SJAA EPHEMERIS

SJAA Activities Calendar

Jim Van Nuland

(late) May

23 Dark Sky weekend. Sunset 8:16 p.m., 0% moon rises 5:40 a.m. Henry Coe Park's "Astronomy" lot has been reserved.

29 Houge Park star party. Sunset 8:21 p.m., 41% moon sets 1:05 a.m. Star party hours: 9:30 until midnight.

June

6 General Meeting. Our speaker is our own Rod Norden (SJAA) who will tell us about the Pioneer 10-11 missions.

12 Astronomy Class at Houge Park. 7:30 p.m. Topic is TBA

12 Houge Park star party. Sunset 8:29 p.m., 75% moon rises 11:56 a.m. Star party hours: 9:30 until midnight.

20 Dark Sky weekend. Sunset 8:31 p.m., 3% moon rises 4:19 a.m. Henry Coe Park's "Astronomy" lot has been reserved.

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. Our speaker is Norm Sperling, based on his new book, "The Book Warps Space and Time".

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.

The Board of Directors meets before each general meeting. Call the hotline for the exact time.

24 hour news and information hotline:
(408) 559-1221
http://www.sjaa.net

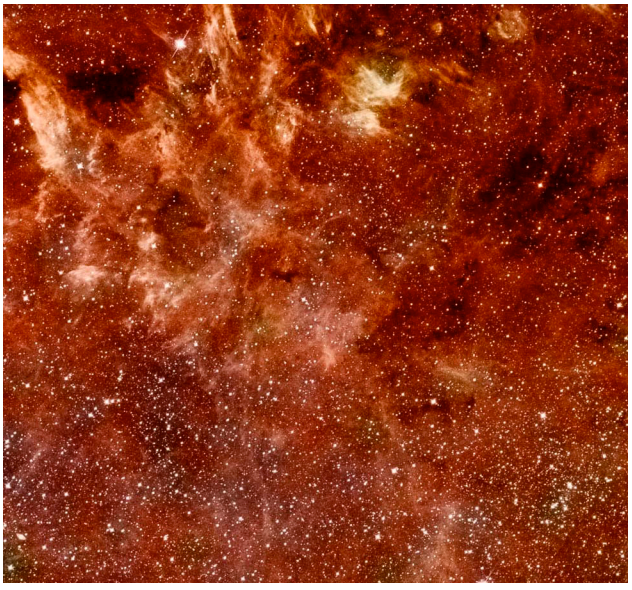
Hubble Repairs

On May 11, the Space Shuttle Atlantis started its latest mission - to repair the Hubble Space Telescope. The modifications that are to be done will not merely return the Hubble back to where it was but will greatly increase its capabilities. One estimate is that its scientific power will increase by 90 times over its original design after it is refurbished. How do they measure that?

Let's look at numbers we can understand like money. The Hubble Space Telescope has cost the average American so little per year that you could almost add it to the McDonald's dollar menu ($10 billion divided 300 million people divided by 25 years = $1.33). Compare this to the amount spent just this year on AIG which would cover the cost for you and a friend to fly to Paris, eat at the McDonald's there, and fly back (about $600).

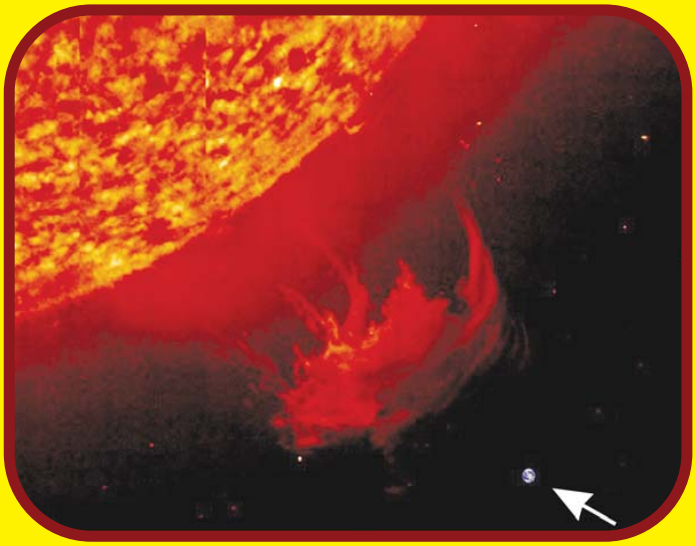
So what did you get for your $1.33? About 570,000 images so far looking at 29,000 celestial objects. And all of these images are yours, property of the U.S.A. though it doesn't mean that you can get money from them unless properly licensed.

