



SJAA EPHEMERIS

SJAA Activities Calendar

Jim Van Nuland

(late) June

- 20 Summer begins at 10:45 p.m.
20-24 Golden State Star Party - see <http://www.goldenstatestarparty.blogspot.com/>
26 Houge Park star party. Sunset 8:32 p.m., 26% moon sets 11:35 p.m. Star party hours: 9:30 until midnight.

July

- 11 **General Meeting at 8 p.m.** Our speaker is Norm Sperling, based on his new book, "This Book Warps Space and Time". Board of Directors meeting at 6:30 p.m.
17 Astronomy Class at Houge Park. 7:30 p.m. Topic is TBA
17 Houge Park star party. Sunset 8:27 p.m., 19% moon rises 2:03 a.m. Star party hours: 9:30 until midnight.
18 Dark Sky weekend. Sunset 8:26 p.m., 11% moon rises 3:01 a.m.
25 Dark Sky weekend. Sunset 8:21 p.m., 23% moon sets 10:31 p.m. Henry Coe Park's "Astronomy" lot has been reserved. AANC Star-B-Q at Fremont Peak State Park
31 Houge Park star party. Sunset 8:16 p.m., 81% moon sets 2:07 a.m. Star party hours: 9:00 until midnight.

August

- 1 **General Meeting at 8 p.m.** Our speaker is TBA
14 Astronomy Class at Houge Park. 7:30 p.m. Topic is TBA
14 Houge Park star party. Sunset 8:00 p.m., 33% moon rises 12:47 a.m. Star party hours: 9:00 until midnight.
15 Dark Sky weekend. Sunset 7:59 p.m., 22% moon rises 1:49 a.m.
22 Dark Sky weekend. Sunset 7:50 p.m., 11% moon sets 8:58 p.m. Henry Coe Park's "Astronomy" lot has been reserved.
28 Houge Park star party. Sunset 7:42 p.m., 68% moon sets 1:53 a.m. Star party hours: 8:45 until 11:45.

The Board of Directors meets before each general meeting at 6:30 p.m. All are welcome to attend.

24 hour news and information hotline:

(408) 559-1221

<http://www.sjaa.net>

ULP Cepheids

Astronomers use an array of tools to determine the distance to an object. Parallax works well for objects that are relatively close but extragalactic objects are another matter. One "standard candle" that astronomers use is the Cepheid variable. Henrietta Leavitt discovered these stars about 100 years ago. She was one of Dr. Pickering's "computers" at the Harvard Observatory. She noticed that the luminosity of these stars was related to the time between peaks in the star's variable nature. Ejnar Hertzsprung (yes, the one celebrated for the Hertzsprung-Russell diagram) was able to use parallax to get distances to a few Cepheid variables and thus Leavitt's relationship could now be calibrated. Since astronomers could now compute the difference between a star's absolute magnitude and its apparent magnitude, distances to these stars could be computed. This turned out to be critical in determining that "spiral nebulae" like the Andromeda Galaxy are located well outside of the Milky Way.

Now astronomers have a new tool, ultra long period Cepheid variables. These ULP Cepheids allow for more accurate determinations of distances to far out objects. This in turn can be used to improve the accuracy of another standard candle, Type 1A Supernovae. It was these supernovae that led to the discovery by Alex Filippenko (and team) that something, now called dark energy, was accelerating the expansion rate of the universe. But a key question remained, was this acceleration due to a change in the universe or was dark energy at work from the very beginning? This is the kind of question that might be answered with more accurate distance measurements.

One example of the improved accuracy is seen in the more accurate number of the Hubble Constant. This is a number that tells us the current rate of the universe's expansion. Previously, the uncertainty in this number was 10%. The new number, determined by Adam Riess and the SHOES team using ULP Cepheids and other tools, is 74.2 ± 3.6 , an uncertainty of 5%.

