May 2008

The Observer

East Valley Astronomy Club

Volume 22 Issue 5

Inside this Issue:

Remarkable Elliptical Galaxy	*3*
May Guest Speaker	*5*
Classified Ads	*6*
Meeting Maps	*7*
Calendar	*8*
Membership Form	*9*
NASA's Space Place	*11*
If It's Clear…	*12*
The Moon and the Magnetotail	*13*
Deep Sky Object of the Month	*14*
2008 Great Moonbuggy Race	*15*

From the Desk of the President
by Claude Haynes

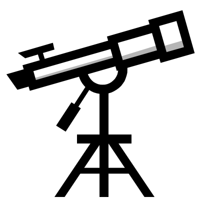
Astronomy is often thought of as a solitary hobby. After all, there is only one person looking through the eyepiece, but for the past three years I have had the good fortune to share the Messier Marathon with my son-in-law Micah. It is much more fun to have someone join in the hunt, and a lot easier to work through the Virgo galaxies with someone reading the chart and saying "now go down a little and to the right, and you'll find two more". We swap roles and he moves the scope as I call out positions. We each have a chance to view the objects, and compare thoughts on what we see.

After the marathon this year, there were some emails about other sharing. An East Valley member who loaned an air pump to a Saguaro Astronomy member with a flat tire, and an EVAC member whose car was stuck in the sand and a SAC member who pulled him out with his truck. While we gaze at stars through our telescopes, the stars shine brightest when we gather as the astronomical community. Congratulations to AJ Crayon and the Saguaro Astronomy Club for another great marathon.

Special thanks also to the large group that participated in the highway cleanup. It was a beautiful day, and we had great time at breakfast afterward.

Also thanks to Howard Israel for covering for me at the last meeting. My voice is back and I'll see you on the 16th for the talk by Dr. Clyde Hostetter.

Keep looking up
Claude Haynes



Upcoming Events:

Deep Sky Star Party - May 3
Public Star Party - May 9
East Valley Academy Star Party - May 13
General Meeting - May 16
RTMC Astronomy Expo - May 23–26
Local Star Party - May 24

The Backyard Astronomer
The Lion Roars Tonight *by Bill Dellinges*

When Leo the Lion is spied rising in the east, it can mean only one thing – spring has arrived. This season offers us a porthole through the Galaxy in which we can see other distant galaxies. During this time, our view at night is through the Galaxy's relatively thin plane (roughly only 2,000 light years thick) towards the Galactic North Pole versus the summer and winter views that force us to look through that plane, the so-called Zone of Avoidance. There we peer through thousands more light years of gas, dust and stars. The fall night sky offers another window towards the South Galactic Pole. It is for this reason the spring and fall night skies suffer a paucity of bright stars – however, there is no finer time for the observer of galaxies to explore "island universes."

Leo is one of the twelve zodiacal (Zodiac, Greek: "Circle of Animals") constellations and one of the few to look something like what it's suppose to be, albeit in stick figure form.

The constellation is one of the oldest, created around 3000 BC when it occupied the superior position of the summer solstice, an appropriate place for the king of beasts. Since then, 5,000 years of precession have moved the summer solstice two constellations west to Gemini.

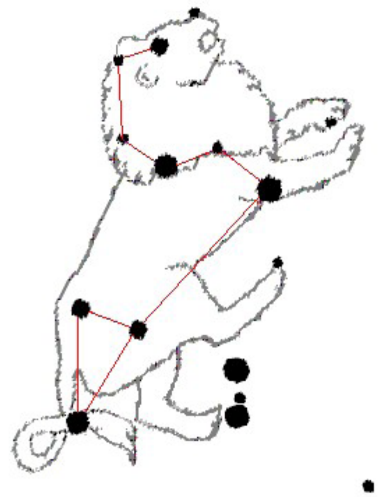
In Greek mythology, Leo was the Nemean lion killed by Hercules as the first of his twelve Labors. Hercules is often depicted wearing or holding the unfortunate cat's pelt.

Regulus (Latin: "Little King") is its brightest

Continued on page 2

The Backyard Astronomer

Continued from page 1 star marking the lion's heart. Regulus, magnitude +1.4, is a B7 V star 78 light years away. This blue-white giant is 4 times the Sun's diameter, 3 times its mass and 350 more luminous – a real power house. Comparing absolute magnitudes by putting both stars at a distance of 32.6 light years (10 parsecs), Regulus' magnitude would be -0.7; the Sun, +4.8. The star is a binary, with a 7.7 magnitude companion 177" away at position angle 307° (northwest).



Regulus and the five stars above it form the front of the lion. It's also an asterism referred to as the Sickle, or Backward Question Mark. The unique curve of stars at the Sickle's top form the lion's mane and head.

Just off the last star, Epsilon Leonis, and below Lambda Leonis lies NGC 2903, an often overlooked bright galaxy. How Messier missed it is a mystery. William Herschel found it in 1784. Two other galaxy groups lie below the lion's belly and hip. Just below 52 Leonis are M95, 96, and 105. I have always found these objects somewhat forgettable.

However, south of Theta Leonis (Chertan) are M65 and 66, two galaxies I do find interesting. A wide field eyepiece can sweep up NGC 3628 in the same field 30' to the north. Though fainter than M65/66, its edge-on disrupted appearance will no doubt make you wish you had more aperture to examine this bizarre object (A nice photo of it can be found on page 289 of O'Meara's Hidden Treasures. For a wide view of all three, see page 112 in Houston's Deep Sky Wonders).

Leo contains many double stars. Gamma Leonis or Algieba (Arabic: "the forehead") is one of the finest doubles in the sky. It's the third star up in the Sickle. The AB components are magnitude 2.4 and 3.5, with a separation of 4.6". They are a tad tight but my 85mm refractor split them at 100x. The AB pair are actually separated by 125 Astronomical Units (1 AU = Earth-Sun distance). The stars take 600 years to revolve around one another. A triple star may be found on the other end of the lion within the triangle of three stars forming its hind quarters. 90 Leonis is located 1/3 of way from Denebola (Arabic: "the lion's tail") to Delta Leonis or Zosma (Greek: "girdle" or "loin cloth"). I love the sound of the word Zosma: "I come from the planet ZOSMA! The triple's stats are: AB Mag 6.2, 7.3, Sep 3.5". AC Mag 6.2, 9.8, Sep 63.1". My 5" refractor split them at 130x.