Is the HST the most productive telescope ever? Sandra Faber says "... that after Galileo's tiny little telescope ... Hubble is right there.... Telescopes are the only real time machines that human beings have ever invented."



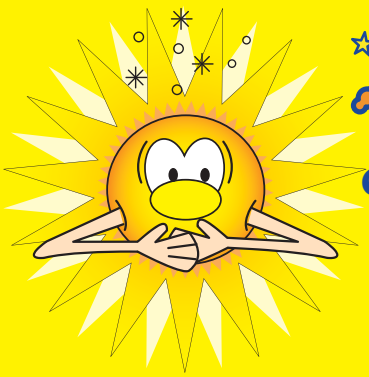
This picture is just a portion of an image resulting from a Hubble/Spitzer composite. Photo courtesy of NASA. This article is inspired by Mike Scott's front page article in the May 10, 2009 issue of the San Jose Mercury News.

National Aeronautics and Space Administration



How small Earth is compared to the Sun! Earth is much farther from the Sun than shown here. But when the Sun "burps" hot, electrically charged gas and particles, only Earth's magnetosphere protects us. Learn more at spaceplace.nasa.gov/en/kids/goes/spaceweather.

JUNE 2009



NASA Space Place CALENDAR

SPACEPLACE.NASA.GOV

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Recycling Month. How else can we take care of our planet?	1	2	3 **First U.S. Space Walk, 1965.** On Gemini 4, astronaut Ed White used a hand-held gas gun to maneuver. See later astronauts at work.	4	5 **World Environment Day.** How are satellites helping us understand and protect the environment?	6
7 **Trial Technology Day.** Without technology, space exploration would not be possible. Why? FULL MOON	8 Birthday in 1625 of **Gian Domenico Cassini,** who discovered four of Saturn's moons. Take a look at some of them at The Space Place image gallery.	9 **Donald Duck's** birthday in 1934. Fortunately for him, Donald is not one of an endangered species like some other ducks.	10	11	12	13 **Pioneer 10**, in 1983, was the first human-made object to travel past Pluto's orbit. Design your own "out of this world" spacecraft.
14	15 **Fly a Kite Day.** What airplane is more like a kite than a jet-liner and flies much higher? LAST QUARTER	16	17	18	19	20 Summer Solstice (first day of summer)
21 Play the **Wild Weather Adventure** game with Dad today. Father's Day	22 NEW MOON	23	24 **Celebration of the Senses Day.** How do space scientists decide which senses their instruments need in order to explore other planets?	25	26	27 **Helen Keller Day.** Born in 1880, she was blind and deaf, yet achieved much in her life. Imagine what we could do with a sixth sense.
28 FIRST QUARTER	29	30 **Huge asteroid** exploded over Siberia in 1908. Where do asteroids come from? Make some to eat while you're finding out.				

Month of June: spaceplace.nasa.gov/en/kids/earth/wordfind
June 3: spaceplace.nasa.gov/en/educators/teachers_astronaut_images.shtml
June 5: spaceplace.nasa.gov/en/kids/phonedrmarc/2003_december.shtml
June 7: spaceplace.nasa.gov/en/kids/nmp/starr
June 8: spaceplace.nasa.gov/en/educators/teachers_ss_images.shtml
June 9: spaceplace.nasa.gov/en/kids/poes_tracking
June 13: spaceplace.nasa.gov/en/educators/teachers_page2.shtml#model
June 14: spaceplace.nasa.gov/en/kids/goes/wwa
June 15: spaceplace.nasa.gov/en/kids/helios_fact.shtml
June 24: spaceplace.nasa.gov/en/educators/teachers_page2.shtml#alienworld
June 27: spaceplace.nasa.gov/en/kids/lisa_fact2.shtml
June 30: spaceplace.nasa.gov/en/kids/ds1_ast.shtml

Trojans in STEREO

Akkana Peck

Saturn continues to give a lovely show in the western sky, visible most of the evening. Saturn's so pretty that you just never get tired of looking at it. And it's a good thing, because all the rest of the planets except Pluto — Jupiter, Venus, Mars, Uranus and Neptune — are in the morning sky.

