NOVEMBER 2007

THE OBSERVER

East Valley Astronomy Club

VOLUME 21 ISSUE 11

INSIDE THIS ISSUE:

From the Desk of the President
by Claude Haynes

Clear skies, beautiful nights and a surprise comet have made for a memorable Fall so far. Comet 17P/Holmes is providing a great visual display, and presenting a mystery of its sudden brightness worthy of Sherlock himself. It has certainly provided great conversation material at the observatory and our star parties.

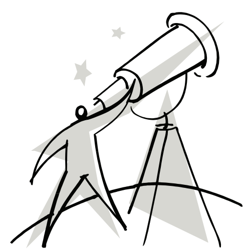
Please check further in this edition for the list of officers and board members due for election in November. While we have a full slate, email me if you are interested in any office. The bylaws allow for open nominations.

Special thanks also to those who helped in the highway cleanup on October 27. We had some mix-up on dates and travel restrictions, but we had a good time and got our section cleaned ahead of the highway construction. The highway work extends to Superior. I don't believe it will impact our observing at Boyce Thompson, but do allow extra travel time.

Special thanks also to Dr. Paul Knauth for a great presentation on an alternative theory concerning past water on Mars based upon the discoveries of the Spirit and Opportunity rovers. I appreciate his scholarship and skepticism.

Wes Lockwood, from Lowell Observatory, is our speaker in November. His review of the changes in Photometry during the past 50 years should highlight a great deal of change in astronomical research.

Happy skies
Claude Haynes



The Backyard Astronomer
An All-Nighter on Kitt Peak *by Bill Dellinges*

It used to be the public had to leave Kitt Peak Observatory at 4:00 p.m. But the facility began offering night observing programs a few years back and in November 2003 my wife and I tried the early version referred to as the Nightly Observing Program (NOP). This runs from dusk to about 10:00 p.m. I reported this experience in the January 2004 club newsletter. The cost is currently $39/per person, $34 for seniors over 62. Groups vary in size from 30 on up depending on how many telescopes are in use that night. The original Meade LX 200 16" has been joined by 16" and 20" Ritchey - Chretien Optical Systems instruments, the latter housed in the dome adjacent to the visitor's center.

For those wishing a more in depth and private stargazing session, Kitt Peak offers the Advanced Observing Program (AOP) which begins following the departure of the NOP folks and lasts till dawn. The cost is $425 for two people plus $60 per person for a twin bed dorm room (each extra person is $75 plus the room fee). My wife and I did the AOP program October 11th of this year. I had my choice of telescopes and chose the RC 16" because it's in a roll off roof observatory which I thought might be a nice change from the dome experience we had with the 20" back in 2003. The fee includes three meals: a cafeteria style dinner, a middle of the night snack, and breakfast in the morning. As the cafeteria is only open for dinner, the other meals are ordered ahead of time and placed in a refrigerator with your name on them. You may attack them at your leisure.

Continued on page 2

Upcoming Events:

Local Star Party at Boyce Thompson – November 3

ASU Star Party at Power Ranch – November 3

Public Star Party in Gilbert – November 9

Deep Sky Star Party at Vekol Road – November 10

Yavapai School Star Party – November 14

Peralta Trails School Star Party – November 15

General Meeting at Southeast Regional Library – November 16

Leonid Meteor Shower – November 18

The Backyard Astronomer

Continued from page 1

We received a friendly welcome at the visitor's center by staff members and were led around the grounds to learn where the observatory, dining room, and our dorm room were. We had dinner with our telescope operator, Roy Lorenz, and later met him at the 16" around 9:00 p.m. (There was no NOP on that scope that night, so we could start earlier than usual). The RCOS 16" F 8.4 ($34,000), little brother to a nearby 20", is a beautiful looking instrument and like the 20" is supported on a Paramount ME mount ($12,500). Piggybacked on the 16" is a Televue 76. The 20" carries a Takahashi FSQ 106 with plans to add a TEC 140.

The sky was glorious. It was the night of the new moon and there wasn't a cloud to be seen. There is a modest light dome to the east from Tucson and an even brighter one to the northeast from our beloved Phoenix. But the observatory walls blocked them out. I had prepared a list of 40 objects in order of right ascension and informed Roy I was only interested in visual observation – no need for imaging. During the evening, I think he had as much fun as I did observing all the DSO's. He was an affable fellow who appreciated my introducing him to a few new objects and views through my tripod mounted 10x70 binoculars. We took a snack break at midnight and chatted about our backgrounds. The wind picked up a bit at 1:00 a.m. but was mostly blocked by the observatory's walls. I suggested we call it a night at 4:00 a.m. He was OK with going until dawn and said it was his job to be there all night with AOP participants. But we had plans to meet people later in the morning and wanted to get a couple hours of sleep in before driving down the mountain. In retrospect, I should have milked that extra hour or so – how often do you get an opportunity like this! Anyway, I could have run on adrenaline that morning after a night on Kitt Peak.

Would you be interested in the objects we viewed that night? OK, here you go:

M 57, 27, 2, 15, 31, 33, 76, 1, 42, 37, 35, 46, 81, 82, 44, 45; NGC 6888, 7009, Stephens Quintet, 7662, 7889, 253, 457, 752, Double Cluster, 1502, 1554, 2261, 2264, 2237, 2403, 2392, 2158, 2438, 7293; IC 1396; 32 Cam, Kuma, Perseus OB Association, Orion's Belt and Sword, Mars (Darn! I forgot to look at Uranus and Neptune and several double stars on my list – too excited). Eyepieces used were Televue 31 and 17 Naglers (110x, 200x).

I was especially impressed with M15, 46, NGC 253 and 7789. At M15's core, about a dozen stars were resolved into pinpoints at 200x with direct vision. I had never seen that before. It was as though a miniature open cluster was residing there. I attribute this to the excellent seeing and the telescope's superb optics (I noted Mars' image was razor sharp – though too small at this time to show any meaningful detail). M46's stars filled the field and the foreground planetary nebula NGC 2438 looked large and bright. It seemed to harbor a central star as bright as the cluster stars but I suspect it was a background cluster star, as the central star in the nebula is suppose to be magnitude 17.5.The galaxy NGC 253 was very bright and mottled, crossing the entire 0.7 degree field like a huge cigar in space. NGC 7789, an open cluster in Cassiopeia and one of my favorite OC's was just stunning, the field chock full of its uniformly faint stars. Upon peering into the Nagler's porthole into space at this cluster, I could only think, "Oh my God."