Now that we have dissected the lion, let us stand back and take a look at the big picture. As stated earlier, there is a dearth of stars in the spring sky because we're looking out through the top of the Galaxy. About the only thing that jumps out at us is the Big Dipper to the north – at its highest position this time of year – and Leo. At first glance, it appears there's nothing to the east, south, or west of the great lion. So is that it for spring stars? Nope. Look at the huge void northeast of the lion's tail. There is a nebulous patch of light in its center. This is the Coma Star Cluster or Melotte 111, about 50 stars 288 light years away. It is the third closest cluster to us after the Big Dipper (80 light years) and Hyades (120 light years in Taurus). If you can see this group of stars with the naked eye, you have a fairly dark sky. Just on the east side of Mel 111 there is a wonderful edge-on galaxy with a prominent dark lane, NGC 4565.

On the west side of Leo, also in a void, resides another fuzzy patch of light. This is M44, the Beehive Cluster, about 50 stars 577 light years away, the fifth closest cluster to us after the Pleiades (400 light years). Again, seeing it naked eye takes a fairly dark sky. I use these two "smudges" to judge how dark the skies are. It is said the Greeks used M44 as a weather beacon – if obscured by high clouds, rain was sure to follow. Mel 111 and M44 are found within the confines of Coma Berenices and Cancer, respectively, two impressive binocular objects in otherwise dim constellations.

In the south we find one lonely bright star. This is 2nd magnitude Alphard (Arabic: "the solitary one") in Hydra, the Water Snake, the sky's largest constellation – and one of the faintest! My favorite object in the constellation is NGC 3242, a planetary nebula nicknamed "Ghost of Jupiter." This 9th magnitude planetary is conveniently located just south of Mu Hydrae. One look and you'll see how it got its name. It's quite large and bright.

Running generally southeast, Hydra wanders over 100 degrees from Cancer to Libra. A challenging and fun thing to do is to try following its zigzag path through the heavens with the aid of a star chart – can you do it?

Spring has sprung. Take advantage of peering out through the galaxy into deep space. The next chance you'll get is this fall when we look out the south side of our home galaxy, the Milky Way.

This is a drawing of the constellation Leo by John Hevelius of 1690.

M87: A Remarkable Elliptical Galaxy
by Henry DeJonge IV

Messier 87, (aka NGC 4486 and Virgo A) is one of three domineering giant elliptical galaxies in the heart of the Virgo cluster of galaxies. M87 was discovered by Charles Messier on March 18, 1781 while he was cataloguing nebulous objects in the general region. It is classified as an E0 galaxy and is quite interesting because of its huge size, radio emissions, SMBH size and evidence, relatively close location, its extremely large globular cluster system, and primarily because it has a jet that is visible in both radio, (source 3C 274) and optical frequencies, which is a rare sight from Earth.

The other two giants M86 and M84 nearby are also unique unto themselves, each with a diameter of about 900 Kpc. Contrast this to the size of our Milky Way Galaxy at about 100,000 light years, (or about 30 Kpc) and the distance to the Andromeda Galaxy, (M31) of about 2.4 million light years, (or about 740 Kpc) and the truly immense nature of these objects becomes apparent. The rough diameter of the Virgo cluster is 3 Mpc or about 10 million light years. The Virgo cluster contains over 2000 galaxies and is about 15-16 Mpc distant, (or about 50-60 million light years away).

M87 is a bit larger than our own galaxy with a diameter of about 120,000 light years; however it contains a much greater number of stars, (not including the SMBH in the center) than the Milky Way. Estimates are about 2.5-3.0 trillion solar masses, which is at least 10 times the number of solar masses in the Milky Way. It is therefore extremely bright and has an absolute magnitude of -22. If one takes into account the faint outlying stars and luminous matter, the diameter of this galaxy is thought to be greater than 500,000 light years. The outer boundaries also appear to be highly irregular in shape, most likely due to past gravitational interactions from passing and absorbed galaxies.

Figure 1: a visible light image of M87

Radio

M87 was identified with the strong radio source Virgo A by W. Baade and R. Minkowski in 1954, while in 1956 a weaker radio halo was seen by astronomers at Cambridge. It is classified as an FR I radio galaxy. Radio galaxies like M87 are classified into either F I or F II sources depending upon whether or not the radio hot spots are lying close to or within the system or instead lie outside of the system.

SMBH

It has long been known, (since the late 70's) that the stars near the center of M87 have a greater overall velocity than the stars further away from the center and this has long suggested that a SMBH resides near the center.

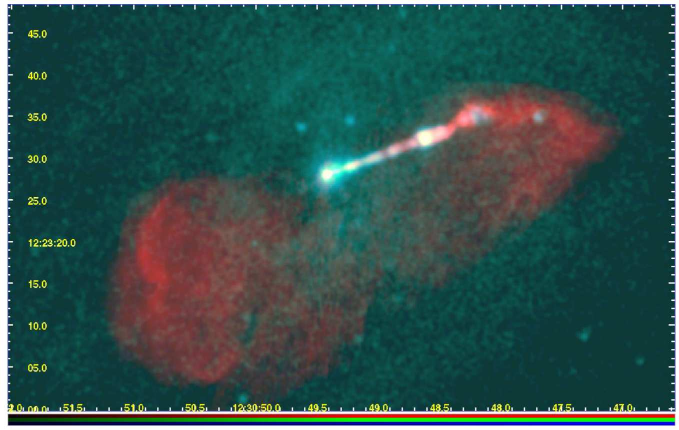


Figure 2: A composite image of the inner radio lobes and jet of M87.

Using the high resolution images by Hubble it was found that the central nucleus contained about 2-3 billion solar masses within a diameter of about 60 light years, and what appeared to be a rapidly rotating accretion disk. The most recent data from Hubble suggests, (2008) that the central SMBH, (with assumed existence) is about 3.2 billion solar masses. Its Schwarzschild radius is estimated to be about 60AU.

Globular Clusters

M87 is thought to contain about 16,000 globular clusters of which about 6,000 have been identified. They comprise about 2% of the total luminosity of the galaxy and are in general more metal rich than the globular clusters that surround the Milky Way. In comparison, the Milky Way has less than 200 known globular clusters.

The TeV Jet

M87 has the first know emitted plasma jet and has been observed over many wavelengths from radio to gamma ray, from both the ground and space. The basic structure of the jet is similar in all wavelengths and may also involve protons as well as electrons spiraling about the magnetic field lines to produce the large amounts of energy in the TeV range. The visible jet was discovered by H.D. Curtis at Lick observatory in 1918. In 1966 Halton Arp discovered a second, much fainter, jet moving in the opposite direction. The long string of knots and tangles was also discovered in 1977 by Halton Arp at Mt. Palomar and J. Lorre at JPL.

Figure 3: A Hubble visible light image of M87 and the primary jet

This classical prototype jet of M87 extends at least 5000 light years, travels at relativistic speeds, and

Continued on page 4

M87: A Remarkable Elliptical Galaxy

Continued from page 3 consists of material from the central regions of the galaxy. The light is polarized as is usual for synchrotron radiation. This is radiation that is generated by charged particles, (usually electrons) that are moving in a magnetic field at very high velocity, normally at a large fraction of the speed of light. They follow helical paths along the magnetic lines of force and this induces polarization.

