June 2008

The Observer

East Valley Astronomy Club

Volume 22 Issue 6

Inside this Issue:

From the Desk of the President
by Claude Haynes

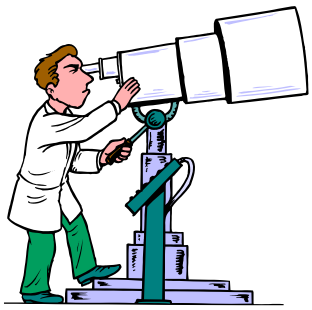
As I write this I am listening to the sound of raindrops pelting my roof. It is a pleasant sound, but I would prefer to be out looking for the International Space Stations passing overhead tonight. I guess the unusual weather is a reminder to get my observing in before the monsoons.

We have a number of opportunities before the storms start. Hopefully there was good weather at the RTMC event, and I would encourage you to check out the Grand Canyon Star Party (www.tucsonastronomy.org). The canyon is beautiful and the gathering of so many observers is lots of fun.

We also have several local and deep sky parties scheduled, so check the EVAC website for details.

I enjoyed the lecture at last month's meeting by Dr. Hostetter. I'm haven't decided whether the markings on his bowl are not just a series of interesting coincidences, but it was a beautiful and well crafted object. It certainly reminded me that the ancient sky watchers were meticulous in their record keeping and brilliant in their conclusions on the cycles of the universe. We owe them a great deal of gratitude for laying the foundations on solid observation. Our next meeting features A J Crayon and a talk on galaxies. I look forward to seeing you there.

Wishing you clear skies before the rains
Claude Haynes



The Backyard Astronomer
From Cats to Quasars *by Bill Dellinges*

Once again it's time to produce another monthly article. My deadline approaches. I've got nothing. This can mean only one thing. I need to scrape the bottom of the barrel drawing upon trivia, bits and pieces, clearing my junk box, or doing whatever it takes to get this thing to the presses on time.

First let me take a hit of oxygen. Thanks, I needed that. OK, here we go.

I read somewhere recently that if the quasar 3C273, three billion light years away in Virgo, was at a distance of 10 parsecs (32.26 light years – the distance we put all stars to measure their absolute magnitude) it would be as bright as the Sun. Geez, magnitude -27?! Holy cow, what a monster, eh? Anytime Virgo was out at night, there would be no night.

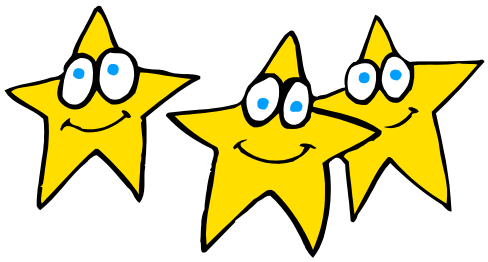
Have you ever noticed that cigarette smoke always drifts towards the non-smoker?

I have had cats for many years. I love cats. They do however, on occasion, drive me nuts. Especially the two I have now. They are high maintenance prima donnas. Someone once said, "Cats are God's joke on mankind." I agree.

While cats all share typical cat-like behavior, I've come to realize that every cat I've owned has had its own distinct personality - just like children, I suppose (I wouldn't know, I'm not a breeder). And this I'm sure of - you cannot experience anxiety while petting a cat.

At public star parties I'm often asked why a person's astrological sign isn't out that night. After all, this is their month's birthday.

Continued on page 2



Upcoming Events:

Deep Sky Star Party – June 7

Public Star Party – June 13

General Meeting – June 20

Grand Canyon Star Party – June 21-28

Local Star Party – June 28

The Backyard Astronomer

Continued from page 1 OK, here's the deal folks. Your "sign" is the constellation the Sun was in when you were born. Suppose you were born on February 13th. The traditional sign for you would be Aquarius, January 20th to February 19th. During February nights you'll see the winter constellations with Aquarius nowhere to be seen (Aquarius is normally visible at night in the fall). Aquarius is out during February, but at daytime! Remember…it's where the Sun was when you were born. Since it was in Aquarius then, you could not see it because the Sun was in the way! However, you could see your constellation (sign) at day on your birthday IF a solar eclipse occurred at your location. Otherwise, you need to wait about six months for it to appear in the fall night sky. "Astrology – the foolish daughter of a wise mother." Kepler.

There's no doubt in my mind that television rots the brain.

Have you ever noticed there are 206,265.6 Astronomical Units (1 AU = Sun-Earth distance) in a parsec (3.26 light years) and 206,265.6 arc seconds in a radian (57.296 degrees)? Hmmm, that must be more than a coincidence. I'll leave it to the brainiacs to figure that one out.

We often share with the public that Subaru means "Pleiades" in Japanese. If the Seven Sisters star cluster is represented on their car logo, why does it only show six stars? Clue: Google it, and click on Wikipedia link.

The speed of light is 186,322 miles per second. You could go around Earth seven times in a second at that speed. Now that you've digested that little morsel, let's compare that to our rockets doing 7 miles per second (25,200 miles per hour) – Earth's escape velocity. And about as fast as we can go these days without gravity assist from a planet. Turns out our escape velocity is 0.004% the speed of light. So we have a little ways to go in rocket technology before we join the big leagues.