Later that morning, after a few hours sleep, we needed to think about leaving - I did not want to go! After observing most of the night, eating in their dining room, sleeping in their dorm, and wandering about the grounds, I was getting used to being a member of this mountain community. Yes, the Kitt Peak observing programs are addictive. Contacts:

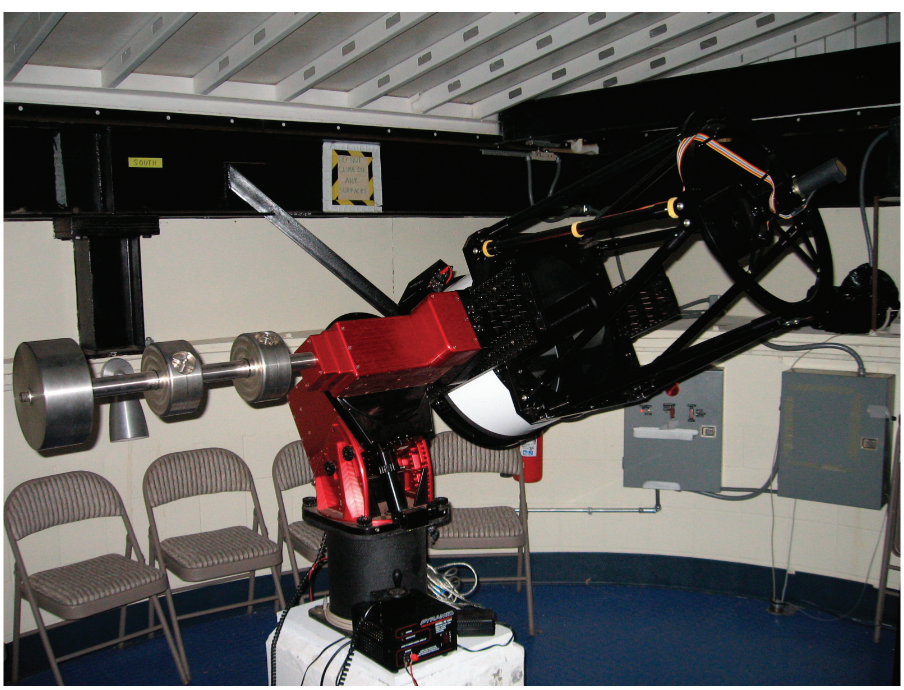
NOP: (520) 318-8726 www.noao.edu/outreach/nop

AOP: (520) 318-8728 or 8733 www.noao.edu/outreach/aop

Ritchey – Chretien Optical Systems: (928) 526-5380 www.rcopticalsystems.com

Bisque Paramount ME mount: (800) 843-7599 www.bisque.com

[Kitt Peak Observatory, el. 6,875 feet, is located 56 miles west of Tucson, AZ]



Our telescope at Kitt Peak for the evening: a 16" RCOS Ritchey-Chretien riding atop a Paramount ME.

A Short Introduction to Astronomical Magnitude, Distance and Standard Candles

by Henry De Jonge IV

From the earliest times that we have looked up to the stars we have wondered how far away they are. This question has been thought to have been answered in the past many times such as when the Greeks thought of the stars as lying upon a fixed vast sphere, to when the known universe was encapsulated just in the small Milky Way galaxy, to when the true expansiveness of the universe became apparent in the mid 20th century with the discovery of other island universes beyond our own.

The first use of standard candles for distance began in earnest in the mid to late 1800's and became a mature technique by the mid 1900's. The essence of standard candle metrology, calibration and applicability is the measurement and comparison of luminosity or magnitudes. Thus the determination of magnitude, (visual, photographic, photoelectric, spectral, and absolute) and standard candles are inexorably tied together. The search and study of standard candles is largely the search and study of magnitudes.

Introduction

Distance measurements and brightness measurements in astronomy have not always been very precise, understood, or well calibrated. Accurate distance measurement is necessary to understand the real properties of stars, galaxies, and our universe, and plays a critical role in all theoretical models. It is a naïve assumption to assume that the further an object is away from us the dimmer it will be and vice versa. This belief naturally follows from the inverse square law of light. People have been using the visual magnitude of an object to judge distance for many years. In the time of the ancient Greeks about 150 BC, astronomers such as Hipparchus used visual sightings of brightness to classify stars. Most of these ancient Greeks believed that the stars were part of an immense outer fixed sphere and at a constant distance. It was not until the mid 1500's that people such as Rene Descartes and Thomas Diggs suggested that the sphere of the stars extended infinitely beyond a fixed radius so that there could be differences in the distances between stars. Thus Hipparchus was most likely using visual magnitude for merely classifying the brightness of stars without regards to their distance. Nonetheless this was the first recorded attempt to tabulate and standardize visual magnitudes. Hipparchus divided the visible stars into 6 brightness groups as observed from Earth. The brightest he called first magnitude and the ones barely visible to the naked eye he called sixth magnitude. This is obviously dependent on how bright the star is to a human eye and is not a reflection of its true properties or its distance from earth.

In 140 AD Claudius Ptolemy used this visual magnitude system of Hipparchus for his star catalog and this became the standard in astronomy for the next 1,400 years, so that the visual magnitude system became very well ingrained. Galileo in the early 1600's with his new telescope found that there were many more faint stars than 6th magnitude. He labeled some of the brightest he saw through his telescope as 7th magnitude, thus beginning the expansion the long fixed visual magnitude scale. Today a pair of 50 mm diameter outer lens binoculars will show stars of about the 9th magnitude while the HST has imaged objects as faint as 30th magnitude.

In the mid 1800's photography was developed and used for making images of stars and for recording spectral measurements. Due to the inherent wavelength responses of film, (more sensitive to blue light and less for red) and its nonlinear response to different light levels, some stars that looked visually the same appeared different on a photographic plate and vice versa. Astronomers began the adoption of a different magnitude system called photographic magnitude. Still due to the differences in human eyes, film responsiveness, and processing, something had to be done to calibrate these magnitudes once and for all. This began the mainstream search in the astronomical community for well-defined distance metric.

A brief overview of magnitude, distance metrology, the distance ladder, and standard candles

The measurement of astronomical distances begins right here on Earth and in our solar system. The astronomical unit or AU is defined as the mean radius of the Earth's orbit around the sun and is equal to 1.496x108 km or 93.2 million miles. The parsec is defined as being the distance to a star if it moves by one second of arc when the Earth has moved one AU. This name comes from the phrase 'second of parallax' being read as a 'parallax of second'. It is equal to 3.26 light years and is of great advantage in astronomy metrology as distances in parsecs are not affected by the accuracy of the AU, (although the value of the parsec may change). One close star, Proxima Centauri has a parallax of 0.76 arc second which puts it at about 1.3 parsecs away from Earth.

Absolute magnitude is defined as the magnitude of a star if it were placed at a standard distance of 10 parsecs and is usually referenced to the visible band. Apparent magnitude is the brightness of an object measured by an observer by any means at any specified distance. All magnitude measurements should always be given with a note as to exactly what wavelength region was used in the measurement, however this is not always specified. If a wavelength region is not indicated it is usually meant to be restricted to the visible region. Unfortunately adding to the confusion many astronomers use a different absolute magnitude for comets and asteroids. This is defined as how bright a comet or asteroid would appear if we were at the sun and the object was one AU away.