The jet shows a continuous spectrum, has visible, (and radio) clumps and knots and apparent superluminal motion, (from 4 to 6 times the speed of light). This is an effect that caused the material to seem to be traveling faster than the speed of light, which is limited by special relativity. It occurs when material is traveling close to the speed of light near our line of sight. A very interesting movie of this jet done in radio wavelengths can be seen at http://www.aoc.nrao.edu/~cwalker/M87/

M87 is the first extragalactic source detected in the TeV range that is not a blazer, which is a class of the most active AGN, (active galactic nuclei) of which quasars belong. This is because we see the jet of M87 somewhat on the side, (according to the unified model of AGN) and not pointing directly at us. This TeV energy output was discovered in 2003 by the HEGRA array of telescopes, (via the detection of Cerenkov radiation) and confirmed in 2006 by H.E.S.S., (High Energy Stereoscopic System). H.E.S.S. is a collection of 4 imaging telescopes in Namibia used to detect gamma rays from 100 GeV to 10's of TeV also via Cerenkov radiation, when a particle or photon enters the atmosphere. The resolution is sufficient to confine the emitting region of this energy from M87 to the central core area, but not sufficient to confine it to this region exclusively.

Although this TeV energy level is a matter of record we still do not understand exactly where this energy is emitted from. The resolution we can detect is still too limited. The relatively rapid variations in this energy output do help us to constrain the general locations and ensure that it is somewhat limited in size. It could be the galactic nucleus, certain knots, the base of the jet, (near the SMBH) or a combination of sources. These rapid variations in TeV energy output do imply that the SMBH in the galactic center does rotate fairly quickly though.

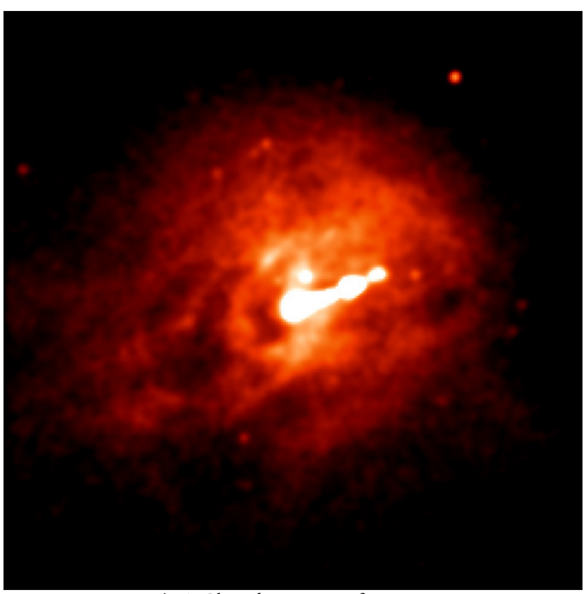


Figure 4: A Chandra image of M87 in X-rays

In terms of how such jets are formed, recent MHD models using the prevailing model of magnetic self collimation in a single zone support much of the data and the TeV emission as well as the collimation of the beam. However there are other models that have different foundations such as multiple zones that are also being investigated to describe this high energy TeV jet behavior. It is safe to say that we still do not have a complete understanding of the mechanisms of jet production and behavior.

It is thought that the size of the base of the jet directly corresponds to the size of the SMBH. Further measurements and analysis of this region should provide us with valuable information on the SMBH. M87 is ideal for this type of scrutiny due to its relatively close proximity to us, its huge mass and very conspicuous nature. It is currently the best galaxy with a jet that we can study at sub parsec scales with any detail. Currently a long term study with the VLBA is being undertaken of the jet in M87, (at 43 GHz) to obtain more data.

In a related vein of thought, M87 is also considered to be a plausible source of ultra high energy cosmic rays, (with energies greater than 1020 electron volts) which are currently thought to have origins in such AGN.

In summary we can see that M87 is one of the best, (if not the best) galaxies to examine for a better understanding of elliptical galaxies, galactic evolution, AGN, SMBH's, accretion disk physics, and beautiful jets. It is hoped that in the future more accurate measurements of this TeV radiation, such as pulse timing, etc. will reveal more information on the SMBH and especially its spin and accretion rates. M87 is truly a beautiful enigma.

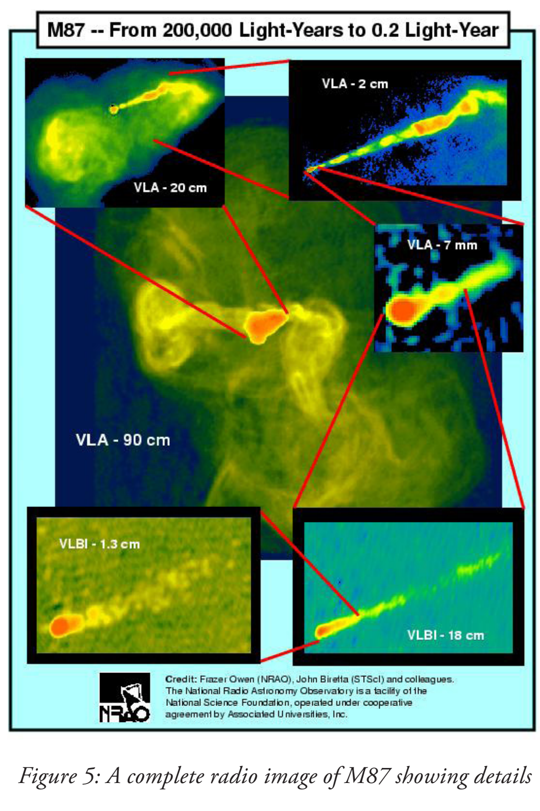
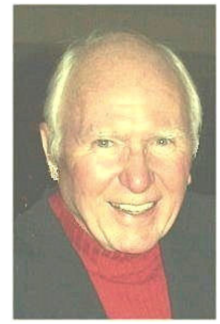


Figure 5: A complete radio image of M87 showing details

May Guest Speaker: Clyde Hostetter



Professor Clyde Hostetter was born in the pre-Depression days - back when there were perfect celestial viewing conditions - on a Potawatomi Indian reservation where there was no electricity and no flaring electric lights for ten miles around.

Viewing conditions were nearly as good in the desert of Saudi Arabia in 1976-77 when he worked there for the U.S.-Saudi Joint Economic Commission. The Milky Way was easily visible almost every night.