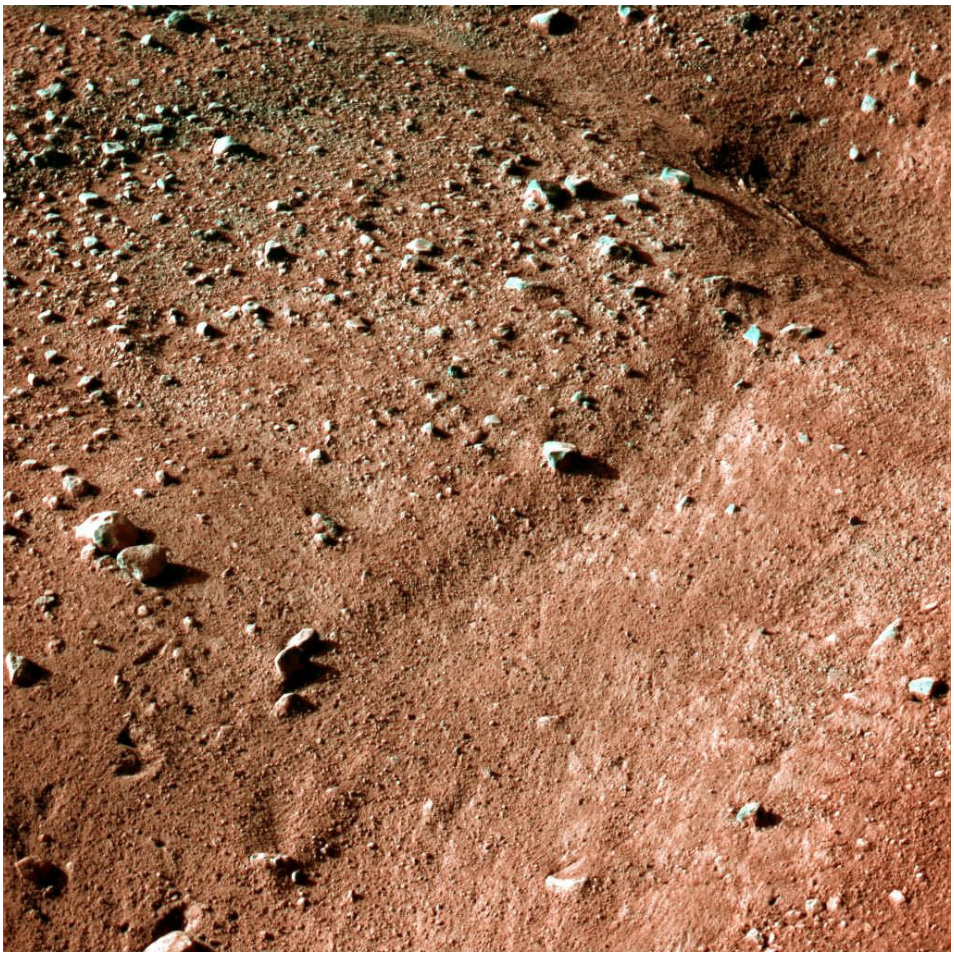
A light year is the distance a beam of light travels in one year, just under six trillion miles. How does the size of our solar system compare to that? Its diameter is about 0.12% of a light year.

Don't you hate it when a waiter brings your drink and places it down with his grubby fingers wrapped all around the top of the glass? Hey buddy, may I have a straw please?

Think Earth is important in our solar system? The sun represents 99.8% the mass of the solar system. How does that make you feel?

There are three North Poles us Earthlings need to address. There is the familiar celestial North Pole ¾ degrees from Polaris for just our planet. Then there is the solar system's North Pole found in the constellation of Draco (not far from NGC 6543) representing the direction 90 degrees upwards from the ecliptic or plane of the solar system – defined as Earth's orbit. Finally, we have the Milky Way's North Pole found in the faint spring constellation of Coma Berenices (just east of Mel 111, an impressive large, sparse open star cluster – use binoculars with a field of at least six degrees to scoop up this beauty). Is there a North Pole for our universe? An interesting question, but I don't think we're aware of one yet.

I'm a huge fan of chocolate. I tried a dessert called "Death by Chocolate," but it only made me stronger.



This image shows a polygonal pattern in the ground near NASA's Phoenix Mars Lander, similar in appearance to icy ground in the arctic regions of Earth.

Phoenix touched down on the Red Planet at 4:53 p.m. Pacific Time (7:53 p.m. Eastern Time), May 25, 2008, in an arctic region called Vastitas Borealis, at 68 degrees north latitude, 234 degrees east longitude.

This is an approximate-color image taken shortly after landing by the spacecraft's Surface Stereo Imager, inferred from two color filters, a violet, 450-nanometer filter and an infrared, 750-nanometer filter.

The Phoenix Mission is led by the University of Arizona, Tucson, on behalf of NASA. Project management of the mission is by NASA's Jet Propulsion Laboratory, Pasadena, Calif. Spacecraft development is by Lockheed Martin Space Systems, Denver.

Image credit: NASA/JPL-Caltech/University of Arizona

The Effect of Dark Skies on Observations

by Dan Gruber

Occasionally I observe from home with my grab-and-go scope (currently an 8" SCT). I usually take my 18" dob to dark sites, where I enjoy working on the Saguaro Astronomy Club (SAC) monthly observing lists prepared by AJ Crayon. But on the few occasions when I've tried to observe the objects on AJ's lists at home, I've been frustrated. Many of the objects on the lists - like galaxies - either simply aren't visible in my 8" or are just tiny featureless blobs.

I actually can keep the 18" dob assembled at home and roll it outside. I never did, however, because it seemed like a waste in my light-polluted suburban location. But a few months ago I got curious about what I could see from home using the larger scope, and particularly about whether I could see the objects on one of AJ's typical lists with it. One night of experimentation showed that I indeed could see some pretty faint DSOs from home with the larger scope.

That result led to a second, broader question. We all enjoy observing at dark sites. They're peaceful and quiet, often comfortably cool, and of course dark - so we can see hundreds of stars and the Milky Way instead of dozens of stars and our neighbor's lights. But how much difference do dark skies really make in what we can observe?

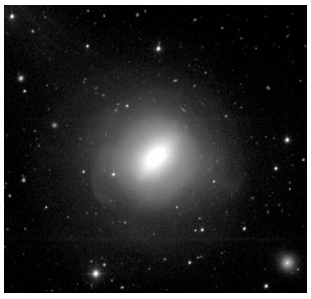
To begin to answer this question, I decided to observe the same objects through the same scope and eyepiece under similar conditions (except light pollution) from my home and from a dark site. I chose to observe the seven objects that were on one of AJ's recent UMa observing lists - all galaxies. These observations were done over the weekends in late April and early May, beginning at the end of astronomical twilight and ending about two hours later. There was no moon in the sky during any of the observing sessions.

My home is located near (the equivalent of) Northern and 60th Street in Paradise Valley (33° 33' N, 111° 57' W). This is an area with no street lights and my scope was positioned so that no lights from nearby houses, etc were visible. The Phoenix and Scottsdale lightdomes are partially blocked by a nearby mountain that blocks between 30 and 45 degrees from the horizon of the southern and western sky. A few miles to the east is an Indian reservation, on which there are few lights. I don't have an SQM, so I estimated the sky darkness based on what stars were visible. On Saturday night, April 26, the skies were about mag 3.4 (I could barely see Megrez in UMa, mag 3.3, and only the two brightest stars in the bowl of the Little Dipper) and the seeing was only about 5/10. Sunday night, April 27, was a little better: probably mag 4.3 skies (I could see 3 stars in the bowl of the Little Dipper) and seeing about 6/10.

On Saturday, May 3, I repeated the observations from the Antennas site at Hovatter Road. I could see all of the Little Dipper stars plus 15 UMi (mag 5.2) and 19 UMi (mag 5.5), so the skies were at least mag 5.5 and possibly darker. Seeing was about 7/10, with periods when it was 8/10.

All observations were done with a 7mm Televue Nagler in my 18" f4.5 dob using a Paracorr, yielding 329X and a 15' FOV. For each of the seven objects my observations at home and at the Antennas site are shown below, as recorded at the time of the observation. The objects were observed in the order shown at both sites. The brightness and size information provided for each object is from the *Night Sky Observer's Guide* by Kepple and Sanner.