Today we use photoelectric photometry with very specific color filters to determine magnitudes. The UBV system is the most common and was defined in 1953. It is a wide band system where we use U for the near UV (a Corning 9863 filter), B for blue, (a Corning 5030 and a Schott GG 13 filter) which roughly corresponds to the photographic region, and V (a Corning 3384 filter) for a rough visual magnitude that peaks in the yel- *Continued on page 4*

Astronomical Magnitude, Distance and Standard Candles

Continued from page 3

low-green band where the eye is most sensitive. This definition also uses a very specific optical system requiring a reflecting telescope with aluminized mirrors and an RCA 1P21 photomultiplier. There are 10 primary standard stars used as well defined references for this magnitude system with dozens more as secondary standards. The magnitudes are scaled so that they equal each other through all 3 filters for A0 V stars. Color index is defined as the difference between a stars magnitude through two different filters. The most common is B-V, which gives an indication of the spectral type, (and thus temperature) of the star. The B-V for A0 type stars is defined to be zero. Sometimes the index is expanded to include other bands such as R, (for red) and I, (for near IR) and is called the UBVRI magnitude system. Another common system is the UVBY system, which is composed up of intermediate bands and has its own set of primary standard stars. Bolometric magnitude is defined as the total energy emitted by an object over all wavelengths. Since it is not possible to measure this 100% completely, its value is determined by various mathematical models using the magnitudes from other measurable systems.

Magnitude measurements nowadays are almost exclusively taken by photoelectric means including the photometer, CCD, and CMOS imaging devices. Measurements from one magnitude system can be converted to another magnitude system, albeit usually with great difficulty. There must be extensive observational calibrations used or thorough detailed calculations made using object spectral distributions. The best and often easiest method is to use the photometric system of interest to make the actual measurements. This difficulty is especially noticed when modern researchers attempt to use very old photometric data in their research.

Today we enjoy the accuracy of magnitude measurements to about +/- 0.01. Even though researchers do not always agree upon the absolute or relative measurement of magnitudes, with the exact same optical filters and detectors, (as best that can be manufactured and calibrated) they can at least however agree upon the ratios of the magnitudes.

The formula "m-M=5Log(d)-5" (1)

where m is the apparent visual magnitude, M is the absolute magnitude, and d is the stars distance in parsecs, relates a stars relative visual magnitude to its absolute magnitude and from it we can determine its distance. The quantity "m-M" is called the distance modulus. Luminosity is related to absolute magnitude by the equation,

$$M_v = -2.5 \log(L_o/L_{std}) \qquad (2)$$

Where L_o is the luminosity of the object and M_{std} is the luminosity of the standard.

In the most complete form of equation (1) if we take into account the scattering and absorption of photons in interstellar space, which is wavelength dependent, (decreasing with longer wavelengths) this will cause the visual magnitudes to be dimmer than from the distance alone. If we also take into account any recessional velocity, (redshift) for cosmological distant objects, (which will lengthen the wavelengths overall), we get the equation:

$$m - M = 5 \log (d) - 5 + A + K \qquad (3)$$

Where A is the interstellar extinction or dimming in magnitude and K is called the K-correction and is a magnitude associated with the redshift. Magnitude measurements also have to contend with the absorption of light in the atmosphere as well as with wind, temperature, and humidity variations. The atmosphere will absorb and redden a stars light and is angle dependent, having the least amount of atmosphere to go thorough at the zenith. These effects are determined by Bouguer's law, which is represented by the equation;

$$m_{\lambda.0} = m_{\lambda.z} - a_\lambda \sec z \qquad (4)$$

where $m_{\lambda.z}$ is the magnitude at wavelength λ at zenith distance z, and a_λ is a constant, (extinction coefficient) which depends upon λ. This law is generally accurate up to zenith distances of 60 degrees. The largest uncertainty in this equation is the extinction coefficient, which can vary from one observing site to another, the time of day and year, and even throughout the night. Usually the extinction coefficient is determined by observing a standard star at several different zenith distances and by plotting the magnitude against sec z. For zenith angles less than 60 or 70 degrees the secant is assumed to be the measure of the air mass along the line of sight so that extrapolating the observations back to an air mass of zero, (not the secant itself) has proven to be a good approximation. In modern usage this extinction coefficient is determined for each filter used as it is very wavelength dependent. Once the extinction coefficient has been determined the above atmosphere magnitude of the star, m_λ becomes;

$$m_\lambda = m_{\lambda.z} - a_\lambda (1 + \sec z) \qquad (5)$$

and the observations of the star and the standards must be multiplied by a factor k_λ, which equals;

$$k_\lambda = 10^{0.4a_\lambda}(1 + \sec z) \qquad (6)$$

to correct them to their unabsorbed values. The zenith angle z, is a function of the latitude of the place of observation φ, the right ascension α, and declination δ, of the star and the local sidereal time of the observation, (LST). This is expressed by the following equation;

$$\cos z = \sin \varphi \sin \delta + \cos \varphi \cos \delta \cos (LST - \alpha) \qquad (7)$$

The time of observation should be expressed in heliocentric Julian days with the time expressed as heliocentric time corrected for the travel time of the light to the sun. In

Continued on page 13

November Guest Speaker: Dr. G. Wesley Lockwood

Wes Lockwood is a native of the Tidewater area of Virginia and was educated at Duke University (BA in Physics, 1963) and the University of Virginia (MA in Astronomy, 1965; PhD in Astronomy, 1968).
He began his postgraduate career as an astronomer at Kitt Peak National Observatory in Tucson.
In 1973, he moved to Lowell Observatory to work on a long term program known as the "Solar Variations" project. This project involves measuring reflected sunlight from the planets Uranus and Neptune and Saturn's moon, Titan. The work has been carried out continuously on Mars Hill using the historic 21-inch reflecting telescope located a few hundred yards west of the main observatory complex.
In addition, in collaboration with Jeffrey Hall, he carries out fundamental spectroscopic measurements of sunlike stars at Lowell's Anderson Mesa site. This work is aimed at understanding the Sun's variability and activity in the context of similar measurements of stars we call "solar twins.".
Other interests include working with City and County officials to preserve Flagstaff's dark skies.
Dr. Lockwood will give a presentation entitled "A Tribute to Photoelectric Photometry at Lowell Observatory, 1953 - 2003".

Last Quarter Moon on November 1 at 14:189

New Moon on November 9 at 16:04

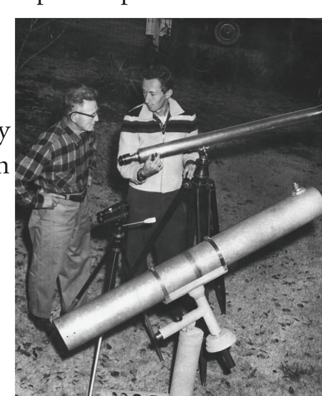
First Quarter Moon on November 17 at 15:33

Full Moon on November 24 at 07:30

In accordance with the club's constitution and bylaws, nominations for Officer or Board positions were opened at the October general meeting and shall be publicized prior to the November general meeting. Nominations will be closed at the start of the November general meeting. Officers shall be elected by a simple majority of the General Assembly present at the November general meeting. Is this the year you get involved? The future of EVAC depends on you. Contact a current officer for more information.