Between those celestial bonanzas Hostetter worked as associate editor for a Washington D.C. news magazine, then as communications advisory for the Howard Hughes enterprises while Hughes was still around, and finally as a journalism professor at California Polytechnic State University before retiring and moving to Mesa in 1997.

Hostetter's most serious exposure to astronomy was as a Navy officer in WWII in the Pacific, where he learned to use a sextant for celestial navigation

Hostetter became interested in ancient astronomy when, by accident, while working in Riyadh he came across a small copper bowl with ancient documentation of more advanced astronomical knowledge than was previously assumed.

In recent years proofs have been found that ancient astronomers knew more about eclipses and such detailed items as the retrograde motions of Venus than previously had been thought, perhaps because cuneiform experts and archaeologists still hadn't understood how important astronomy was in the ancient Middle East and elsewhere in B.C.E. days. Examples are The Cynthia Bowl found in Riyadh, the Anticythera Mechanism located at the bottom of the sea off a Greek island, and the Sky Disk of Nebra found on a German hilltop.

Professor Hostetter will deliver a presentation is entitled *Echoes of Ancient Sky-Watching*.

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.

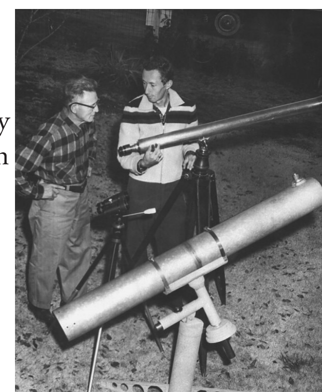
Robert Burnham compiled his three volume Celestial Handbook while working at Lowell Observatory as part of the Stellar Proper Motion Survey. This grassroots effort began on a Cloudy Nights discussion forum, and with the guidance of Burnham's sister, Viola Courtney, and her daughter Donna Cox, has grown 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

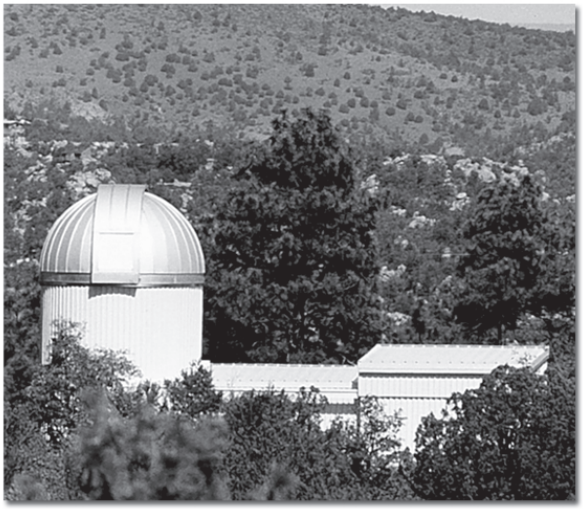
New Moon on May 5 at 05:19

First Quarter Moon on May 11 at 20:47

Full Moon on May 19 at 19:12

Last Quarter Moon on May 27 at 19:57

PRESCOTT OBSERVATORY FOR SALE



Beautiful adjoining home. Superb views, dark skies, privacy.

Located at 5800 feet on a mountain ridge. 2.7 miles south of downtown Prescott, Arizona. One-acre lot abuts the Prescott National Forest. No lights, no neighbors to the south, just trees and hiking trails.

The 3-part observatory includes a 4.5-m Ash Dome above a raised floor with a 30"-diameter cement post to support a large telescope, a warm room/storage and a 13x14 room with roll-off roof.

The two-level home, approximately 3300 sq. ft., includes passenger elevator. Upper level features master suite/full bath, living/dining, kitchen, pantry, two study/offices, 3/4 bath, laundry, wood floors, 9 ft. ceilings, skylights, large deck. Lower level features two bedrooms, bath, two-car garage, workshop, storage, utility room, small deck, hot tub. Stucco exterior with block pillars. $675,000

For details contact Cheri Carey • West USA • 231 N. Marina St. • Prescott, AZ 86301
(928) 713-3299 or (866) 777-8331 • View home at www.westusa.com

Photon Instrument Ltd.

Sales Repair Service Restoration

Astronomical Telescopes

Warren & Judy Kutok

122 E. Main Street Mesa, Az. 85201

480-835-1787 800-574-2589

TeleVue Panoptic Eyepieces For Sale

Panoptic 35mm
2" Barrel, 68° apparent field of view
24mm eye relief
Very good condition
$380 new, asking $285 (25% off)

Panoptic 27mm
2" Barrel, 68° apparent field of view
19mm eye relief
Very good condition
$345 new, asking $258 (25% off)

Contact: Jim Waters 480-554-8789 (8 am - 5 pm)
Email: james.t.waters@cox.net

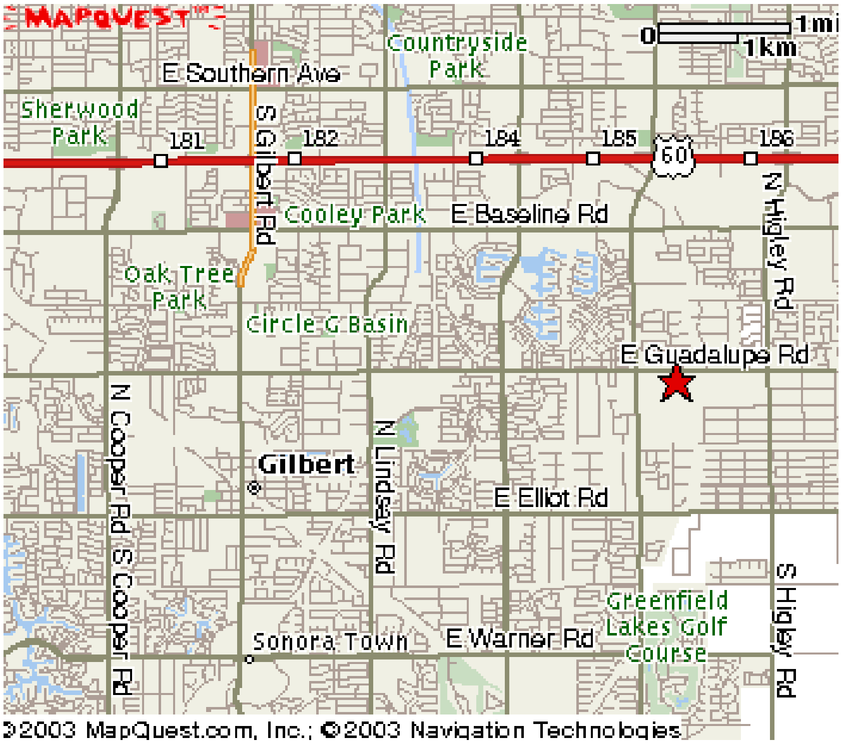
www.eastvalleyastronomy.org/grco/obs.asp

Support your local telescope dealer

STARIZONA
ADVENTURES IN ASTRONOMY & NATURE

5201 N. Oracle Road Tucson, AZ 85704 520-292-5010

www.starizona.com



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!