Pluto season officially starts this month, with opposition on the 23rd. The bad news: it's in Sagittarius, right in the heart of the Milky Way, in a very crowded star field. That means there are lots of nearby stars to potentially point the way — but it also makes it tough to figure out which of those dim points is the planet. A fun challenge for experienced or aspiring Plutocrats!

There may not be many planets in our night sky, but an interesting pair of spacecraft was in the news last month, a NASA mission called STEREO.

It's a solar observation mission, designed to view the sun in stereo. The two spacecraft will view the sun from different angles, creating images that can be combined to give a three-dimensional view of the sun and a better understanding of solar storms, specifically the huge storms known as coronal mass ejections. CMEs eject billions of tons of particles into space and can cause magnetic storms and electromagnetic interference once the particles reach our atmosphere.

The STEREO spacecraft have been flying since 2006 (and has also discovered 20 comets along the way) but they're just now entering an interesting phase of their mission: they're nearing the Earth's Lagrangian regions L4 and L5.

The points are named after Joseph-Louis Lagrange, who in the 1700s came up with a way of describing orbital mechanics. His equations predicted that a two-body system, such as the Earth and the Sun, would create stable five points where a third object could orbit without its orbit being perturbed by the first two bodies. These points came to be known as Lagrangian points.

Three of them were already known. L1 is a point between the Earth and Sun (but much closer to the Earth) where the gravitational attraction of the two bodies is cancelled out: the Earth is pulling just as hard on an object at L1 as the Sun is. L2 is on the opposite side of the Earth from the Sun, about four times as far away as the moon's orbit. L3 is on the opposite site of the Sun from us, roughly at the point the Earth will be half a year from now.

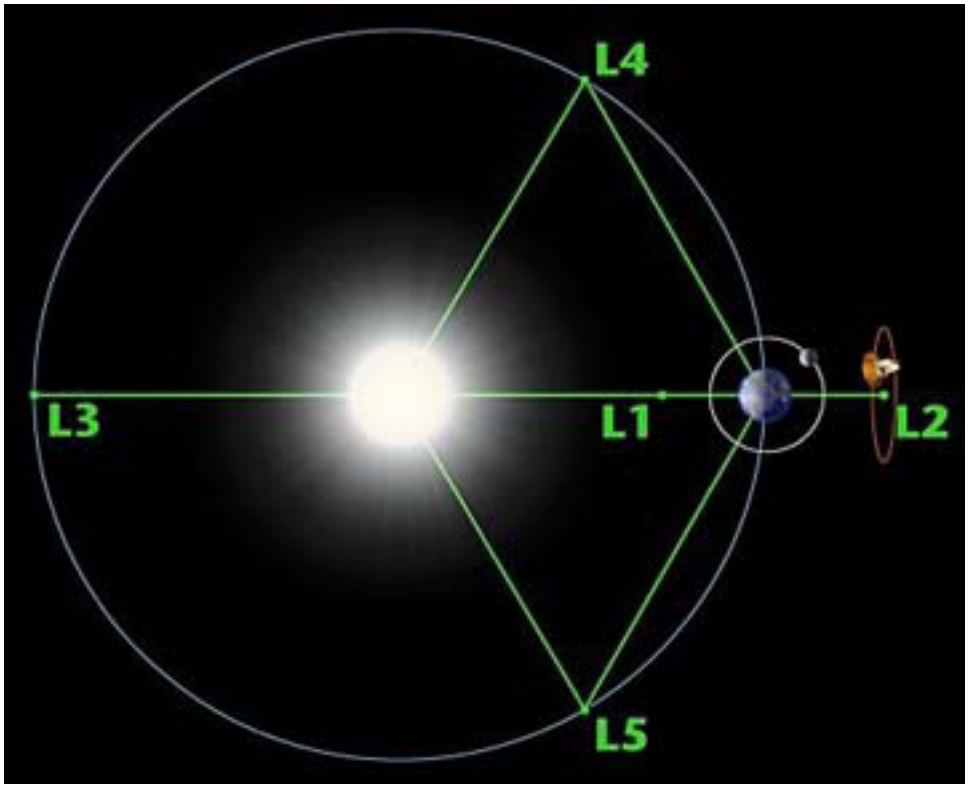
But the last two Lagrangian points were more interesting and unexpected. They lie along Earth's orbit, but 60 degrees ahead of and behind Earth's current position. That puts them at about 93 million miles away. And unlike the other Lagrangian points, they're highly stable: if you put an object at L4 or L5 and perturb it a little bit, it will eventually be pulled back to the Lagrangian point. In the 1970s, an organization called the L5 Society argued that we should put a space station at L4 or L5, but that idea never got off the ground.