Robert Burnham Jr. Memorial Fund

You can be a part of history as people from all walks of life coordinate their efforts to pay tribute to one of the most influential people in amateur astronomy. The East Valley Astronomy Club is proud to serve as fiduciary agent for a drive to place a permanent memorial to Robert Burnham Jr on the grounds of Lowell Observatory in Flagstaff, Arizona. It is estimated the memorial will cost approximately $20,000. Any additional funds raised will be contributed to the Northern Arizona University scholarship fund for the benefit of astronomy students.
Robert Burnham compiled his three volume Celestial Handbook while working at Lowell Observatory as part of the Stellar Proper Motion Survey. This grassroots effort began on a Cloudy Nights discussion forum, and with the guidance of Burnham's sister, Viola Courtney, and her daughter Donna Cox, has grown to include numerous members of the astronomy community, including the honorary chairman of our fundraising committee Jack Horkheimer of the Miami Science Museum, better known for his PBS Star Gazer series.
For more information on Robert Burnham Jr please visit the official memorial website www.rbjm.org .
If you wish to make an online donation, please use the PayPal link here:
http://www.eastvalleyastronomy.org/rbjm.htm
If you wish to make a donation by mail, please make check payable to Burnham Memorial Fund and mail it to EVAC, PO Box 2202, Mesa, Az., 85214-2202... or you can donate at a club meeting.



Robert Burnham Sr and Robert Burnham Jr at the telescope

10” Deep Space Hunter

A very nice Dobsonian from Hardin Optical. Included in the sale are a finder scope and Telrad. Three eyepieces are also included: 9mm and 25mm (1¼” diameter) and 32mm (2” diameter). Asking price $400.

Peri Cline
480-981-5203 between 6 pm and 9 pm weekdays

peri_cline@cox.net

Your ad could have appeared here.

Contact the Editor for details.

Orion StarMax 102mm Maksutov-Cassegrain

1300mm focal length F12.7

Orion TeleTrack Alt-Az tracking mount

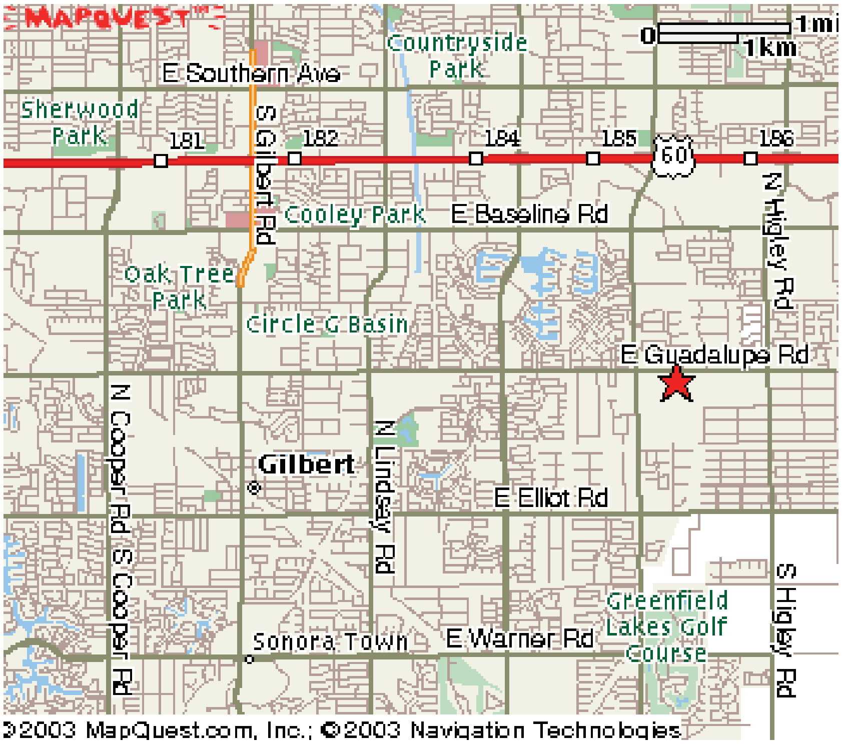
$300 *damionbow2@aol.com*

SBIG ST-402ME

SBIG ST-402ME with Class 1 sensor and CFW402 internal color filter wheel installed and a set of RGBC filters. Same Microlensed, Blue Enhanced, Full Frame KAF-0402ME CCD as the ST-7XME camera. The array is 765 x 510 pixels at 9 microns square. Peak QE is nearly 85%. Also has enhanced cooling and USB-2. Asking price $1200. Also have a set of SBIG BVI filters for photometry, $250.

Marty Pieczonka 480-983-0915 or martyp@sybase.com

www.eastvalleyastronomy.org/grco/obs.asp

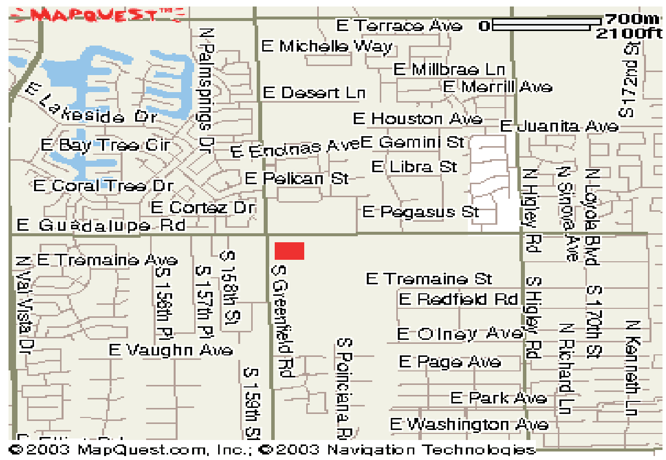


The monthly general meeting is your chance to find out what other club members are up to, learn about upcoming club events and listen to presentations by professional and well-known amateur astronomers.

Our meetings are held on the third Friday of each month at the Southeast Regional Library in Gilbert. The library is located at 775 N. Greenfield Road; on the southeast corner of Greenfield and Guadalupe Roads.

Meetings begin at 7:30 pm.

Visitors are always welcome!



2007 Meeting Dates

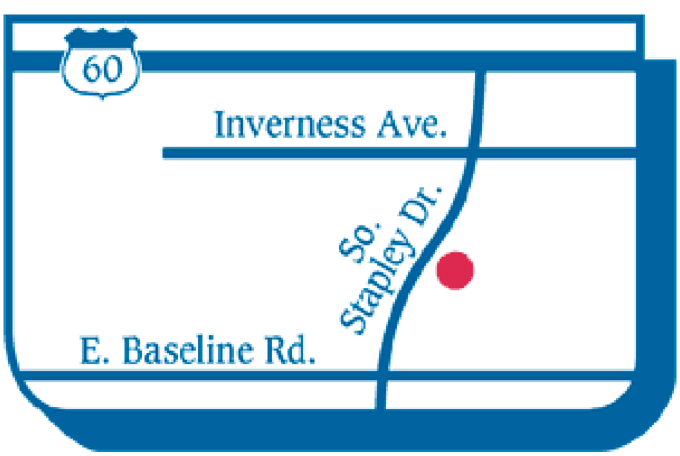
November 16

December 21

Holiday Party

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, just south of US60.