2008 Meeting Dates

May 16

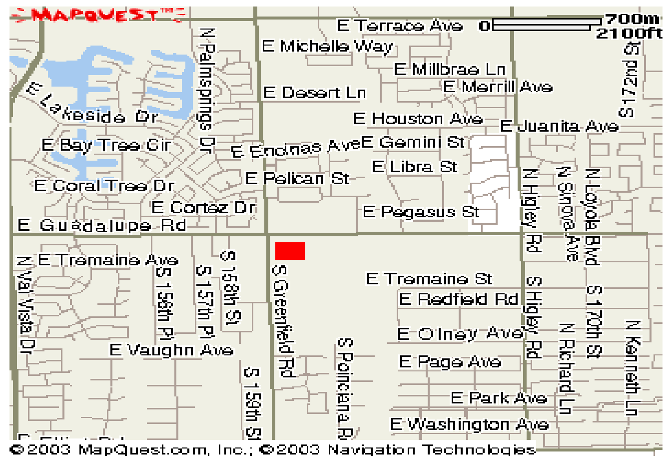
June 20

July 18

August 15

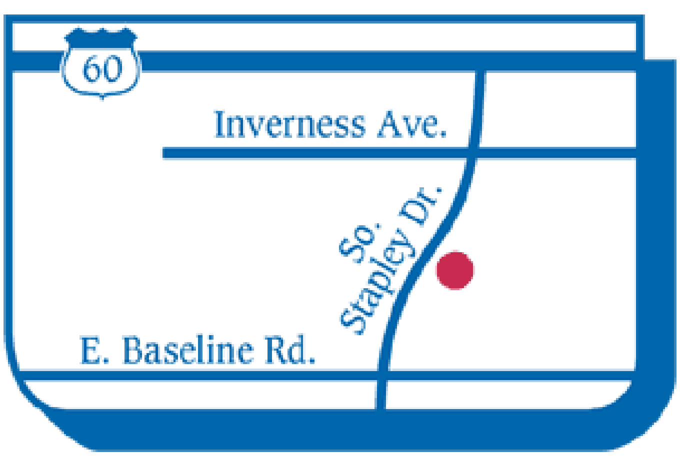
September 19

October 17



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

May 2008

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
				1	2	**3**
4	5	6	7	8	**9**	10
11	12	**13**	14	15	**16**	17
18	19	20	21	22	**23**	**24**
25	26	27	28	29	30	31

May 3 - Deep Sky Star Party at Vekol Road

May 9 - Public Star Party at Riparian Preserve in Gilbert

May 13 - East Valley Academy Star Party in Mesa

May 16 - General Meeting at Southeast Regional Library in Gilbert

May 23 - 40th Annual RTMC Astronomy Expo at YMCA Camp Oakes

May 24 - Local Star Party at Boyce Thompson Arboretum

2008 Adopt-a-Highway Spring Edition

Many thanks to the dozen who chipped in to keep *our* highway clean!

East Valley Astronomy Club -- 2008 Membership Form

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

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

Select one of the following:

☐ New Member ☐ Renewal ☐ Change of Address

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

☐ **$30.00 Individual** January through March

☐ **$35.00 Family** January through March

☐ **$15.00 Individual** July through September

☐ **$17.50 Family** July through September

☐ **$22.50 Individual** April through June

☐ **$26.25 Family** April through June

☐ **$37.50 Individual** October through December

☐ **$43.75 Family** October through December

Includes dues for the following year

Renewal (current members only):

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

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

---

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

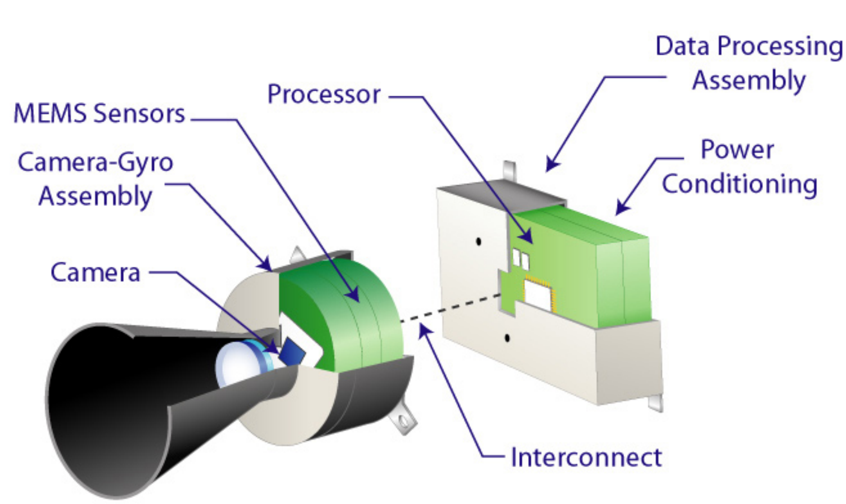
Stellar Compass for Space Explorers
by Patrick L. Barry

In space, there's no up or down, north or south, east or west. So how can robotic spacecraft know which way they're facing when they fire their thrusters, or when they try to beam scientific data back to Earth?

Without the familiar compass points of Earth's magnetic poles, spacecraft use stars and gyros to know their orientation. Thanks to a recently completed test flight, future spacecraft will be able to do so using only an ultra-low-power camera and three silicon wafers as small as your pinky fingernail.

"The wafers are actually very tiny gyros," explains Artur Chmielewski, project manager at JPL for Space Technology 6 (ST6), a part of NASA's New Millennium Program.

Traditional gyros use spinning wheels to detect changes in pitch, yaw, and roll—the three axes of rotation. For ST6's Inertial Stellar Compass, the three gyros instead consist of silicon wafers that resemble microchips. Rotating the wafers distorts microscopic structures on the surfaces of these wafers in a way that generates electric signals. The compass uses these signals—along with images of star positions taken by the camera—to measure rotation.



Compass is built as two separate assemblies, the camera-gyro assembly and the data processor assembly, connected by a wiring harness. The technology uses an active pixel sensor in a wide-field-of-view miniature star camera and micro-electromechanical system (MEMS) gyros. Together, they provide extremely accurate information for navigation and control.

Because the Inertial Stellar Compass (ISC) is based on this new, radically different technology, NASA needed to flight-test it before using it in important missions. That test flight reached completion in December 2007 after about a year in orbit aboard the Air Force's TacSat-2 satellite.