ULP Cepheids are so useful because they can be used over longer distances than normal Cepheids. In general, Cepheids can be used to measure distances up to 100 million light-years. The ULP Cepheids can be used for distances up to 100 million parsecs (1 parsec = 3.26 light-years).



JULY 2009



The Dawn spacecraft uses ion propulsion. It is going to the asteroid belt. It will orbit asteroid Vesta, then leave and go on to orbit dwarf planet Ceres. Find out about this first of its kind mission at spaceplace.nasa.gov/en/kids/nmp/starr.

SPACEPLACE.NASA.GOV

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
			1 First zoo in the U.S. opened in 1874 in Philadelphia, PA. How many zoos can you find on the map of Space Place partners?	2	3 Earth at aphelion, the time of year when we are farthest from the Sun. How do we use the Sun as our master timekeeper?	4 Mars Pathfinder rover landed on Mars in 1997. What kind of weather did it encounter? Independence Day
5	6	7 FULL MOON	8	9 Voyager 2 spacecraft flew by Jupiter in 1979 and found stranger worlds than we could have ever imagined.	10	11 United Nations World Population Day. Too many people make too many Gummy Greenhouse Gases.
12	13 Galileo spacecraft dropped a probe into Jupiter's atmosphere, 1995. Are there other ways to find out about Jupiter's clouds?	14	15 LAST QUARTER	16	17	18
19	20 Apollo 11 astronaut Neil Armstrong became the first human to walk on the Moon, 1969. See pictures at The Space Place gallery.	21 NEW MOON	22	23	24 Amelia Earhart born, 1897. As a famous aviator, she knew all about different kinds of clouds. Make a Cloud Mobile.	25
26 All or Nothing Day. This is how computers work. They understand only ON or OFF. So how do we get them to do so much?	27	28 FIRST QUARTER	29 NASA was established in 1958. Get acquainted with some NASA scientists and engineers at Space Place Live!	30	31 Apollo 15's rover was the first vehicle driven on the Moon, 1971. See a picture of the lunar rover at The Space Place gallery.	

Month of July: spaceplace.nasa.gov
 July 1: spaceplace.nasa.gov/en/kids/museums
 July 3: spaceplace.nasa.gov/en/educators/NMP_timekeeping.pdf
 July 4: spaceplace.nasa.gov/en/kids/goes/planets
 July 9: spaceplace.nasa.gov/en/kids/vgr_fact3.shtml
 July 11: spaceplace.nasa.gov/en/kids/tes/gumdrops

July 13: spaceplace.nasa.gov/en/kids/phonedrmrc/2002_may.shtml
 July 20: spaceplace.nasa.gov/en/educators/teachers_moon_images.shtml
 July 24: spaceplace.nasa.gov/en/kids/clouds
 July 26: spaceplace.nasa.gov/en/kids/vgr_fact2.shtml
 July 29: spaceplace.nasa.gov/en/kids/live
 July 31: spaceplace.nasa.gov/en/educators/teachers_moon_images.shtml

A faint shadow of an eclipse

Akkana Peck

The big shallow-sky event this July is one that, alas, most of us won't get to see. It's the total solar eclipse on July 22, visible from India, China and the south Pacific. What a terrific trip that would be! I hope some of you get a chance to see it, and I'm sure we'll be hearing reports from SJAA members who go.

Eclipses generally come in pairs – where there's a solar eclipse, there's often a lunar eclipse of some sort half a month earlier or later, since the moon will still be close to the ecliptic. This month is no exception, but it's not much of an eclipse: a penumbral lunar eclipse on July 7. The penumbra is the outer band of the earth's shadow, and compared to a bright full moon, it's very subtle. Worse, this time the penumbra will just barely graze the edge of the moon, making it very unlikely the shadow will be visible at all. But if you're still up between 1:30 a.m. and 3:30 on the morning of July 7, why not check and see if you can detect anything? If nothing else, you'll see the unusual sight of a truly full moon with no terminator at all.