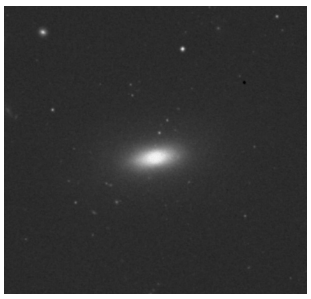
NGC 3610 (m10.8v, SB 13.2, 3.2' x 3.2')



Home: This galaxy has a dim, roughly circular halo about 3' in diameter, brightening to an oval core NW – SE and a stellar nucleus.

Antennas: This galaxy has an oval halo about 3' x 2' oriented NNW – SSE, brightening to an oval core about 30" x 60" with the same orientation and a stellar nucleus. The core appears to have several bright areas with the nucleus being at the southern end of the core.

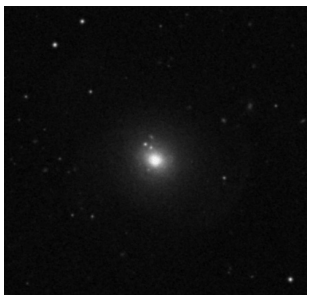
NGC 3613 (m10.9v, SB 12.8, 3.4' x 1.9')



Home: The dim halo extends about 4' x 2' E – W. The oval core also extends E – W and there is no apparent nucleus.

Antennas: An oval halo about 3' x 1.5' is oriented E – W and brightens gradually to a large oval core about 1.5' x 1' with the same orientation. There is a non-stellar nucleus.

NGC 3619 (m11.5v, SB 13.9, 3.7' x 2.8')



Home: This small galaxy was barely distinguishable from the background at my location. The very faint circular halo is about 2' in diameter, brightening slightly to a faint core. There might be a stellar nucleus.

Antennas: This small galaxy has a roughly circular dim halo about 2' in diameter brightening slightly to a small circular core with a non-stellar nucleus.

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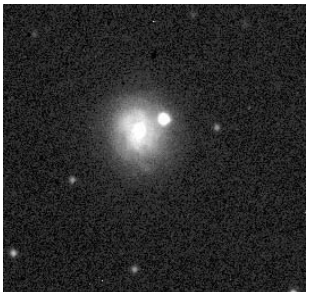
The Effect of Dark Skies on Observations

Continued from page 3

NGC 3898 (m10.7v, SB 12.5, 3.3' x 1.9')

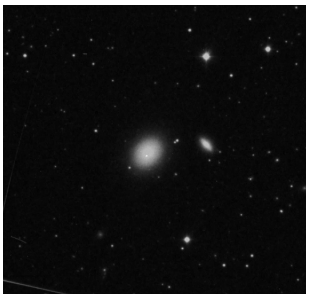
Home: This galaxy has a very faint halo extending about 3' X 2' E – W. The large (1') circular core has no apparent nucleus.
Antennas: This is an oval-shaped galaxy about 4' X 2' oriented ESE – WNW with a bright elongated core and a possibly stellar nucleus.

NGC 3982 (m11.0v, SB 12.4, 2.2' x 2.0')



Home: Another galaxy that was barely visible from my location. A very faint halo about 3' in diameter brightens gradually to a large, dim core with a possible nucleus.
Antennas: A galaxy with a dim circular halo about 2' in diameter brightening gradually to a large circular core 30" – 60" in diameter with a possibly stellar nucleus.

NGC 3998 (m10.6v, SB 12.7, 3.0' x 2.6')



Home: This galaxy has a very faint halo about 2' in diameter and a bright core with a non-stellar nucleus.
Antennas: This galaxy has a dim circular halo about 3' in diameter, a fairly bright circular core 30" – 60" in diameter and a possibly stellar nucleus.

NGC 3990 (m12.6v, SB 12.5, 1.4' x 0.8')

Home: This tiny (1') galaxy is about 5' west of NGC 3998. It has no visible halo, just a dim core.

Antennas: This galaxy is located about 6' west of NGC 3998, which is much brighter. This galaxy has a 1.5' X 1' halo elongated NE – SW and a very small, bright elongated core (or possibly nucleus) with the same orientation.

Observations from this experiment

1. I was surprised by how much I can see from my house with the equipment noted. My results reinforced the fact that even in a light-polluted environment you can see more with greater aperture.

2. Observations from the much-darker Antennas site under better observing conditions generally don't differ greatly from the home observations. The most obvious difference is that many of the Antennas observations have more specific details about size and orientation. (It's possible that objects with more structure and detail would have exhibited greater differences between the two sites.)

3. Observational differences between the sites are greater when describing dim objects (in terms of either visual magnitude or surface brightness). Several objects that were barely visible or very dim from my home were clearly visible from the dark site.

4. Although not included in the observations, my notes indicate that there were more obvious differences in the background between the two sites. At home, generally few stars were visible in the fields around the observed objects. At Antennas, there often were many stars in the field. In fact, in some cases the difference in the field detail (e.g. number of stars and other galaxies) between the sites was greater than the observed difference in the objects themselves.

Additional steps

I intend to duplicate this comparison in the future using objects from the Urban List. These objects generally are brighter, larger, and have more structure and detail than, for example, the UMa galaxies observed this time. This may help make differences in observing results between my home and a dark site more obvious and specific. Based on a suggestion by AJ, I also will document more explicitly field details like nearby stars.

My plan (or at least hope) is to do this additional comparison not only with the 18" but also with my smaller scope, since the Urban List has the kinds of objects that I usually observe from home with the 8". I'm interested in seeing whether the differences in observing results between my home and a dark site are greater, less, the same, or just different for the 8" scope versus the 18" scope. My hypothesis is that the smaller scope, with its inherently greater limitations, will benefit more from the dark site than the 18" - but that remains to be seen.

I can't transport both scopes to dark sites or set both up at my house simultaneously, so these variations will have to be done sequentially. With the monsoon approaching, there's no telling when conditions will permit continuation of this experiment (and I want to continue working on AJ's new lists in addition to doing this). But I'll write up and submit future installments as they get done.

Image credits: Digitized Sky Survey. The Digitized Sky Surveys were produced at the Space Telescope Science Institute under U.S. Government grant NAG W-2166. The images of these surveys are based on photographic data obtained using the Oschin Schmidt Telescope on Palomar Mountain and the UK Schmidt Telescope. The plates were processed into the present compressed digital form with the permission of these institutions.