I've been talking about points, but that's really a fib. Lagrangian "points" are based on a circular orbit with no other bodies (like the moon, or Jupiter) nearby. In the real world, with elliptical orbits and lots of other disturbances, Earth has Lagrangian regions.

Other planets do too, and those regions can hold objects in them. L4 and L5 are sometimes called a planet's "Trojan points", and Jupiter's Trojan points contain quite a few asteroids, called "Trojan asteroids".

Some people think that Earth's Trojan points originally contained something bigger than asteroids: a Mars-sized planet called Theia, which coalesced at Earth's L4 or L5 point, then was

Continued on page 6



The Swiss Army Knife of Weather Satellites

Dr. Tony Phillips

Spotting volcanic eruptions, monitoring the health of crops, pinpointing distress signals for search and rescue teams.

It's not what you might expect from a weather satellite. But these are just a few of the abilities of NOAA's newest polar-orbiting weather satellite, launched by NASA on February 6 and turned over to NOAA for full-time operations on February 26.

Formerly called NOAA-N Prime and now renamed NOAA-19, it is the last in its line of weather satellites that stretches back almost 50 years to the dawn of the Space Age. Over the decades, the abilities of these Television Infrared Observation Satellites (TIROS) have gradually improved and expanded, starting from the grainy, black-and-white images of Earth's cloud cover taken by TIROS-1 and culminating in NOAA-19's amazing array of capabilities.

"This TIROS series has become quite the Swiss army knife of weather satellites, and NOAA-19 is the most capable one yet," says Tom Wrublewski, NOAA-19 Satellite Acquisition Manager at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

The evolution of TIROS began in 1998 with NOAA-K. The satellites have carried microwave sensors that can measure temperature variations as small as 1 degree Celsius between Earth's surface and an altitude of 40 kilometers—even through clouds. Other missions have added the ability to track large icebergs for cargo ships, monitor sea surface temperatures to aid climate change research, measure the amount of ozone in Earth's protective ozone layer, and even detect hazardous particles from solar flares that can affect communications and endanger satellites, astronauts in orbit, and city power grids.

NOAA-19 marks the end of the TIROS line, and for the next four years it will bridge the gap to a new series of satellites called the National Polar-orbiting Operational Environmental Satellite System. NPOESS will merge civilian and military weather satellites into a single system. Like NOAA-19, NPOESS satellites will orbit Earth from pole to pole, circling the planet roughly every 100 minutes and observing every location at least twice each day.