Old Country Buffet
1855 S. Stapley Drive
Mesa, Az. 85204

Likewise, all are invited to meet for coffee and more astro talk after the meeting at the Village Inn restaurant located on the northeast corner of Gilbert and Baseline Roads in Mesa.

Village Inn
2034 E. Southern Avenue
Mesa, Az. 85204

November 2007

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	**3**
4	5	6	7	8	**9**	**10**
11	12	13	**14**	**15**	**16**	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

November 3 - Local Star Party at Boyce Thompson Arboretum

November 3 - ASU Star Party at Power Ranch

November 9 - Public Star Party at Riparian Preserve in Gilbert

November 10 - Deep Sky Star Party at Vekol Road

November 14 - Yavapai School Star Party

November 15 - Peralta Trails School Star Party

November 16 - Monthly General Meeting at Southeast Regional Library in Gilbert

November 18 - Leonid Meteor Shower

Fall Adopt-A-Highway

On the morning of Saturday, October 27 a smaller-than-expected group of club members gathered at a Village Inn restaurant in Apache Junction. From there they carpooled out to the EVAC section of US60 for the semi-annual Adopt-a-Highway program. Special thanks to our cleanup crew: Claude Haynes, Bill Dellinges, Frank Pino, Marty Pieczonka, Dave Lehnen, Ron Risko and Keith Krueger.

Election Time

The nominations for the 2008 governing body of the East Valley Astronomy Club have been compiled and are as follows:

President: Claude Haynes
Vice President: Howard Israel
Treasurer: Ray Heinle
Secretary: Wayne Thomas
Board of Directors: Dave Coshow, Henry De Jonge, Ron Risko, Bill Houston and Jean Thompson.
Events Coordinator: Randy Peterson
Property Director: David Hatch
Webmaster: Marty Pieczonka
Newsletter Editor: Peter Argenziano
Observatory Manager: Martin Thompson

According to the constitution and bylaws, the nominations remain open until the beginning of the November 16th general meeting. If you are interested in any position, please contact President Claude Haynes.

If necessary, voting will occur at the November meeting. Simple ratification of the cabinet will be conducted for all uncontested positions.

East Valley Astronomy Club -- 2007 Membership Form

Please complete this form and return it to the club Treasurer at the next meeting or mail it to EVAC, PO Box 2202, Mesa, Az, 85214-2202. Please include a check or money order made payable to EVAC for the appropriate amount.

IMPORTANT: All memberships expire on December 31 of each year.

Select one of the following:

☐ New Member ☐ Renewal ☐ Change of Address

New Member Dues (dues are prorated, select according to the month you are joining the club):

☐ **$30.00 Individual** January through March

☐ **$35.00 Family** January through March

☐ **$22.50 Individual** April through June

☐ **$26.25 Family** April through June

☐ **$15.00 Individual** July through September

☐ **$17.50 Family** July through September

☐ **$37.50 Individual** October through December

☐ **$43.75 Family** October through December

Includes dues for the following year

Renewal (current members only):

☐ **$30.00 Individual** ☐ **$35.00 Family**

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 payment**

Areas of Interest (check all that apply):

☐ General Observing ☐ Cosmology

☐ Lunar Observing ☐ Telescope Making

☐ Planetary Observing ☐ Astrophotography

☐ Deep Sky Observing ☐ Other

Please describe your astronomy equipment:

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

How did you discover East Valley Astronomy Club? [ ]

PO Box 2202
Mesa, AZ 85214-2202
www.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 I and my family agree to hold EVAC harmless from any claims, liabilities, losses, demands, causes of action, suits and expenses (including attorney fees), which may directly or indirectly be connected to EVAC and/or my presence on the premises of any EVAC Star Party and related areas.

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

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

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

____ ____________________

Please print name here ***Date***

____

Please sign name here

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

NASA's Space Place

The Red (Hot?) Planet

by Patrick L. Barry

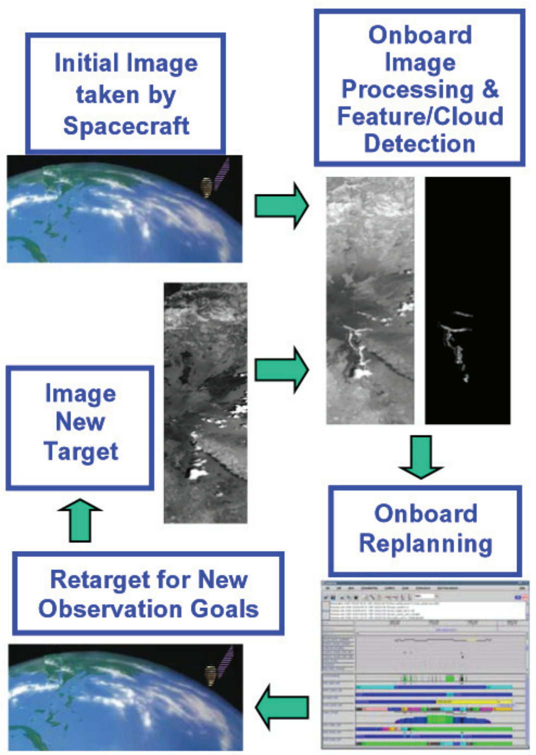
Don't let Mars's cold, quiet demeanor fool you. For much of its history, the Red Planet has been a fiery world.

Dozens of volcanoes that dot the planet's surface stand as monuments to the eruptions that once reddened Mars's skies with plumes of glowing lava. But the planet has settled down in its old age, and these volcanoes have been dormant for hundreds of millions of years.

Or have they? Some evidence indicates that lava may have flowed on Mars much more recently. Images of the Martian surface taken by orbiting probes show regions of solidified lava with surprisingly few impact craters, suggesting that the volcanic rock is perhaps only a million years old.

If so, could molten lava still occasionally flow on the surface of Mars today?

With the help of some artificial intelligence software, a heat-sensing instrument currently orbiting Mars aboard NASA's Mars Odyssey spacecraft could be just the tool for finding active lava flows.



Just as changing cloud patterns on Earth were identified using Earth Observing-1's Advanced Land Imager along with ScienceCraft software, the THEMIS instrument with ScienceCraft on the Mars Odyssey spacecraft can avoid transmitting useless images.

"Discovering such flows would be a phenomenally exciting scientific finding," says Steve Chien, supervisor of the Artificial Intelligence Group at JPL. For example, volcanic activity could provide a source of heat, thus making it more likely that Martian microbes might be living in the frosty soil.

The instrument, called THEMIS (for Thermal Emission Imaging System), can "see" the heat emissions of the Martian surface in high resolution—each pixel in a THEMIS image represents only 100 meters on the ground. But THEMIS produces about five times more data than it can transmit back to Earth.

Scientists usually know ahead of time which THEMIS data they want to keep, but they can't plan ahead for unexpected events like lava flows. So Chien and his colleagues are customizing artificial intelligence software called ScienceCraft to empower THEMIS to identify important data on its own.