June Guest Speaker: AJ Crayon

AJ Crayon first got into astronomy in 1980 with the purchase of an 8" f6 Newtonian on an equatorial mount (why don't they call it a polar mount?). Promptly set about to complete the Messier observing list and the 110 Best NGC. He then spent time contributing to *The Observer's Guide* periodical, which eventually became a two volume book titled *Night Sky Observer's Guide*, which he regards as a high point in his observing career. He completed the Herschel 400 in 1992 with certificate #72, and the EVAC observing award for globular clusters, in 2006.

Along about 1992 or 1993 AJ thought about holding an All Arizona Messier Marathon. Most people credit AJ with the popularity of this annual event, but he modestly contends that the credit is due the observers that continue to show up year, after year, after year.

In 2000, AJ built a 14½" Astro Systems TeleKit (seen at Five Mile Meadow in the photo) and purchased an 8" SCT in 2006.

AJ currently authors the monthly *Call for Observations* column in the SAC Newsletter (SACnews) which encourages folks to observe a few particular items in a given constellation and report their observations.

AJ's presentation entitled *Looking Deeper* is an updated version of a talk he gave to EVAC back in 1982.

Robert Burnham Jr. Memorial Fund

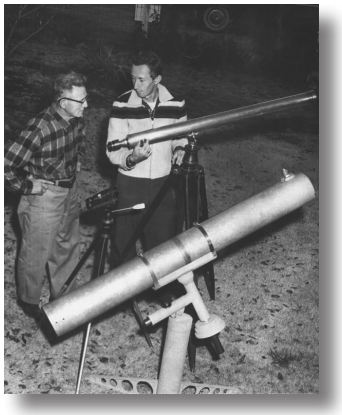
You can be a part of history as people from all walks of life coordinate their efforts to pay tribute to one of the most influential people in amateur astronomy. The East Valley Astronomy Club is proud to serve as fiduciary agent for a drive to place a permanent memorial to Robert Burnham Jr on the grounds 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 June 3 at 12:23

First Quarter Moon on June 10 at 08:04

Full Moon on June 18 at 10:31

Last Quarter Moon on June 26 at 05:10

Celestron CPC 1100 GPS For Sale

Celestron CPC 1100 GPS

Telescope has XLT coatings.
Extras include 12-v battery, counter-weights, 110-v power supply, Telrad.

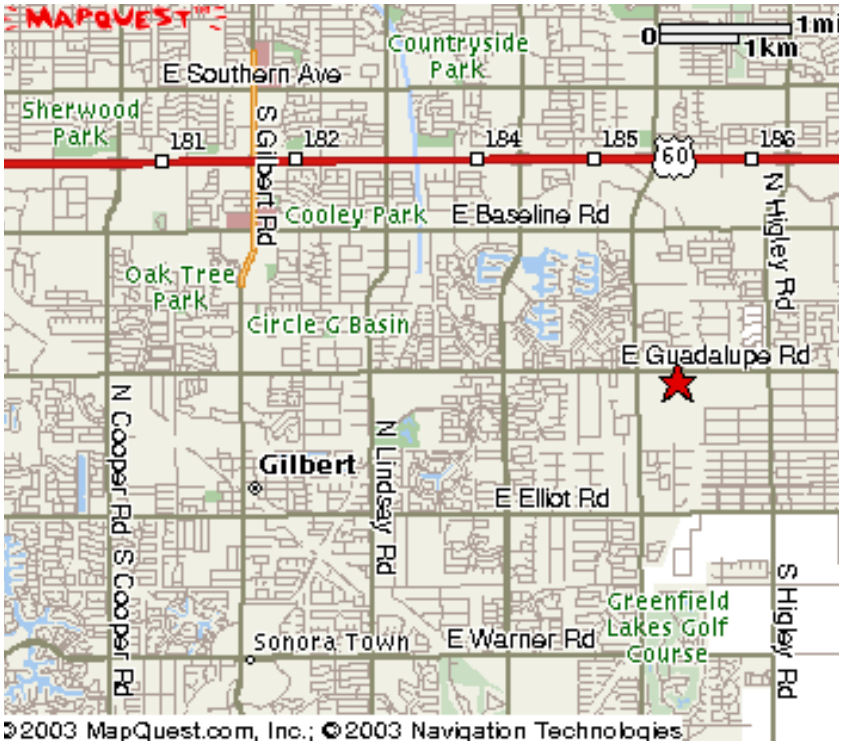
List price is $2899, without extras
My price is $2500 with extras

Contact: Frank Pino 480-882-3485
Email: f.pino@mchsi.com

TeleVue Panoptic Eyepiece For Sale

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



2008 Meeting Dates

June 20

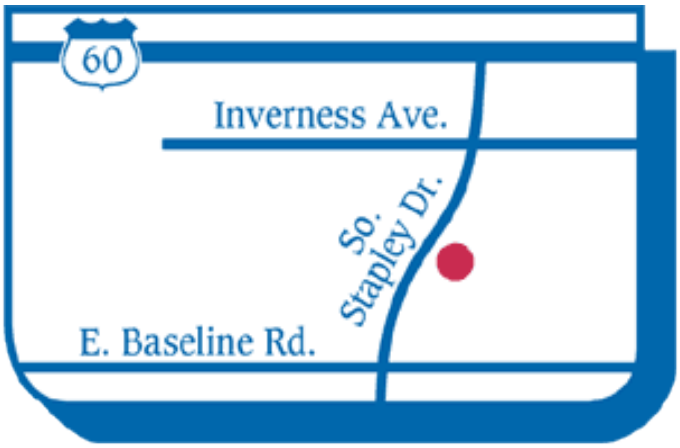
July 18

August 15

September 19

October 17

November 21

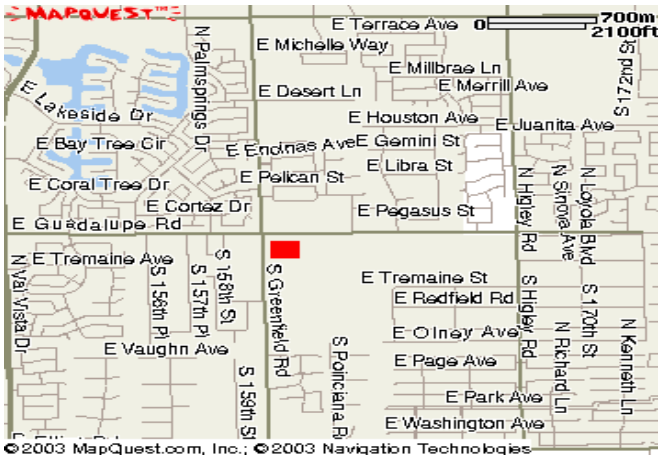


The monthly general meeting is your chance to find out what other club members are up to, learn about upcoming club events and listen to presentations by professional and well-known amateur astronomers.

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!