Back at home, Saturn hangs in the early evening sky, unusually faint at magnitude 1.1, and sets a bit before midnight. Its rings are now tilted about 5 degrees from us and it should continue to give a nice view even if it's not as high as it was a few months ago.

Jupiter rises around 10, moving toward its opposition around the middle of next month, and so is at its best after midnight. On the night of the 13th, it passes very close to Neptune, only about half a degree away, so you should be able to see them in the same field. Neptune is only magnitude 7.8, compared with 6.7 for the faintest Galilean moon, Callisto, and it's due north of Jupiter rather than in line with the moons, so you won't be tempted to mistake it for a Jovian satellite. (Galileo saw Neptune twice near Jupiter, two

centuries before its discovery as a planet, and drew it as a fixed star.) It should be interesting to see the blue-green disk so near Jupiter.

Uranus, near the Pisces/Aquarius border, rises about an hour and a half later and is visible for late evening viewers.

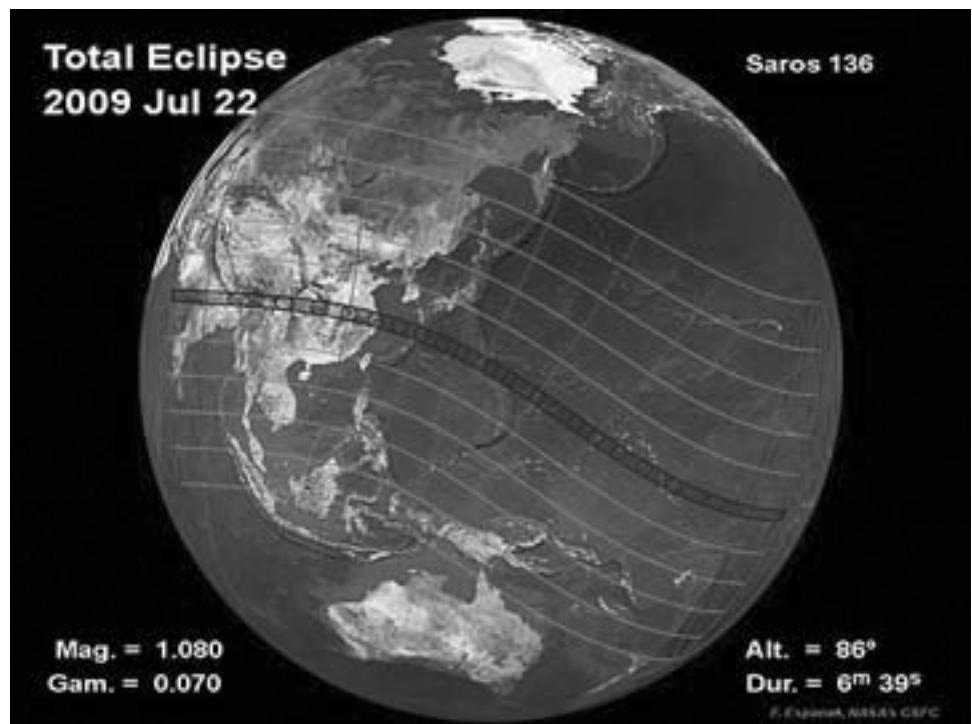
Venus is in the morning sky, rising nearly an hour and a half before the sun. Mars is nearby, and on the morning of the 18th, early risers can get a nice naked-eye view of Venus, Mars, a crescent moon, the Pleiades and Hyades. For extra credit, compare Mars' color to the Aldebaran. They're pretty close to the same magnitude, with Mars at 1.1 just slightly fainter than Aldebaran's 1.0. Which one looks redder? Does the answer change if you use binoculars or a telescope?

Mercury is invisible most of this month, too close to the sun, but emerges barely into the evening sky by the end of the month.

