shadow leaves Jupiter

1:46 AM Jupiter sets

On Wednesday, June 15, after about 8:30 PM, you can see the Moon near a planet. With your unaided eye look halfway up from the southwest horizon for the slightly gibbous Moon, 1.5 degrees from Jupiter. By about 1:00 AM, when they set, the distance will have shrunk to 1 degree.

On Sunday, June 19, after about 8:00 PM you can see the northwest part of the Moon (upper part of the terminator) at its best. Libration tips that part of the Moon toward us. The day before and after are also good.

On Tuesday, June 21, at 7:57 PM, the full Moon rises. Forget the faint fuzzies tonight and check out the rays and other albedo features on the Moon.

On Thursday, June 23, after about 11:00 PM, you can checkout the northeast part of the Moon (the upper part of the terminator). Libration is favorable the next night, too.

On Saturday, June 25, about 8:15 PM, you can see 3 planets close together. With binoculars or a small (3 inch) telescope look 10 degrees above the west horizon for Venus, Mercury, and Saturn within 1.5 degrees of each other. The next two nights, Venus and Mercury pull away from Saturn but are within 10 arcminutes (1/3 Moon diameter) of each other. Also notice Pollux and Castor off to the right.

On Sunday, July 3 (July? Yes, this is a preview of next month's event) about 11:00 PM, you might be able to see the results of a space probe hitting a comet. If all goes according to plan (and that is a big if), Arizona will be well placed to observe the event, and the comet might brighten from mag 10 to mag 6. More next month.

Edward White became the first American to spacewalk on June 3, 1965.

Giovanni Cassini was born on June 8, 1625.

Valentina Tereshkova became the first woman in space on June 16, 1963.

Sally Ride became the first American woman in space on June 18, 1983.

Charles Messier was born on June 26, 1730.

Why Buy a Refractor?

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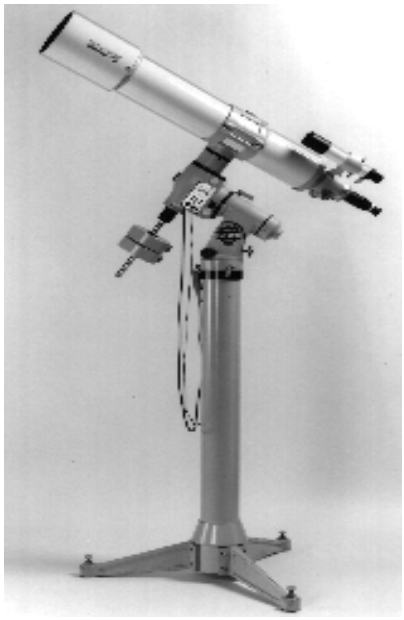
For serious lunar, planetary, globular cluster, and binary star observing – as well as for surprisingly good views of the brighter Messier, NGC, and IC catalog objects – many amateur astronomers prefer the crisp, high-contrast, diffraction-free images of a good refractor.



Under average seeing conditions, a useful rule of thumb in astronomy is that a *good* 3" to 4" refractor will usually outperform an *average* 6" to 8" reflector or Schmidt-Cassegrain for seeing details on the Moon and planets, splitting binary stars, and resolving globular clusters. The situation becomes a little more complicated when comparing refractors to Maksutov-Cassegrains or Maksutov-Newtonians, but (with a few high-priced exceptions) a *good* refractor will usually equal or outperform a Mak-Cass or Mak-Newt of equal or slightly larger aperture

Why? Unlike reflectors and catadioptrics (Schmidt-Cassegrains, Maksutov-Cassegrains, etc.), refractors do not have a secondary mirror obstruction or multiple-reflection optical path to introduce light-scattering diffraction and internal reflections that brighten the sky background, reduce contrast, and smear images.

Refractors also have the highest light transmission – the percentage of the light gathered by the scope that actually reaches your eye. Refractors can transmit 90% or more of the light they collect, compared with the 77% to 80% transmission of reflectors and 64% to 75% of catadioptrics. (The reflector and catadioptric percentages only concern mirror reflectivity. They do not take into account the light blocked by a reflector or catadioptric's diagonal or secondary mirror, which can reach a hefty 15% to 20% additional light loss in some scopes.)