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

June 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					

June 7 - Deep Sky Star Party at Vekol Road

June 13 - Public Star Party at Riparian Preserve in Gilbert

June 20 - General Meeting at Southeast Regional Library in Gilbert

June 21 - 28 - Grand Canyon Star Party

June 28 - Local Star Party at Boyce Thompson Arboretum

The 2008 Grand Canyon Star Party

(GCSP) will be held from June 21st through 28th on the South Rim in northern Arizona's Grand Canyon National Park. All amateur astronomers and the interested public of all ages are invited! Bring your telescope and enjoy the camaraderie. But you don't have to have a telescope to come and enjoy the beautiful Arizona night skies. A visit to the breathtaking Grand Canyon is an unforgettable and fabulous vacation for families, singles, and seniors. Add a week of dark Arizona skies, lots of friends, fun, and astronomy education, and you have a recipe for perfection! Dean Ketelson continues to serve as the main organizer for the Grand Canyon Star Party, and it is sponsored by the Tucson Amateur Astronomy Association.
Info on GCSP, South Rim: http://www.tucsonastronomy.org/gcsp.html

The Saguaro Astronomy Club is planning a North Rim component of the GCSP. This is good news for those of you who prefer the North Rim of the Grand Canyon.
Info on GCSP, North Rim: http://saguaroastro.org/content/2008GrandCanyonStarPartyNorthRim.htm

The current version of the Grand Canyon Star Party began 1991 as the first anniversary of Dean and Vicki Ketelsen's honeymoon there. It was noticed that a telescope set up looking at the Canyon or sky soon gathered a crowd, so a public oriented event was planned. Though tens of thousands visit every day, a small fraction stay overnight to be treated to the spectacular views of the night sky there. The appreciative tourists tend to leave early, leaving the astronomers in solitude for observing far into the night.

Prior to 1991, the San Francisco Sidewalk Astronomers made annual pilgrimages to several western National Parks in the late 1970s and 1980s, spending several weeks at each stop, including the Grand Canyon. The latest version of this star party has been readily endorsed by several of their members who have become regular attendees.

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

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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.

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NASA's Space Place

Ozone, The Greenhouse Gas

We all know that ozone in the stratosphere blocks harmful ultraviolet sunlight, and perhaps some people know that ozone at the Earth's surface is itself harmful, damaging people's lungs and contributing to smog.

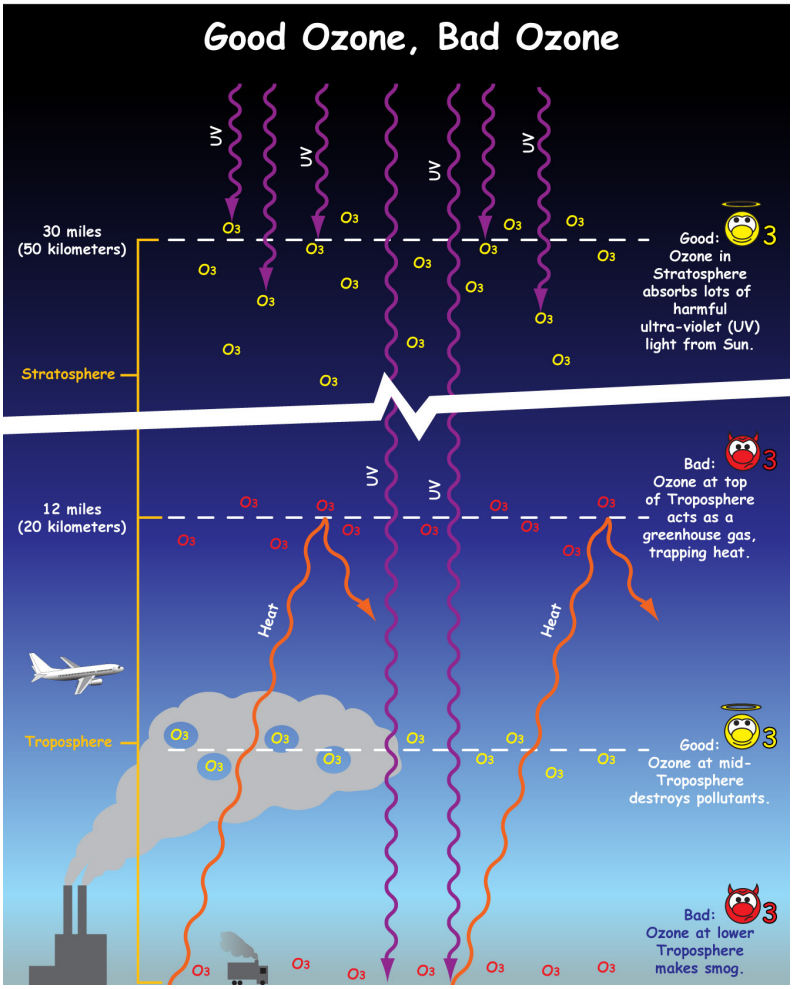
But did you know that ozone also acts as a potent greenhouse gas? At middle altitudes between the ground and the stratosphere, ozone captures heat much as carbon dioxide does.

In fact, pound for pound, ozone is about 3000 times stronger as a greenhouse gas than CO2. So even though there's much less ozone at middle altitudes than CO2, it still packs a considerable punch. Ozone traps up to one-third as much heat as the better known culprit in climate change.

Scientists now have an unprecedented view of this mid-altitude ozone thanks to an instrument aboard NASA's Aura satellite called the Tropospheric Emission Spectrometer—"TES" for short.

Most satellites can measure only the total amount of ozone in a vertical column of air. They can't distinguish between helpful ozone in the stratosphere, harmful ozone at the ground, and heat-trapping ozone in between. By looking sideways toward Earth's horizon, a few satellites have managed to probe the vertical distribution of ozone, but only to the bottom of the stratosphere.

Unlike the others, TES can measure the distribution of ozone all the way down to the heat-trapping middle altitudes. "We see vertical information in ozone that nobody else has measured before from space," says Annmarie Eldering, Deputy Principal Investigator for TES.



Ozone behaves differently at different altitudes in the atmosphere. High in the stratosphere and at mid-troposphere it has positive effects on life at the surface. At the top of the troposphere ozone is a greenhouse gas and at the surface it makes smog.

The global perspective offered by an orbiting satellite is especially important for ozone. Ozone is highly reactive. It is constantly being created and destroyed by photochemical reactions in the atmosphere and by lightning. So its concentration varies from region to region, from season to season, and as the wind blows.

Data from TES show that ozone's heat-trapping effect is greatest in the spring, when intensifying sunlight and warming temperatures fuel the reactions that generate ozone. Most of ozone's contribution to the greenhouse effect occurs within 45 degrees latitude from the equator.