This decision-making ability of the ScienceCraft software was first tested in Earth orbit aboard a satellite called Earth Observing-1 by NASA's New Millennium Program. Earth Observing-1 had already completed its primary mission, and the ScienceCraft experiment was part of the New Millennium Program's Space Technology 6 mission.

On Odyssey, ScienceCraft will look for anomalous hotspots on the cold, night side of Mars and flag that data as important. "Then the satellite can look at it more closely on the next orbit," Chien explains.

Finding lava is considered a long shot, but since THEMIS is on all the time, "it makes sense to look," Chien says. Or better yet, have ScienceCraft look for you—it's the intelligent thing to do.

To learn more about the Autonomous ScienceCraft software and see an animation of how it works, visit http://ase.jpl.nasa.gov .

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

November 2007

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.

November is a good month to begin observing Mars. On the 1st it rises at 9:20 PM and is 12 arc seconds in diameter. On the 31st it rises at 7:20 PM and has grown to 15 arc seconds in diameter. (It remains about this size for December, then starts to shrink.) The bigger the telescope for observing, the better. See Sky & Telescope, Nov. 2007, p. 66 for details.

On Saturday, November 3, about 3:40 AM (ugh), you can see the Moon occult a bright star. Look 30 degrees above the east horizon for the crescent Moon and Regulus. The bigger the telescope and the higher the magnification you use, the easier it will be to see the star near the bright limb of the moon. The star pops out from behind the dark limb about 4:42 AM. While you are at it, check out Saturn and Venus in a line below the Moon, and Mars almost overhead.

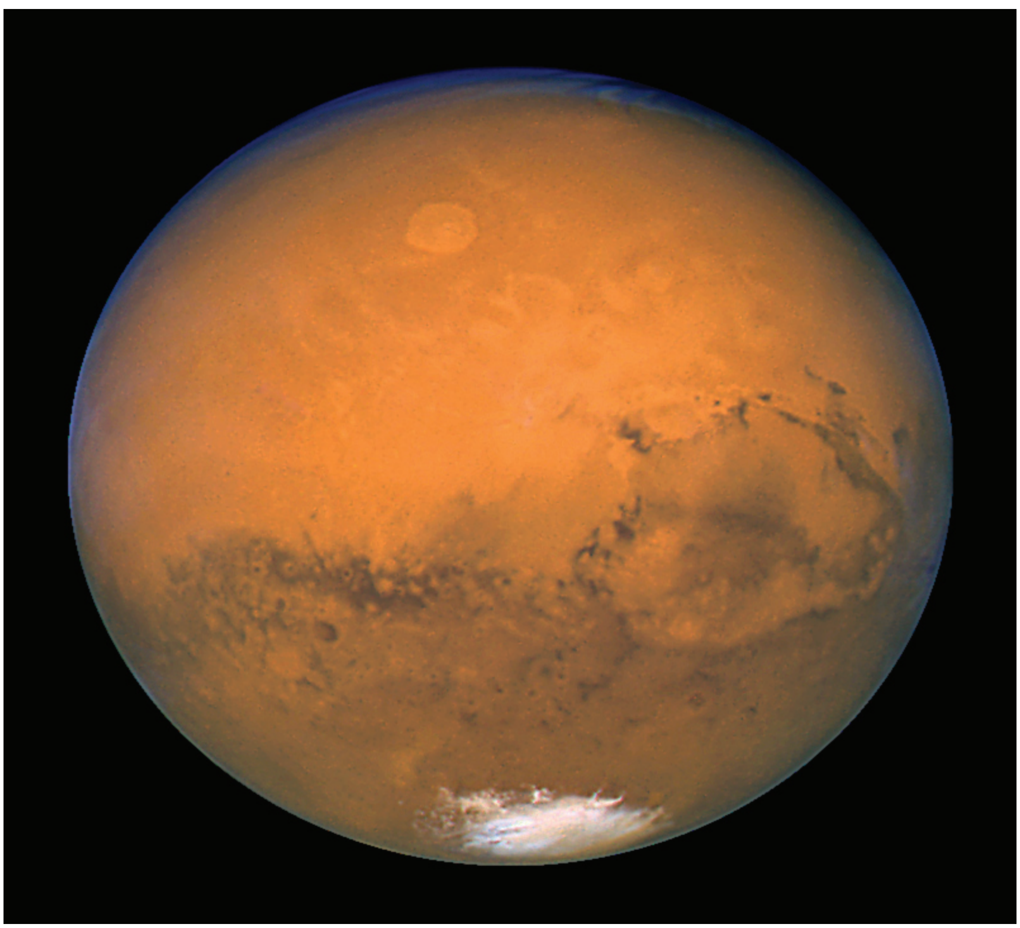
On Thursday, November 8, about 6:30 AM, you can see Mercury at its greatest western elongation. With binoculars look 10 degrees above the east-southeast horizon for the magnitude -.5 planet. It should be visible for about a week around this date.

On Friday, November 9, it is new moon, so you can hunt for faint fuzzies all night.

On Sunday, November 18, after midnight and before dawn, you might see some meteors. With your unaided eye look toward the constellation Leo in the east. This is a "shower" which is not expected to be especially flashy, but with meteors, you never know.

On Saturday, November 24, at 5:20 PM (1 minute after sunset) the full moon rises spoiling any chance of seeing faint fuzzies for the whole night. This is another one of those particularly large appearing full moons which occur near perigee.

On Monday, November 26, about 10 PM, you can see the Moon pass about 1 degree from Mars. With your unaided eye or binoculars, look about 25 degrees above the east horizon for the pair. This is a particularly good time to view the Moon's eastern portion (where the terminator is, libration tips it toward us) so use your telescope, too.



Hubble's Closest View of Mars
August 27, 2003

NASA's Hubble Space Telescope snapped this portrait of Mars within minutes of the planet's closest approach to Earth in nearly 60,000 years. This image was made from a series of exposures taken between 5:35 a.m. and 6:20 a.m. EDT Aug. 27 with Hubble's Wide Field and Planetary Camera 2. In this picture, the red planet is 34,647,420 miles (55,757,930 km) from Earth.

This sharp, natural-color view of Mars reveals several prominent Martian features, including the largest volcano in the solar system, Olympus Mons; a system of canyons called Valles Marineris; an immense dark marking called Solis Lacus; and the southern polar ice cap.

Image credit: NASA, J. Bell (Cornell U.) and M. Wolff (SSI)

Additional image processing and analysis support from: K. Noll and A. Lubenow (STScI); M. Hubbard (Cornell U.); R. Morris (NASA/JSC); P. James (U. Toledo); S. Lee (U. Colorado); and T. Clancy, B. Whitney and G. Videen (SSI); and Y. Shkuratov (Kharkov U.)

Astronomical Magnitude, Distance and Standard Candles

Continued from page 4

the case of very sensitive measurements the varying distance of the Earth from the Sun would also need to be accounted for.