Unlike reflectors and catadioptrics, which lose 1% to 1.5% of their reflectivity per mirror surface per year as their aluminum coatings gradually oxidize, the light transmission of a low maintenance refractor rarely deteriorates significantly with age. Century-old refractors are still used, and highly prized, by discerning amateurs, and the world's largest refractor – the Yerkes Observatory's massive 40" – has been in constant professional use since 1897.

The result of a refractor's lower diffraction and higher light transmission? Given favorable seeing conditions, a modestly-sized refractor can show you subtle lunar and planetary features with a wider and more easily observed contrast range, and with more sharply etched detail, than is possible with the light-scattering optics of many larger reflectors and catadioptrics. This is especially true on nights of less-than-perfect seeing, when the details visible in a larger scope are often blurred by turbulence in our atmosphere. A smaller refractor looks through less of our unstable atmosphere and its images are consequently less affected by this turbulence. A good 80mm refractor, for example, can reveal more lunar detail than you can sketch in a lifetime of observing.

Diffraction spikes on a reflector's star images, caused by its diagonal mirror's spider vanes, are absent in an unobstructed refractor. With no diffraction spikes to hide faint binary star components or smear globular clusters, refractors can resolve close-spaced stars more precisely than the typical reflector.

Since the Moon and planets are all brightly lit by the Sun, a large light-gathering capacity is not as important as high magnification within the solar system. The relatively small aperture of a refractor is therefore often an advantage for this kind of observing, as is the high magnification capability of its long focal length, as there is less glare from brightly lit planetary surfaces to wash out faint detail.

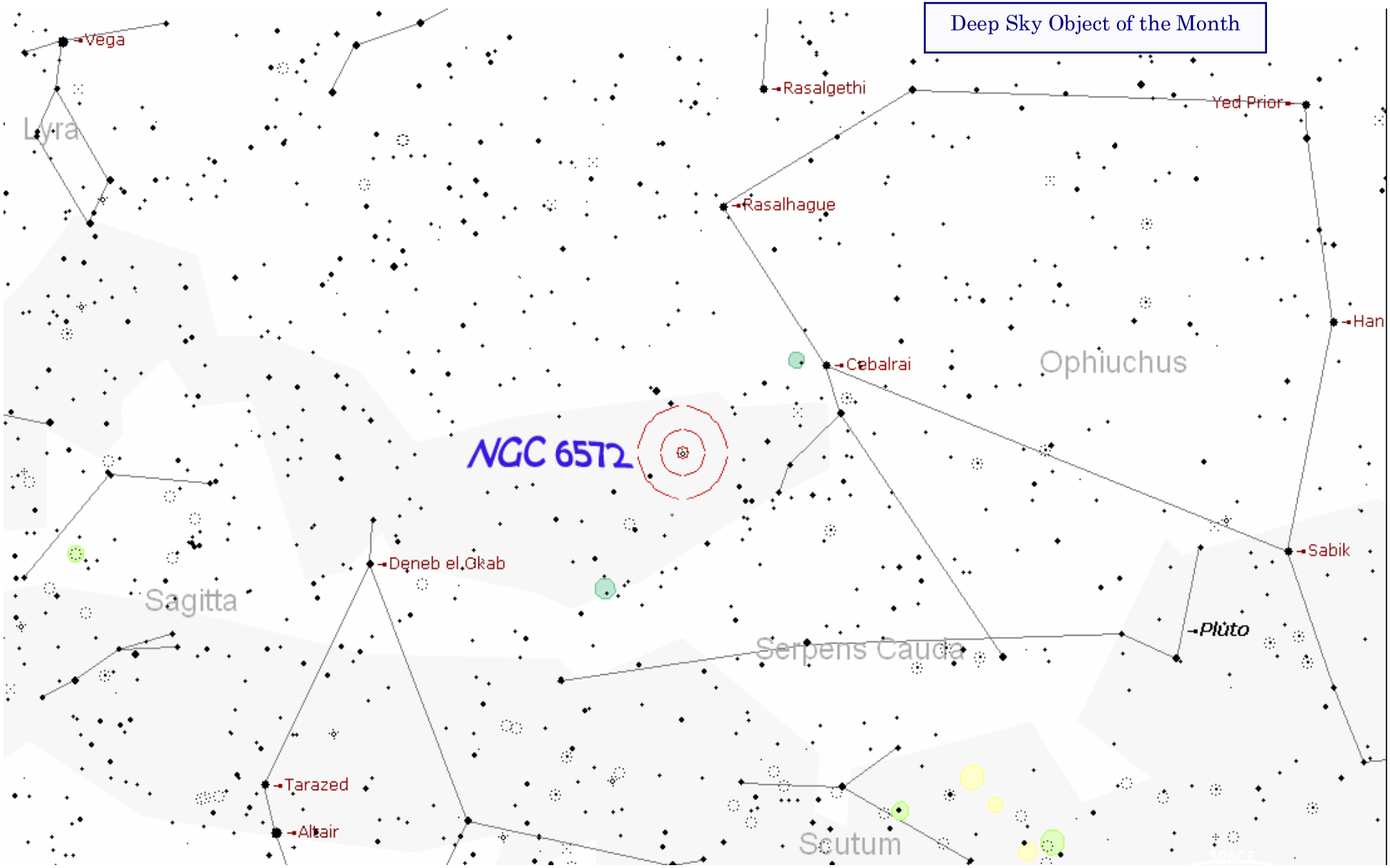
For purely visual lunar, planetary, binary and star cluster observing, an altazimuth refractor with slow motion controls may be perfectly adequate. If a family shares the telescope, however, an equatorial mount with a motor drive will keep objects centered in the field of view so all can share the same view. Close-up lunar and planetary photography requires such a mount and motor drive. Due to the limited light gathering of the *smaller* refractors, long exposure deep space nebula and galaxy photographs are rarely attempted with this type of telescope.