"It just performed beautifully," Chmielewski says. "The data checked out really well." The engineers had hoped that ISC would measure the spacecraft's rotation with an accuracy of 0.1 degrees. In the flight tests, ISC surpassed this goal, measuring rotation to within about 0.05 degrees.

That success paves the way for using ISC to reduce the cost of future science missions. When launching probes into space, weight equals money. "If you're paying a million dollars per kilogram to send your spacecraft to Mars, you care a lot about weight," Chmielewski says. At less than 3 kilograms, ISC weighs about one-fifth as much as traditional stellar compasses. It also uses about one-tenth as much power, so a spacecraft would be able to use smaller, lighter solar panels.

Engineers at Draper Laboratory, the Cambridge, Massachusetts, company that built the ISC, are already at work on a next-generation design that will improve the compass's accuracy ten-fold, Chmielewski says. So ISC and its successors could soon help costs—and spacecraft—stay on target.

Find out more about the ISC at nmp.nasa.gov/st6. Kids can do a fun project and get an introduction to navigating by the stars at spaceplace.nasa.gov/en/kids/st6starfinder/st6starfinder.shtml.

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

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

May 2008

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.

On Sunday, May 4, it is new moon so you can hunt for faint fuzzies all night.

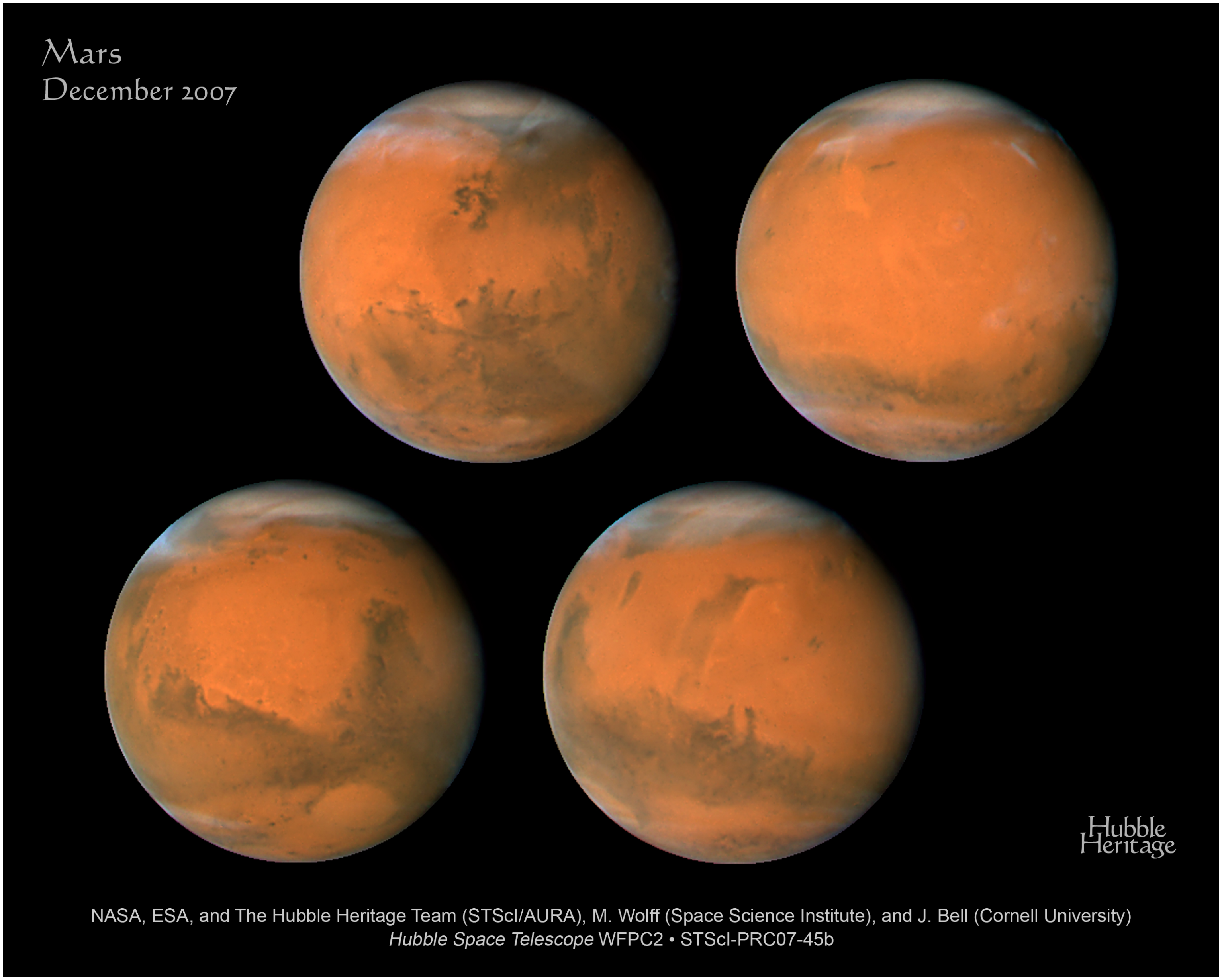
From Monday, May 5 to Monday May 19, about 8:30 PM you can see Mercury. With a small (3 inch) telescope look low in the west-northwest for the magnitude 1 planet. Watch the planet's phase change from gibbous to crescent as the 2 weeks progress.

On the night of Sunday, May 11, the moon is first quarter and sets at 1:30 AM (actually May 12), so it is a better night for lunar observations than deep sky.

On Monday, May 19, at 7:38 PM, the full moon rises (9 minutes after sunset) spoiling any chance of seeing faint fuzzies all night.

On Thursday, May 22, about 9:15 PM, you can see Mars in the Beehive cluster. With binoculars look for Mars 30 degrees above the west horizon

On the night of Tuesday, May 27, the moon is third quarter and rises at 12:39 AM (actually May 28), so you should be able to get in some deep sky work.



The Moon and the Magnetotail
by Dr. Tony Phillips

Behold the full Moon. Ancient craters and frozen lava seas lie motionless under an airless sky of profound quiet. It's a slow-motion world where even a human footprint may last millions of years. Nothing ever seems to happen there.

Right?

Wrong. NASA-supported scientists have realized that something does happen every month when the Moon gets a lashing from Earth's magnetic tail.