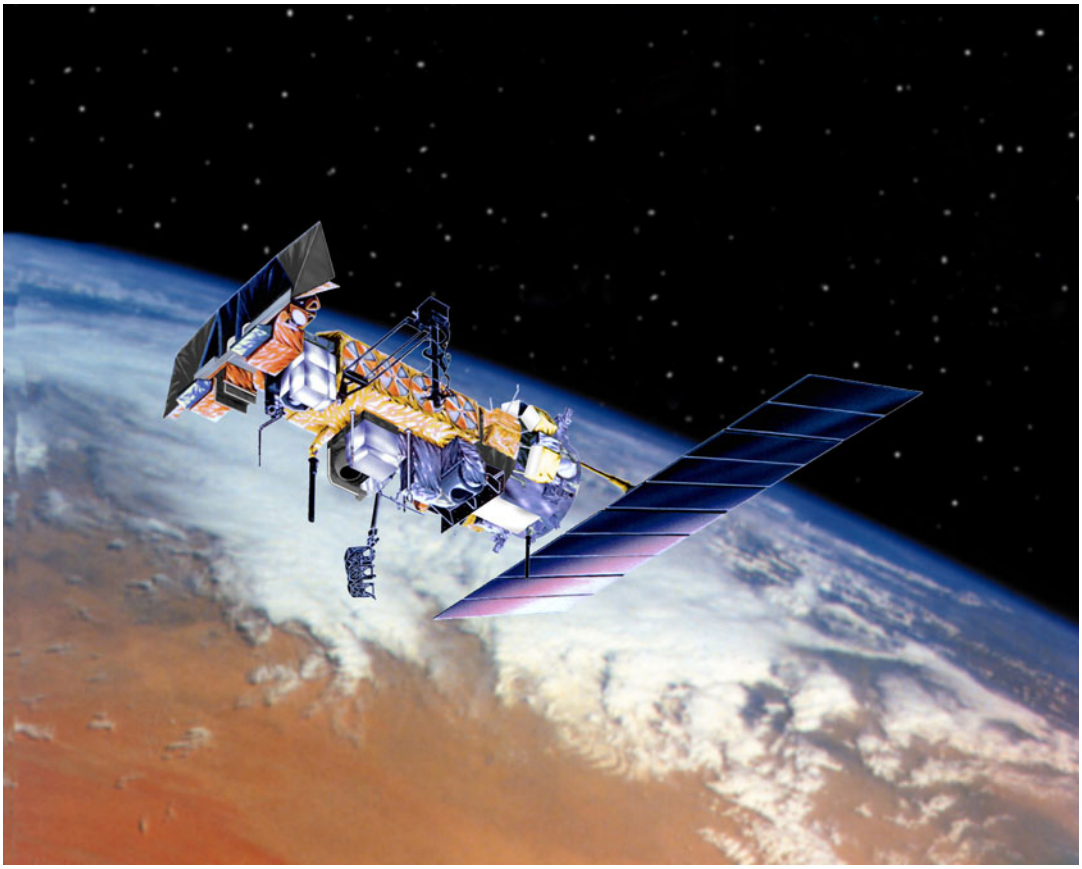
NPOESS will have yet more capabilities drawn from its military heritage. Dim-light sensors will improve observations of the Earth at night, and the satellites will better monitor winds over the ocean — important information for ships at sea and for weather and climate models.

"A lot more capability is going to come out of NPOESS, improving upon the 161 various environmental data products we already produce today," Wrublewski says.

Not even a Swiss army knife can do that many things, he points out.

For more on the NPOESS, check out http://www.npoess.noaa.gov. Kids can find out about another NOAA satellite capability—tracking endangered migrating species—and play a fun memory game at http://spaceplace.nasa.gov/en/kids/poes_tracking.

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



The new NOAA-19 is the last and most capable in the long line of Television Infrared Observation Satellites (TIROS).

Astronomical CCDs

Paul Kohlmiller

Last month in this space we discussed webcams, this month we look at astronomical CCDs. The original application for CCD circuitry was supposed to be as a replacement for hard disk drives. The CCD (charge-coupled device) stored information as packets of electrons. During the 70's and 80's a lot of work was done to get CCDs to replace vidicon tubes by making them photosensitive. By 1974, Fairchild had a 100x100 imager. In 1976, the first article appeared that reported astronomical results from the use of a CCD – the first features seen on Uranus.

Uses

The astronomical CCD can do things that are virtually impossible for cheaper imagers such as webcams.