Increasing industrialization, particularly in the developing world, could lead to an increase in mid-altitude ozone, Eldering says. Cars and coal-fired power plants release air pollutants that later react to produce more ozone.

"There's concern that overall background levels are slowly increasing over time," Eldering says. TES will continue to monitor these trends, she says, keeping a careful eye on ozone, the greenhouse gas.

Learn more about TES and the science of ozone at tes.jpl.nasa.gov/. Kids can get a great introduction to good ozone and bad ozone at spaceplace.nasa.gov/en/kids/tes/gases.

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

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

On Tuesday, June 3, it is new moon so you can hunt for faint fuzzies all night.

On Saturday, June 7, about 9:00 PM, you can see the Moon about 2 degrees from Mars. The next night it is near the Regulus - Saturn pair. All month Mars approaches Regulus (while Saturn slowly moves away) and is less than 1 degree away, low in the west on June 30. Next month we get Mars and Saturn close to each other.

On the night of Monday, June 9, the moon is first quarter and sets at 12:28 AM (actually May 10), so it is a better night for lunar observations than deep sky.

On Sunday, June 15, about 11:00 PM, you can see an unusual configuration of Jupiter's moons. In terms of REAL distance, Io is the closest, followed by Europa, Ganymede, and Callisto. Tonight their APPARENT distance will be exactly the opposite!

On Wednesday, June 18, at 8:14 PM, the full moon rises (half an hour after sunset) spoiling any chance of seeing faint fuzzies all night.

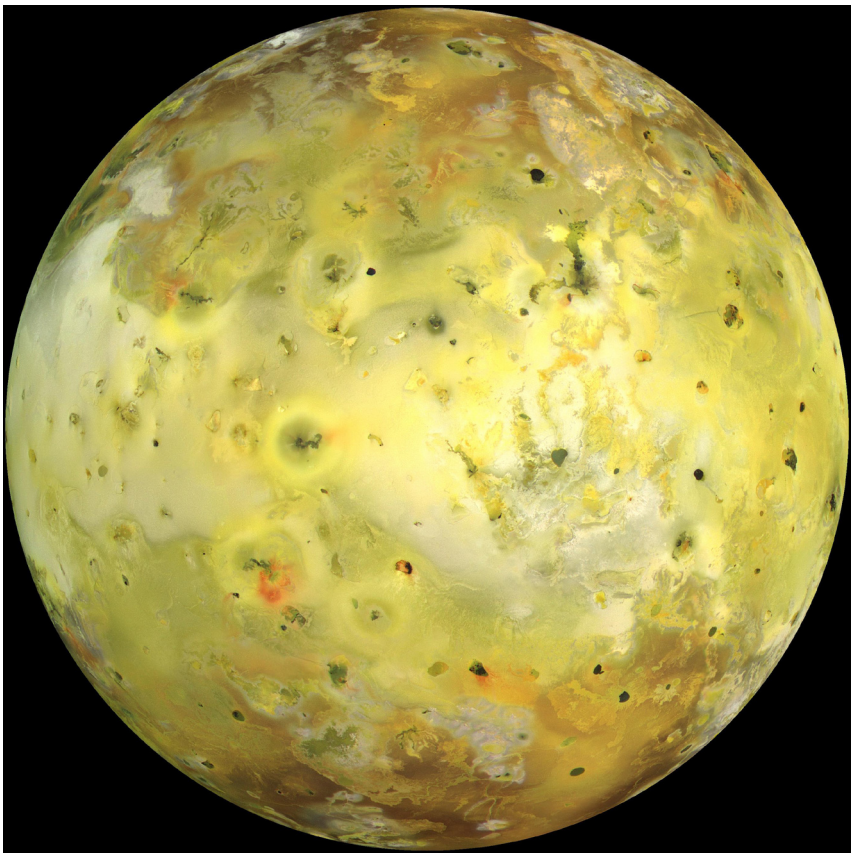
On Friday, June 20, about 9:30 PM, you can easily check out 4 of Saturn's brightest satellites. Titan (mag 8.5), Rhea (mag 9.9), and Dione (mag 10.6) are in a horizontal line from left to right, below the planet. Tethys (mag 10.4) is up and slightly left.

On Sunday, June 22, at 11:55 PM, the Moon occults Neptune. This will be very hard to observe because the Moon is so bright (mag -11) and Neptune is so dim (mag 8). Neptune reappears at 1:08 AM (June 23 now). This all happens low in the southeast.

On Tuesday, June 24, about 11:00 PM; Io, Europa, and Callisto form a short, straight line on the east side of Jupiter. If you stay up late, you can see the pattern change, becoming an equilateral triangle about 1:15 AM.

On the night of Wednesday, June 25, the moon is third quarter and rises at 12:03 AM (actually June 26), so you should be able to get in some deep sky work.

On Thursday, June 26, after dark, you might see some meteors. Look over in the direction of Bootes. This one is pretty chancy. There were outbursts in 1998 and 2004, but don't make any promises to your friends.



NASA's Galileo spacecraft acquired its highest resolution images of Jupiter's moon Io on 3 July 1999 during its closest pass to Io since orbit insertion in late 1995. This color mosaic uses the near-infrared, green and violet filters (slightly more than the visible range) of the spacecraft's camera and approximates what the human eye would see. Most of Io's surface has pastel colors, punctuated by black, brown, green, orange, and red units near the active volcanic centers. A false color version of the mosaic has been created to enhance the contrast of the color variations

Current Status of Cepheids as Standard Candles & Cosmic Distance Calibration

by Henry De Jonge IV

In a previous article we looked at cosmic distance metrology, magnitude, standard candles, the period-luminosity relationship and using Cepheid variable stars as a fundamental building block in establishing a cosmic distance ladder. Now we will talk briefly about how we gather data and use Cepheids in modern astronomy for such distance calculations.

The use of the HST and Hipparcos satellites has greatly opened up the scale of application for using Cepheids, and was a key project for the HST. The HST was used for examining Cepheids by Wendy Freedman and her group at Carnegie Observatories, to collect data from about 800 Cepheids in 20 nearby galaxies in 1994. They have found good agreement with Cepheids and other distance indicators for many distant galaxies. We can now go out to 30-40 Mpc or about the distance to the Virgo Cluster, (about 60 million light years away) where they found over 50 Cepheids. This type of Cepheid measurement is very time consuming and can take hundred's of orbits to finalize. This project is still continuing today. We now express confidence in HST Key Project Cepheid measurements of distance to within 5%, out to the Virgo cluster using 9 galaxies in both Virgo and Leo.

Today, modern calibrations of the P-L relation for Cepheids are:

$$MV = -2.76[\log (P) - 1.0] - 4.16$$

And

$$MI = -3.06[\log (P) - 1.0] - 4.87$$

Where P is the period in days, M is the absolute magnitude, and V and I are the wavelength bandpasses. The zero points of these relations has been determined by observing Cepheids in the SMC and LMC whose distances are known from main sequence fitting, (spectroscopic parallax).