Directions to Houge Park

Houge (rhymes with "Yogi") Park is in San Jose, near Campbell and Los Gatos. From Hwy. 17, take the Camden Avenue exit. Go east 0.4 miles, and turn right at the light, onto Bascom Avenue. At the next light, turn left onto Woodard Road. At the first stop sign, turn right onto Twilight Drive. Go three blocks, cross Sunrise Drive, then turn left into the park.

From Hwy. 85, take the Bascom Avenue exit. Go north, and turn right at the first traffic light, onto White Oaks Road. At the first stop sign, turn left onto Twilight Drive. You will now be passing the park. Turn right at the first driveway, into the parking lot.



Graphic from F. Espanek, GSFC/NASA

For spacecraft, power is everything. Without electrical power, satellites and robotic probes might as well be chunks of cold rock tumbling through space. Hundreds to millions of miles from the nearest power outlet, these spacecraft must somehow eke enough power from ambient sunlight to stay alive.

That's no problem for large satellites that can carry immense solar panels and heavy batteries. But in recent years, NASA has been developing technologies for much smaller microsattellites, which are lighter and far less expensive to launch. Often less than 10 feet across, these small spacecraft have little room to spare for solar panels or batteries, yet must still somehow power their onboard computers, scientific instruments, and navigation and communication systems.

Space Technology 5 was a mission that proved, among other technologies, new concepts of power generation and storage for spacecraft.

"We tested high efficiency solar cells on ST-5 that produce almost 60 percent more power than typical solar cells. We also tested batteries that hold three times the energy of standard spacecraft batteries of the same size," says Christopher Stevens, manager of NASA's New Millennium Program. This program flight tests cutting-edge spacecraft technologies so that they can be used safely on mission-critical satellites and probes.

"This more efficient power supply allows you to build a science-grade spacecraft on a miniature scale," Stevens says.

Solar cells typically used on satellites can convert only about 18 percent of the available energy in sunlight into electrical current. ST-5 tested experimental cells that capture up to 29 percent of this solar energy. These new solar cells, developed in collaboration

with the Air Force Research Laboratory in Ohio, performed flawlessly on ST-5, and they've already been swooped up and used on NASA's svelte MESSENGER probe, which will make a flyby of Mercury later this year.

Like modern laptop batteries, the high-capacity batteries on ST-5 use lithium-ion technology. As a string of exploding laptop batteries in recent years shows, fire safety can be an issue with this battery type.

"The challenge was to take these batteries and put in a power management circuit that protects against internal overcharge," Stevens explains. So NASA contracted with ABSL Power Solutions to develop spacecraft batteries with design control circuits to prevent power spikes that can lead to fires. "It worked like a charm."

Now that ST-5 has demonstrated the safety of this battery design, it is flying

on NASA's THEMIS mission (for Time History of Events and Macroscale Interactions during Substorms) and is slated to fly aboard the Lunar Reconnaissance Orbiter and the Solar Dynamics Observatory, both of which are scheduled to launch later this year.

Thanks to ST-5, a little sunlight can go a really long way.

Find out about other advanced technologies validated in space and now being used on new missions of exploration at <http://nmp/TECHNOLOGY/scorecard>. Kids can calculate out how old they would be before having to replace lithium-ion batteries in a handheld game at "http://spaceplace.jpl.nasa.gov/en/kids/st5_bats.shtml"

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



Helen Johnson, a spacecraft technician at NASA's Goddard Space Flight Center, works on one of the three tiny Space Technology 5 spacecraft in preparation for its technology validation mission.

FITS and Starts

Paul Kohlmler

Astrophotography often requires more work than simply taking an image and printing it. Unless you are taking a picture of one of the brighter objects in our solar system, the image is relatively dim. This means the exposure time is measured in many seconds or minutes or more. As a result, the camera, probably using a CCD imaging chip, has to be very sensitive. Increasing sensitivity often leads to an increase in noise. If you are old enough to remember vinyl records, try to recall what happened when you turned up the volume - the sound was louder but so were the scratches and bumps. Second, the longer length of the exposure creates more opportunities for things like cosmic rays to leave artifacts in the image.