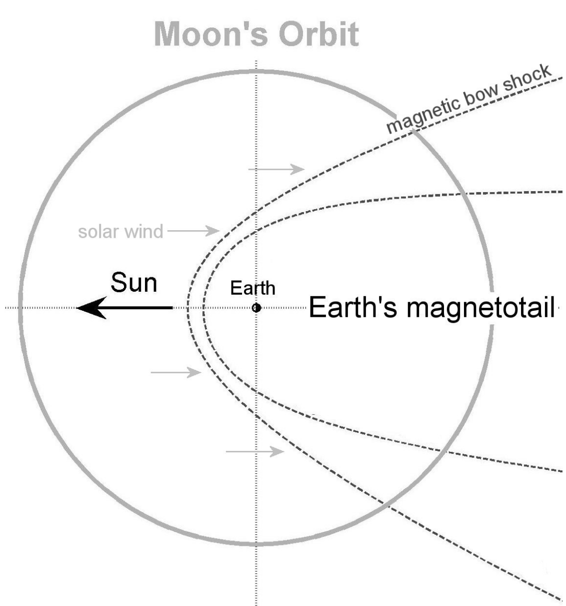
"Earth's magnetotail extends well beyond the orbit of the Moon and, once a month, the Moon orbits through it," says Tim Stubbs, a University of Maryland scientist working at the Goddard Space Flight Center. "This can have consequences ranging from lunar 'dust storms' to electrostatic discharges."

Yes, Earth does have a magnetic tail. It is an extension of the same familiar magnetic field we experience when using a Boy Scout compass. Our entire planet is enveloped in a bubble of magnetism, which springs from a molten dynamo in Earth's core. Out in space, the solar wind presses against this bubble and stretches it, creating a long "magnetotail" in the downwind direction.

Anyone can tell when the Moon is inside the magnetotail. Just look: "If the Moon is full, it is inside the magnetotail," says Stubbs. "The Moon enters the magnetotail three days before it is full and takes about six days to cross and exit on the other side."

It is during those six days that strange things can happen.

During the crossing, the Moon comes in contact with a gigantic "plasma sheet" of hot charged particles trapped in the tail. The lightest and most mobile of these particles, electrons, pepper the Moon's surface and give the Moon a negative charge.



The Moon's orbit crosses Earth's magnetotail.

On the Moon's dayside this effect is counteracted to a degree by sunlight: UV photons knock electrons back off the surface, keeping the build-up of charge at relatively low levels. But on the nightside, in the cold lunar dark, electrons accumulate and voltages can climb to hundreds or thousands of volts.

Walking across the dusty charged-up lunar terrain, astronauts may find themselves crackling with electricity like a sock pulled out of a hot dryer. Touching another astronaut, a doorknob, a piece of sensitive electronics—any of these simple actions could produce an unwelcome zap. "Proper grounding is strongly recommended," advises Stubbs.

The ground, meanwhile, may leap into the sky. There is compelling evidence that fine particles of moondust, when sufficiently charged-up, actually float above the lunar surface. This could create a temporary nighttime atmosphere of dust ready to blacken spacesuits, clog machinery, scratch faceplates (moondust is very abrasive) and generally make life difficult for astronauts.

Stranger still, moondust might gather itself into a sort of diaphanous wind. Drawn by differences in global charge accumulation, floating dust would naturally fly from the strongly-negative nightside to the weakly-negative dayside. This "dust storm" effect would be strongest at the Moon's terminator, the dividing line between day and night.

Much of this is pure speculation, Stubbs cautions. No one can say for sure what happens on the Moon when the magnetotail hits, because no one has been there at the crucial time. "Apollo astronauts never landed on a full Moon and they never experienced the magnetotail."

The best direct evidence comes from NASA's Lunar Prospector spacecraft, which orbited the Moon in 1998-99 and monitored many magnetotail crossings. During some crossings, the spacecraft sensed big changes in the lunar nightside voltage, jumping "typically from -200 V to -1000 V," says Jasper Halekas of UC Berkeley who has been studying the decade-old data.

"It is important to note," says Halekas, "that the plasma sheet (where all the electrons come from) is a very dynamic structure. The plasma sheet is in a constant state of motion, flapping up and down all the time. So as the Moon orbits through the magnetotail, the plasma sheet can sweep across it over and over again. Depending on how dynamic things are, we can encounter the plasma sheet many times during a single pass through the magnetotail with encounters lasting anywhere from minutes to hours or even days."

"As a result, you can imagine how dynamic the charging environment on the Moon is. The Moon can be just sitting there in a quiet region of the magnetotail and then suddenly all this hot plasma goes sweeping by causing the nightside potential to spike to a kilovolt. Then it drops back again just as quickly."

The roller coaster of charge would be at its most dizzying during solar and geomagnetic storms. "That is a very dynamic time for the plasma sheet and we need to study what happens then," he says.

What happens then? Next-generation astronauts are going to find out. NASA is returning to the Moon in the decades ahead and plans to establish an outpost for long-term lunar exploration. It turns out they'll be exploring the magnetotail, too.