In 2004 the angular diameter of seven classical Cepheids was determined by using the near-infrared interferometer (VINCI) at the ESO Very Large Telescope. This new data combined with previous data has allowed the P-L relationship to be better defined than previously. However there are still questions about the universality of the P-L relationship. Metallicity and pulsation effects in Cepheids is not completely modeled or understood. In 2003 Cepheids with a higher metal content were thought to be brighter while in 2004 the findings indicated that metal poor Cepheids with a fixed period are brighter than metal rich Cepheids. In another example Cepheids have now been shown to have pulsation periods and overtones that may affect the P-L relation and subsequent distances. It is thought that long period Cepheids, (with pulsation periods of over 9 days) are expected to be free of overtones and thus provide a more stable source of data for the P-L relation. This is still ongoing research.

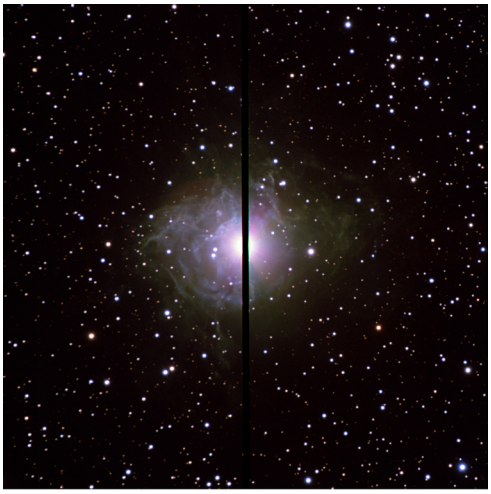
As of 2008 the most accurate measurement of distance to a Cepheid was determined using a telescope in Chile. The Cepheid named RS Pup, (located in the constellation Puppis) was found to be 6,500 light years from Earth with a suspected error of +/- 90 light years.

In terms of other efforts to better calibrate Cepheids and the distance ladder, the European Space Agency satellite Hipparcos has measured the parallaxes of stars as small as 10-3 seconds of arc, which gives a distance of 3250 light years. Today we have reliable parallax measurements of over 120,000 stars. Hopefully better analysis and refinement of the Hipparcos data will help yield better parallax measurements.

The Sloan Digital Sky Survey (SDSS) is being carried out and is providing photometry of over 108 objects over a 10,000 square degree area of the sky. This project is expected to locate and identify many new variable stars, especially RR Lyrae stars, (roughly one per square degree). These new variables should help us better determine the scale, mass, and morphology of our Galaxy.

Future satellites will be able to even better refine and tune in the cosmological distance metrics and their calibrations. ESA is scheduled to launch Gaia a successor to Hipparcos in 2011, which should be able to get accurate distances to over 200 million stars out to 30,000 light years. Gaia will collect data from multi wavelength bands, determine radial velocities, chemical compositions, and parallax data for a large sample of variables with unprecedented accuracy. This vast new and rich database should help in better defining the P-L relationship with Cepheids and other variable stars for even more accurate distance measurements.

Thus there is still work to be done in refining the Cepheid rung of the distance ladder for greater accuracy and in applying Cepheids to help better determine cosmic distances.



The nebula around the Cepheid star RS Pup undoubtedly holds a wealth of information about the mass-loss history of this star. It will thus be instrumental to understand the evolution of Cepheids. Less than five years away from the centenary of the discovery of the Period-Luminosity relation by Leavitt & Pickering, RS Pup could well become a 'Rosetta stone' for this important class of stars. This colour composite image is based on observations made with the 3.6-m ESO New Technology Telescope (NTT) installed at the La Silla Observatory (Chile) and equipped with the ESO Multi-Mode Instrument (EMMI). The image is based on data obtained through B, V, and R-filters. In order to avoid a heavy saturation of the detector, RS Pup was positioned in the gap between the detectors.