Distance measurement in astronomy has traditionally been built up via a bootstrap process, essentially by using smaller but well defined, absolute distance steps to calibrate larger more relative distance steps in a straight forward process, like the rungs on a ladder. Thus the name distance ladder, (or cosmic distance ladder) for this process. This is like using distance to find distance and this concept is used in all types of metrology from semiconductor to astronomical. The first rung of the ladder is an absolute distance measurement or reference point that serves to calibrate the next rung of the ladder which is a relative distance measurement and so on for each subsequent rung. These relative distance rungs can then be turned into an absolute distance, (within error limits) with the proper calibration. Most metrology methods or rungs in the ladder are only useful over specific and limited distance ranges. One factor in this scheme is that each rung of the ladder depends upon the previous rung for its calibration and accuracy. Thus any error in a rung will be propagated and accumulated further up the ladder. An advantage in the distance ladder model is that the error for each step is usually quantifiable and can be taken into account further up the ladder. Unfortunately there are still some discrepancies in all derived distances due to systematic errors and random errors. It is also known that different combinations of distance metrics (rungs of the ladder) will produce different total distances.

The first rung of the distance ladder is the AU, which is defined as the mean distance between the Earth and the sun. Parallax is the next rung of the distance ladder. Trigonometric, (or dynamical) parallaxes are based upon using the AU as a baseline. They are the first distance measurement method useful for extra solar distances. This method works out well from the ground to about 100-200 pc.

The satellite Hipparcos which measured trigonometric parallax from space between 1989 and 1993 was able to obtain data from space which is usually much better than land based telescopes, due to the lack of atmosphere, lack of telescope distortions, and by producing a diffraction limited image. It measured the parallax of over 120,000 stars out to 500-1,000 pc.

There are other types of parallax such as spectroscopic parallax. If we know where the star fits on the main sequence of the HR diagram by measuring its surface color or spectral details, then we can read off the absolute luminosity. A comparison with the apparent magnitude will give us the distance. Measuring the surface temperature of the star usually by comparing the ionized metal lines in its spectrum to determine its spectral class does this. The surface gravity or pressure of the star can be determined by the broadening and amount of ionization in the spectral lines and this gives the luminosity class of the star. This data gives the mass and luminosity of the star, which gives the distance. Main sequence fitting with this method is much more reliable in a cluster than for a single star.

Secular parallax makes use of a larger baseline for determining parallax by using the movement of the entire solar system. The solar system, (or sun) moves around the Galactic center at about 4 AU per year, thus providing a much longer baseline for stellar parallax measurements. The complex formula for this measurement must also take into account the proper motion of the star group under study during the time under consideration, (which can be decades), the differential Galactic rotation, and is computed by taking the average parallax of those stars. Statistical parallax is a version of secular parallax in which the velocities of the group of stars is assumed to be isotropically distributed so that the distance of the sample under study can be derived from the perpendicular component of the proper motion by a complex formula. This method also assumes that the group of stars is at the same distance from the solar system and also needs to account for the differential Galactic rotation. These methods can give us the average parallax of a group of stars, usually with similar properties out to about 500 pc. Accurate parallax measurements are available for only relatively nearby stars and this limitation is severe for galactic and extragalactic scale metrology.

The next rungs in the distance ladder are the standard candles. Standard candles are defined as an object that given its apparent luminosity one can determine its distance due to the fact that its true luminosity, (absolute magnitude) is always the same, thus a "standard candle". This known luminosity should be due to a specific quality possessed by the object or the class of objects. It is assumed that the distant objects and the closer objects that are both defined as standard candles share identical characteristics. Distance methods such as standard candles are relative distance indicators. They use a distance independent property of an object such as the stars period, combined with a property that does vary with distance such as the luminosity. They do not have to be completely understood on a physical basis to be effective and because of this fact their absolute calibration must be done independently as in using parallax. This assumption that all the standard candles are identical in their characteristics is often subject to debate and is cause for concern. Their advantages are that they rely on established properties of the objects utilized with a minimum of assumptions and they are relatively common objects, so as to increase their usability and range. The main problem is usually determining the true luminosity or absolute magnitude in the first place. Cepheids are the most common type of stellar standard candle.

The basic principle for determining distance is to determine the apparent brightness of 2 standard candles of different distances. We determine the distance of the closer one via a reliable method, (parallax) and then determine its luminosity, (L) via the equation;

$$L = 4\pi d^2 b, \tag{8}$$

where d is the distance and b is the apparent luminosity. If the further standard candle has the same intrinsic luminosity as the closer, then one can calculate the distance to the further by using the formula; $d^2 = L/(4\pi b)$. (9)