To solve the problems caused by the longer exposure, most solutions involve taking even more exposures. These extra images are called bias, flat or dark images. A bias image is a readout of the CCD after a shutter-closed exposure of 0 seconds. This is sometimes called a zero image. A flat field is an exposure taken of a plain white surface, sometimes using the inside roof of a dome. No dome? Then take a towel (one without a pattern) and cover the scope. This gives a method for removing differences that might occur between one pixel and another. Since a filter can introduce differences, flats must be taken for each filter used. A dark is simpler but is kind of a combination of a bias and a flat image. The exposure is taken with the shutter closed (like a bias image) but it is taken for the same length of time as the real image. (To see the impact of using a dark exposure, see the picture on page 6.) Bias, flat and dark images are all used to do process images - a procedure that is often called reduction. In one recent data reduction process, a number of bias, flat and science images totaling 100 Mb of data were used to create a 100 Kb JPEG file so the word "reduction" is apt.

Astronomical images often use a file

format called FITS - Flexible Image Transport System. A FITS file is usually very large. In one experiment, a FITS file saved as a bit-mapped (.bmp) file was half the original size. A JPEG (.jpg) version of the file with 20% compression was 1/8 of the FITS file size. In addition to the extra image information, the FITS file includes a lot of other information such as the length of the exposure, the filter used, and even the temperature of the camera. So far I've found about 60 attributes saved in the FITS file.

Wait a minute - the temperature of the camera? Another method for reducing the amount of noise

that is introduced by the electronics of the CCD imager is to cool the camera - lower temperature means less noise.

Now that you have dark, bias and flat exposures you just need the one actual image file, sometimes called the science image. Well, not so fast. Most astronomical CCD images are monochrome. If you want a CCD that produces color images it might be cheaper. Really, color is cheaper? Well, there is a price to pay for a color imager. If you have a TV that is the old CRT style, take a magnifying glass (a jeweler's loop works) when the TV is off (or else you might go blind) and look at the dots on the screen. You should be able to see dots of different colors: red, green and blue. These are the primary color of light, also called the additive primary colors. You might be used to the primary colors of pigment used in paint or crayons also called the subtractive primary color: yellow, red (actually a shade of magenta) and blue (more specifically, cyan). If you have an LCD panel TV or an LCD monitor on your computer, use the magnifying glass on a portion that appears to be white. You will again see the red, green

and blue dots. A color imager has to use individual pixels (meaning "picture elements") that are sensitive to red, green and blue light. This means that, all other things being equal, a color imager uses 3 pixels to create one color pixel. So a color astronomical CCD has only one third the number of pixels as a monochrome CCD (again, assuming everything else is the same - it rarely is). So the astronomer taking pictures usually has to take 3 images to make a

The camera's temperature? Color is cheaper? A bias is a good thing? Can any of this be true?

color picture: one with a red filter, one with a green filter, and then one with a blue filter. Since all three of these images are likely to be dimmer than an image taken without a filter, an unfiltered image is also taken to get the correct brightness or luminance for the image. These images, likely many of these aligned and stacked, are combined to create the final color image.

Of course, if a monochrome image is desired, multiple color images are not needed. Even more interesting, the filters don't have to be red, green and blue. Narrowband filters that preferentially allow the light that comes from nebulas can create interesting images and block out most city-based light pollution as well.

There are still other things that might need to be done before completing the picture. CCDs often have defects called column defects where an entire column is always hot (bright) or cold (dark). These can be corrected using a process called dithering where the object is moved within the frame of the image so that when the images are stacked the defect is effectively masked.