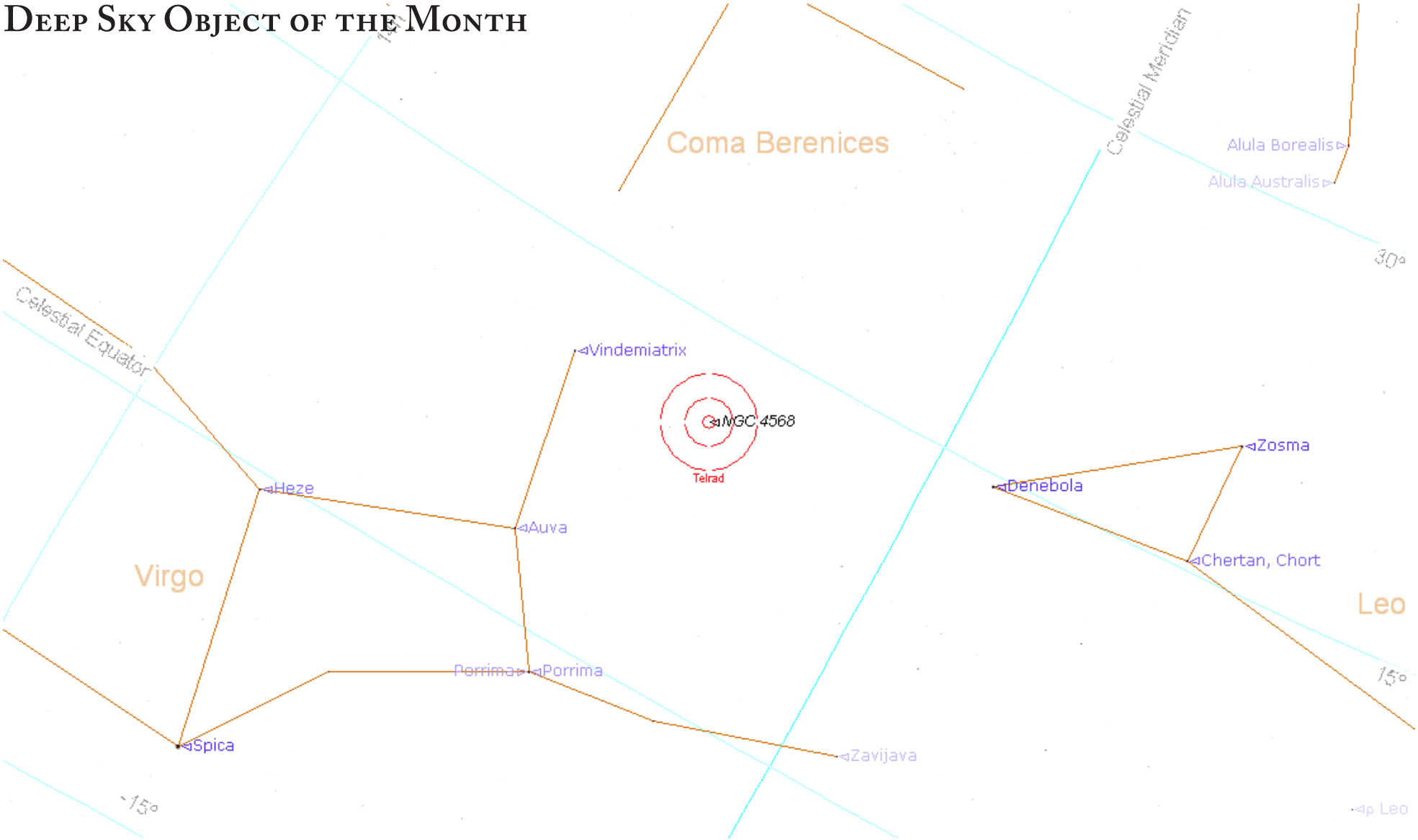


Chart generated with Starry Night Pro

NGC 4568 (Siamese Twins, with NGC 4567) Galaxy Pair in Virgo

RA 12h 36m 34.2s DEC +11° 14' 24" Size: 4.8' x 2.0' Magnitude: 11.7

A Super Solar Flare

by Trudy Bell and Dr. Tony Phillips

At 11:18 AM on the cloudless morning of Thursday, September 1, 1859, 33-year-old Richard Carrington - widely acknowledged to be one of England's foremost solar astronomers - was in his well-appointed private observatory. Just as usual on every sunny day, his telescope was projecting an 11-inch-wide image of the sun on a screen, and Carrington skillfully drew the sunspots he saw.

On that morning, he was capturing the likeness of an enormous group of sunspots. Suddenly, before his eyes, two brilliant beads of blinding white light appeared over the sunspots, intensified rapidly, and became kidney-shaped. Realizing that he was witnessing something unprecedented and "being somewhat flurried by the surprise," Carrington later wrote, "I hastily ran to call someone to witness the exhibition with me. On returning within 60 seconds, I was mortified to find that it was already much changed and enfeebled." He and his witness watched the white spots contract to mere pinpoints and disappear. It was 11:23 AM. Only five minutes had passed.

Just before dawn the next day, skies all over planet Earth erupted in red, green, and purple auroras so brilliant that newspapers could be read as easily as in daylight. Indeed, stunning auroras pulsated even at near tropical latitudes over Cuba, the Bahamas, Jamaica, El Salvador, and Hawaii.

Even more disconcerting, telegraph systems worldwide went haywire. Spark discharges shocked telegraph operators and set the telegraph paper on fire. Even when telegraphers disconnected the batteries powering the lines, aurora-induced electric currents in the wires still allowed messages to be transmitted.

"What Carrington saw was a white-light solar flare - a magnetic explosion on the sun," explains David Hathaway, solar physics team lead at NASA's Marshall Space Flight Center in Huntsville, Alabama.

Now we know that solar flares happen frequently, especially during solar sunspot maximum. Most betray their existence by releasing X-rays (recorded by X-ray telescopes in space) and radio noise (recorded by radio telescopes in space and on Earth). In Carrington's day, however, there were no X-ray satellites or radio telescopes. No one knew flares existed until that September morning when one super-flare produced enough light to rival the brightness of the sun itself.

"It's rare that one can actually see the brightening of the solar surface," says Hathaway. "It takes a lot of energy to heat up the surface of the sun!"

The explosion produced not only a surge of visible light but also a mammoth cloud of charged particles and detached magnetic loops - a "CME" - and hurled that cloud directly toward Earth. The next morning when the CME arrived, it crashed into Earth's magnetic field, causing the global bubble of magnetism that surrounds our planet to shake and quiver. Researchers call this a "geomagnetic storm." Rapidly moving fields induced enormous electric currents that surged through telegraph lines and disrupted communications.

"More than 35 years ago, I began drawing the attention of the space physics community to the 1859 flare and its impact on telecommunications," says Louis J. Lanzerotti, retired Distinguished Member of Technical Staff at Bell Laboratories and current editor of the journal Space Weather. He became aware of the effects of solar geomagnetic storms on terrestrial communications when a huge solar flare on August 4, 1972, knocked out long-distance telephone communication across Illinois. That event, in fact, caused AT&T to redesign its power system for transatlantic cables. A similar flare on March 13, 1989, provoked geomagnetic storms that disrupted electric power transmission from the Hydro Québec generating station in Canada, blacking out most of the province and plunging 6 million people into darkness for 9 hours; aurora-induced power surges even melted power transformers in New Jersey. In December 2005, X-rays from another solar storm disrupted satellite-to-ground communications and Global Positioning System (GPS) navigation signals for about 10 minutes.

Another Carrington-class flare would dwarf these events. Fortunately, says Hathaway, they appear to be rare: "In the 160-year record of geomagnetic storms, the Carrington event is the biggest." It's possible to delve back even farther in time by examining arctic ice. "Energetic particles leave a record in nitrates in ice cores," he explains. "Here again the Carrington event sticks out as the biggest in 500 years and nearly twice as big as the runner-up."

These statistics suggest that Carrington flares are once in a half-millennium events. The statistics are far from solid, however, and Hathaway cautions that we don't understand flares well enough to rule out a repeat in our lifetime. And what then?

Lanzerotti points out that as electronic technologies have become more sophisticated and more embedded into everyday life, they have also become more vulnerable to solar activity. On Earth, power lines and long-distance telephone cables might be affected by auroral currents, as happened in 1989. Radar, cell phone communications, and GPS receivers could be disrupted by solar radio noise. Experts who have studied the question say there is little to be done to protect satellites from a Carrington-class flare. In fact, a recent paper estimates potential damage to the 900-plus satellites currently in orbit could cost between $30 billion and $70 billion. The best solution, they say: have a pipeline of comsats ready for launch.

Humans in space would be in peril, too. Spacewalking astronauts might have only minutes after the first flash of light to find shelter from energetic solar particles following close on the heels of those initial photons. Their spacecraft would probably have adequate shielding; the key would be getting inside in time.

No wonder NASA and other space agencies have made the study and prediction of flares a priority. Right now a fleet of spacecraft is monitoring the sun, gathering data on flares that may eventually reveal what triggers the explosions. SOHO, Hinode, STEREO, ACE and others are already in orbit while new spacecraft such as the Solar Dynamics Observatory are readying for launch.

Research won't prevent another Carrington flare, but it may make the "flurry of surprise" a thing of the past.

Article courtesy of Science@NASA

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