Continued on page 15

Deep Sky Object of the Month

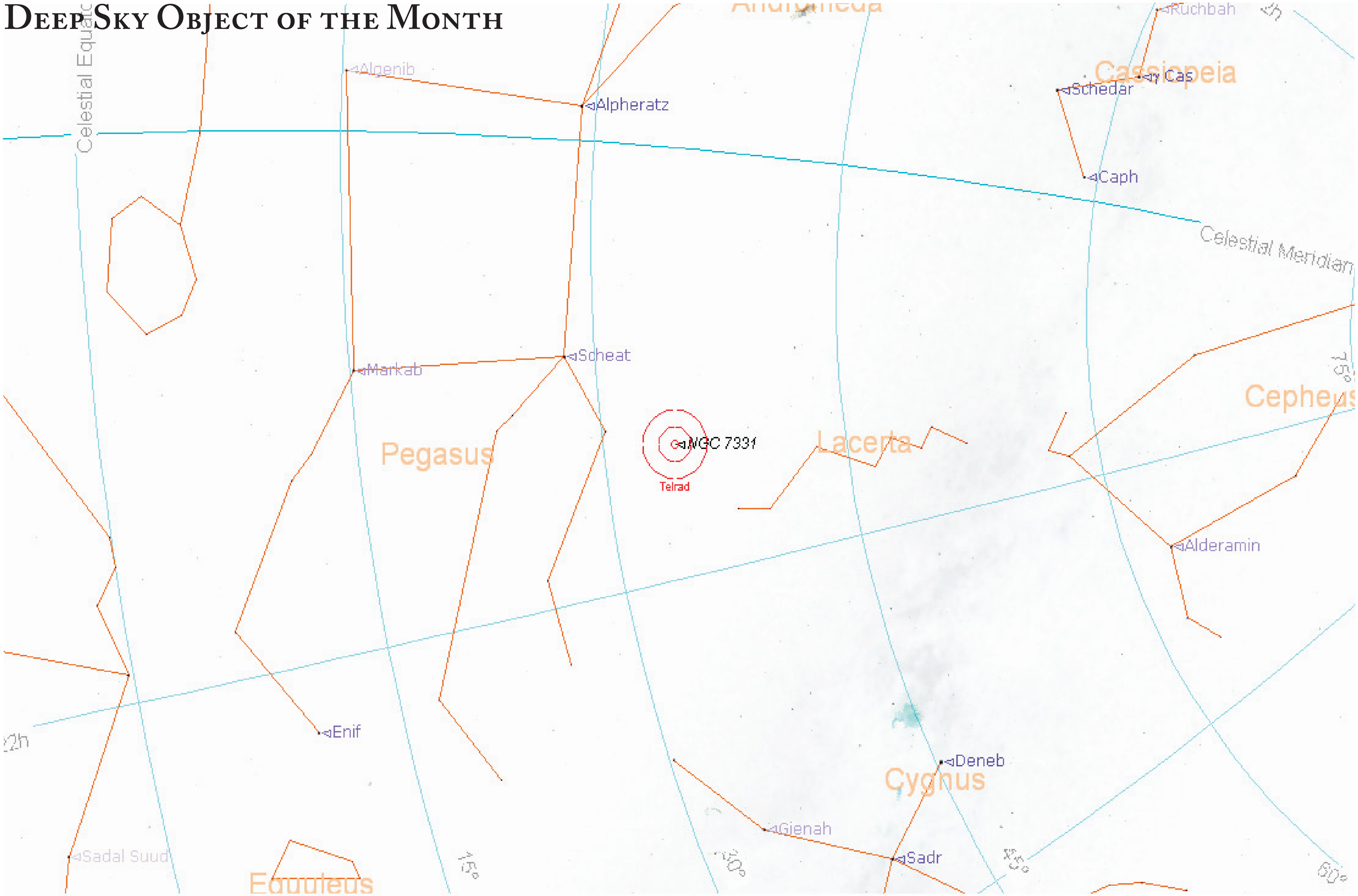


Chart generated with Starry Night Pro

NGC 7331 (UGC 12113) Spiral Galaxy in Pegasus

RA 22h 37m 04.5s DEC +34° 37' 00" Size: 14.5' x 3.7' Magnitude: 9.4

Astronomical Magnitude, Distance and Standard Candles

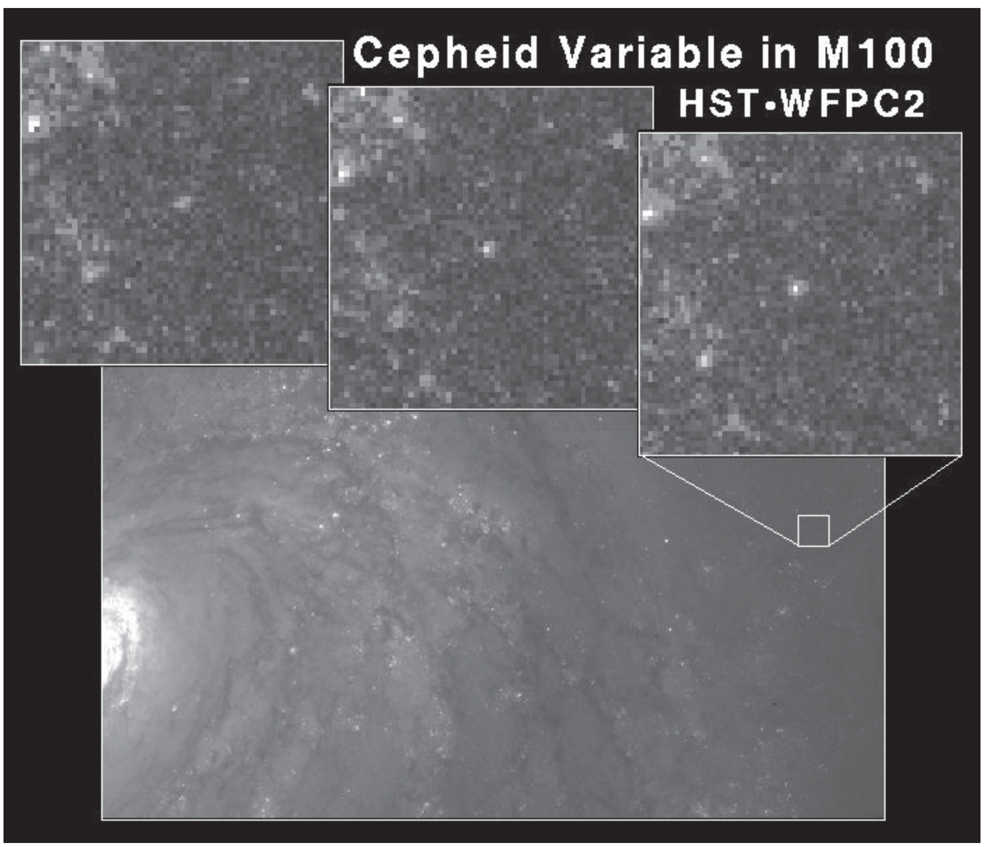
Continued from page 13 To determine the true or absolute magnitude of a standard candle star we plot the apparent magnitude on the vertical axis, against the period of luminosity change, (usually in days) on the horizontal axis. Where this curve intersects the vertical axis is called the zero point and is the absolute magnitude of the standard candle, which is used to determine the distance. This graph or relationship is called the Period-Luminosity relationship or P-L relationship. A general equation of a P-L relationship can be written as:

$$m_c = (\text{slope}) \times \log(P) + \text{Zero Point} \qquad (10)$$

Where P is the period in days, m is the apparent magnitude, and c is the wavelength band used, thus indicating the significance of the zero point in determining the accurate calibration of the P-L relationship. Determining the zero point of the P-L relationship is the most difficult task and the largest source of error in these types of measurements.

When making observations of standard candles one must also be aware of possible bias errors such as the Malmquist bias. This occurs when astronomers use a magnitude limited sample of objects for study and see only those objects that are brighter than a specific, minimum, luminosity, (apparent magnitude). It is a form of volume-density bias. Therefore at larger distances only the brighter objects will be included in the sample and be over represented, which could possibly offset the statistics if this is not taken into account. The farther away the object is, the larger the distance error. There are advanced statistical methods for analyzing and treating this type of statistical bias. Another type of bias is selection bias, whereby apparent magnitudes fainter than a magnitude limit are absent from the data so that any calibration curve is not the same as a true curve. This can be minimized by observing and working in an inverse direction and there are statistical methods for minimizing this bias as well. Most modern distance studies utilize a combination of more than one distance indicator including whenever possible a standard candle.

Thus we see that the seemingly simple question of how far away an astronomical object is can be exceedingly difficult to answer accurately and reliably.



This NASA Hubble Space Telescope image of a region of the galaxy M100 shows a class of pulsating star called a Cepheid Variable. Though rare, these stars are reliable distance indicators to galaxies. Based on the Hubble observation, the distance to M100 has been measured accurately as 56 million light-years (+/- 6 million light-years), making it the farthest object where intergalactic distances have been determined precisely. Hubble's high resolution pinpoints a Cepheid, which is located in a starbirth region in one of the galaxy's spiral arms (bottom frame). The top three frames were taken on (from left to right) May 9, May 4, May 31, and they reveal that the star (in center of each box) changes brightness. Cepheids go through these changes rhythmically over a few weeks. The interval it takes for the Cepheid to complete one pulsation is a direct indication of the stars's intrinsic brightness. This value can be used to make a precise measurement of the galaxy's distance.

Image credit: Dr. Wendy L. Freedman, Observatories of the Carnegie Institution of Washington, and NASA

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Keep Looking Up!

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