Article courtesy of Science@NASA

Deep Sky Object of the Month

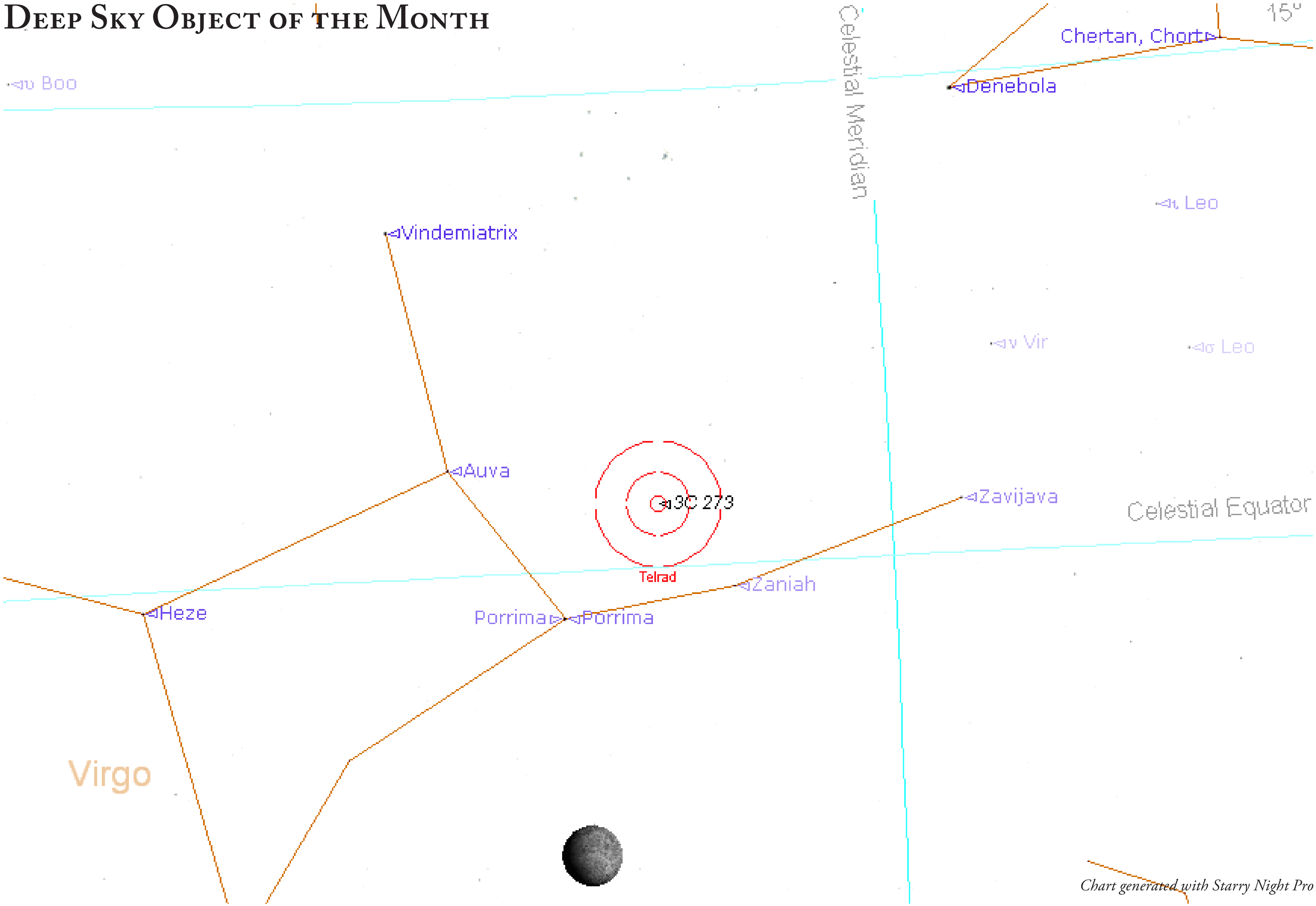


Chart generated with Starry Night Pro

3C 273 (Q1226+0023) Quasar in Virgo

RA 12h 29m 06.7s DEC +02° 03' 08" Redshift (z): 0.16 Magnitude: 12.8

The 2008 Great Moonbuggy Race
by Dana Coulter

Not one of the participants in NASA's 2008 Great Moonbuggy Race was old enough to have seen the 1969 movie, *Those Daring Young Men in Their Jaunty Jalopies*. Nevertheless, the racers all looked like stars of that film as they careened about the simulated lunar terrain race course in a motley variety of strange vehicles.

These high school and college students, representing 20 states, Puerto Rico, Canada, Germany and India, were having a blast in their home-made moonbuggies. They were spinning out in "moondust" and rumbling over "craters" at the US Space and Rocket Center in Huntsville, Alabama, on April 4th and 5th, competing to traverse the 0.7-mile course faster than any other team.

These students from Canada's Carleton University in Ottawa, Ontario, scored a third-place win in the college division of NASA's 15th annual Great Moonbuggy Race.

The two-person crews had to first assemble their odd conveyances as part of the race before setting off from the starting line and competing against the clock on a solo run. Course challenges included obstacles like craters, rocks, hardened lava ridges, inclines, lunar soil and -- one thing never found on the moon -- a gullywasher of a rainstorm. Amazingly, most of the vehicles held up well enough to finish their runs, and a few of the crews actually did so with no penalties at all, whizzing across sandpits and the like as adeptly as the drivers in that 1969 movie they never saw.

While awaiting their turns on the track, crews worked on their buggies out in the parking lot. A Fairhope, Alabama, team was elevating the use of duct tape to high art, securing all the required parts (simulated radios, simulated cameras, simulated batteries, etc.) in place. "Our buggy isn't as fancy as some of the others, but we're proud of it," said one of the Fairhope crewmembers. Indeed, his buggy went on to make a respectable run, all in one piece. (Is it any wonder?)

Dr. Paul Shiue, faculty advisor for the Memphis, Tennessee, Christian Brothers University crew, was on hand to support his team. He laughingly called duct tape their "best engineering tool."

Several teams based their buggies on junk yard parts, resulting in (predictably) tough vehicles: "One of the high school teams badly bent both rims on one side of their buggy in a leap over obstacle #3, then blew out the intertube with a bang on one of those wheels a few obstacles later," describes onlooker and NASA physicist Dennis Gallagher. Despite all that, "they managed to finish the race."

"Meanwhile, a team from India made do without critical parts that never arrived in a lost luggage bag," he continues. "They also forgot their safety helmets, goggles, and gloves, but another team gave them theirs. One of the event highlights is how teams are willing to share their knowledge, tools and parts."

Cooperation, seat-of-the-pants ingenuity and serious engineering know-how were on full display--just as they were 30+ years ago when NASA engineers created the original Lunar Roving Vehicle for the Apollo program.

The moonbuggy of that era had to travel in breathtaking vacuum across a dusty, bumpy landscape, in temperatures exceeding 200 degrees Fahrenheit with very little gravity (1/6 g) to hold it down. Weighing only about 450 pounds on Earth, or just 75 pounds on the Moon, the moonbuggy could carry up to 1000 Earth-pounds -- more than twice its own weight. As if that wasn't enough, it also had to fit in the tight confines of the lunar lander. Designers made it fold up (a bit like a Transformer toy) for the voyage to the moon and easily unfold for adventure when the lander descended to the lunar surface. All in all, the original moonbuggy was a nice little ride!

Here on Earth, in the 2008 Great Moonbuggy Race, all the "daring young" men and women, winners and losers alike, seemed to have fun, and their vehicles were remarkably well constructed. Erie High School Team II from Erie, Kansas, won the high school race, charging through the course in a mere 3 minutes and 17 seconds. The college winner was Evansville University from Evansville, Indiana, with an impressive time of 4 minutes and 25 seconds.

And they didn't even use much duct tape.

A pair of drivers from Puerto Rico High School in Fajardo, PR, endure a fearsome, buggy-flipping crash. The two racers recovered quickly enough to post the fastest race time among competition newcomers, earning them the 2008 "Rookie Award."

The Observer is the official publication of the East Valley Astronomy Club. It is published monthly and made available electronically as an Adobe PDF document the first week of the month. Printed copies are available at the monthly meeting. Mailed copies are available to members for a slight surcharge to offset printing and mailing expenses.

Please send your contributions, tips, suggestions and comments to the Editor at: news@eastvalleyastronomy.org
Contributions may be edited. The views and opinions expressed in this newsletter do not necessarily represent those of the publisher or editor.

The East Valley Astronomy Club is a 501(c)(3) nonprofit charitable organization.

www.eastvalleyastronomy.org

Keep Looking Up!

East Valley Astronomy Club
PO Box 2202
Mesa, Az. 85214-2202