The Last Month In Astronomy

JUN-03-2009 **NASA Announces Winners** NASA has announced the winners of its Competitive Program for Science Museums and Planetariums. The two California winners are the Castle Challenger Learning Center Foundation based in Merced and the Hiller Aviation Institute in San Carlos. For more information, follow the link below and click on the link below "Selections". <http://nspires.nasaprs.com/external/solicitations/summary.do?method=init&solId={F6425211-4E48-A735-A46E-75FB5774AAC6}&path=past>

MAY-28-2009 **New Exoplanet Technique Works** Most exoplanets have been detected using the "wobble" method used by Marcy, Butler et. al. but there are other techniques such as detecting planetary transits (the method used by the Kepler spacecraft). One method has been proposed for a long time but it's success rate had been exactly zero. No more. Planet VB 10b, a Jupiter class planet circling a star 1/12 the mass of the sun, has been detected using astrometry - measuring the changes in the position of a star as it is moved by the planet. The star and planet are about the same size but the star has more mass. <http://jpl.nasa.gov/news/news.cfm?release=2009-090>

MAY-15-2009 **Spitzer loses its cool** The Spitzer Space Telescope has been gazing at the infrared universe for more than 5 years. This has required a significant amount of coolant onboard the spacecraft and that coolant has just run out. Fear not, Spitzer will now enter a warm phase where a couple of its instruments will continue to work after recalibration is completed. <http://jpl.nasa.gov/news/news.cfm?release=2009-086>

MAY-14-2009 **Herschel and Planck successfully launched** <http://jpl.nasa.gov/news/news.cfm?release=2009-085>



This image is a 90-second exposure of M51 taken May 16, 2009. The telescope is a Meade LX 200 Classic and the imager is an SBIG ST-7XE. The left half of the picture shows the image before using the "dark" exposure to subtract the noise. The camera was cooled to -5 Celsius. While this picture isn't going to put the Hubble Space Telescope out of business, I think it is interesting to note a few things visible here. First, M51's companion, NGC 5195, has a bar structure that might be near vertical in this orientation. M51 has two arms but just above the galactic core one of the arms is partially bifurcated. To the left and the right of the core, between the two arms, are some structures that are sometimes called "feathers" which are actually associated with star forming regions. The foreground stars are not crisp, point-like objects which is caused by inaccuracies in the telescope's tracking. Stacking multiple images might improve the quality of the final image. Photo courtesy of the author.

It Must Be Astronomical ...

Loaners

The loaner program offers members a means to try scopes of various sizes and technologies before you buy. It is one of the real jewels of being a member of the club. Scopes are available for all experience levels. The inventory is constantly changing. The following list is a sample. For more information please see the loaner program web page: <http://www.sjaa.net/loaners>

Hot Dates

July 22 - Total Solar Eclipse; Asia and Pacific Ocean. Next one is July 11, 2010

July 25 - AANC Star-B-Q. Fremont Peak State Park.

September 12 - 16 - ASP Annual Meeting in Millbrae, California.

October 30 - Nov.1 - Advanced Imaging Conference in San Jose

Deep Sky Objects

Here are three recommendations for deep sky objects in March. For more information see <http://www.resource-intl.com/Observing.Lists/Deep.Sky.May.09.html>

Difficulty	Name	RA	Dec
Easy	M80	16h 17m 02s	-22° 58' 30"
Globular in Scorpio improves with magnification. Mag 7.3			
Medium	N 6070	16h 09m 58s	00° 42' 32"
Galaxy in Serpens, large oval 2:1; 2 companions. Mag 11.8.			
Difficult	HGC 076	15h 31m 40s	07° 20' 19"
A quartet of galaxies in Serpens. See NGC 5941. Mag. 14.9			

“There is an element of schizophrenia inherent in the life of any astronomer. Torn between the light and darkness, we must be the thoughtful instructor to our day weary students, and the nocturnal voyeur, diligently stalking the heavens.” – Pamela Gay, Ph. D., starstryder.com

Q: How many verified meteorite impact craters are there on Earth, in the U.S., in California?

A: There are 174 such crater sites on Earth, 27 in the U.S. and none in California (RASC 2009, pg. 264)

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