The drawbacks of a refractor? Except for very expensive apochromatic designs, all refractors suffer from chromatic aberration (or "spurious color"). This is an optical defect that produces a faint, and normally unobjectionable, pale violet halo around bright stars, the limb of the Moon, and the planets. Chromatic aberration becomes more visible as the aperture increases and the focal ratio decreases, although modern optical systems minimize the problem in two-element achromatic refractors – and virtually eliminate it in three to four lens apochromatic systems.

While they are light in weight and economical in smaller sizes, refractors become bulkier and considerably more expensive than reflectors or catadioptric scopes as apertures hit 4" (102mm) and above. A premium 4" apochromatic refractor typically costs and weighs four to eight times as much as a 4.5" reflector or 3.5" Maksutov-Cassegrain.

But these drawbacks aside, and if sheer light grasp is not essential – for hunting very faint galaxies, for example, where a larger reflector would have the light-gathering edge – the clarity, contrast, and sheer image quality of a good refractor is well worth your consideration.

Deep Sky Object of the Month



NGC 6572 (Blue Racquetball) Planetary Nebula in Ophiuchus

Magnitude: 9.0 Size: 11” Distance: 3,500 ly

RA 18h 12m 6.4s Dec +06° 51’ 13” Magnitude of central star: 11.0

How Heavy Can a Star Get?

(Continued from page 10)

ter in its life. We have observed super massive stars of well over 100 solar masses and have seen that there are no solid theoretical reasons why stars could not be born with larger masses, through various mechanisms. The physical understanding of the IMF is incomplete and therefore we do not yet fully understand star formation completely.

It would appear that most Pop III, super massive stars have long since expired as they were formed in the early universe. It is probable, that we should expect to see some super massive stars today formed through accretion, or in super massive gas clouds, or through mergers. There seems to be no lack of massive stars, (<100 solar masses) at high metallicity, but no super massive stars with high metallicity are currently observed, thus metallicity seems to play a definite role in their formation, [10]. Mass loss during birth also appears to be less for lower metal content, [14]. The highest mass stars we do know about all show tremendous mass loss but none of them are over 200-250 solar masses and so the truly super massive star dynamics are still only modeled and not yet observed. Nuclear reactions are different in super massive stars and this affects their mass loss, lifetimes, and temperatures.

Thus it would appear that the existence of truly super massive stars is still a question under study.

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Coming in July… our guest speaker will be AJ Crayon. AJ's topic will be sketching at the eyepiece, which we all know to be an excellent way to hone your observing skills. But this presentation will be a little different in that there will be audience participation. That's right, you can work on a deep sky sketch from the comfort of your chair at the July meeting. AJ will cover different techniques that you can then apply to your sketches at the eyepiece. Paper and pencils will be provided. It is recommended that you bring something (clipboard, book, etc.) to write on. Sounds like fun!

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.

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Keep Looking Up!

East Valley Astronomy Club

PO Box 2202

Mesa, AZ 85214-2202