Deep Space Astrophotography – Long Exposures

An astronomical class CCD camera can take long individual exposures often lasting for several minutes or longer. What makes these long exposures possible is the ability to handle the inherent noise in the camera's electrical system. Much of the noise is thermal and it is reduced when the camera is thermoelectrically cooled. It is not unusual for an astronomical camera to be cooled 20° C compared to the ambient temperature. Higher end cameras can use water to further reduce temperatures.

Long exposures allow astronomers to do more than just reduce noise and improve the quality of the image. They also make it possible to only use a portion of the spectrum and still have enough sensitivity to record an image. One example of this is called narrow-band imaging popularized by Rob Gendler and others.

Photometry

The low noise capability of CCDs makes it possible to measure the amount of light from deep sky objects. Photometry can be used to measure the magnitude differences in variable stars and even detect extrasolar planets. The method for doing this is usually to get two or more stars in a single frame where one star is the one being measured and the others can be considered constant. The difference between a constant star and the variable star can be plotted.

Self-tracking

Some astronomical CCDs have the ability to track an object while taking an image. One method for doing this is to have a small part of the CCD detector dedicated for autoguiding.

Other CCD advantages

The astronomical CCDs have other advantages over their cheaper brothers:

- Most astronomical CCDs are monochrome which gives them greater resolution and flexibility.
- Although filters can be used on webcams they tend to be manually operated while astronomical CCD filter wheels can be automated.
- Companies like SBIG sell adaptive optics for their cameras which improves the accuracy of auto guiding and reduces the effect of atmospheric aberration.
- Astronomical CCDs are built for outdoor use on cold nights. Webcams are built for an office or den.
- A spectrograph can be attached to an astronomical CCD. Spectral shifts have been used to detect most of exoplanets discovered to date.

The amateur using these kinds of cameras are approaching the techniques used by professionals although the custom made professional CCDs cost hundreds of thousands of dlollars.

On the left is the Orion StarShoot camera, a webcam that has been packaged for use in astronomy by giving it the dimensions of an eyepiece. When purchased in 2007 the cost was $100. On the right is the SBIG ST-7X astronomical CCD imager with a color filter wheel. The 2009 price for this camera is $2495 without the filter wheel. Photo by author.

The Last Month In Astronomy

MAY-08-2009 ***Solar Weather Forecast*** NOAA and Solar Weather Prediction Center have made their forecast for the upcoming solar cycle. It is expected to be mild and will peak in May of 2013. At the peak there could be 90 sunspots per day. http://www.swpc.noaa.gov/SolarCycle/index.html

MAY-08-2009 ***Warp Drive Proposed*** The timing with the Star Trek movie is suspicious but physicists at Baylor says they know how to create a warp drive, a method for moving faster than the speed light. The idea is to manipulate (wrap) the space ahead of and behind the spacecraft which doesn't actually have to move at all. The warp drive requires energy that can't be generated yet and, oh yes, you need to solve some equations involving 11 dimensions. http://www.sciencedaily.com/releases/2009/05/090507175838.htm

MAY-07-2009 ***Refined Hubble Constant*** The Hubble constant has been refined. The estimates of the Hubble constant, a measure of the universe's rate of expansion, varied by up to 100% before the Hubble Space Telescope started operations in the early 90's. The latest calculations have an error of only 5%. The new number is 74.2 km/sec/Mpc. http://www.astronomy.com/asy/default.aspx?c=a&id=8248

MAY-06-2009 ***Link of two ALMA scopes*** For the first time, two radio telescope dishes in the Atacama Large Millimeter/submillimeter Array (ALMA) have been linked together with a synchronized precision error of less than 1 picosecond. This is an important milestone in the development of ALMA which should be in partial operation by 2012 and full operation by 2015. http://www.astronomy.com/asy/default.aspx?c=a&id=8245

APR-30-2009 ***Smooth Galaxies*** Ever wonder why spiral galaxies are so smooth? After all, stars form in clusters from molecular clouds that are pretty lumpy looking. It turns out that the rotational forces in the galaxy tend to smear out the stars after they are formed. http://www.spitzer.caltech.edu/Media/happenings/20090430/

APR-28-2009 ***New Distance Record*** The Swift spacecraft has detected a gamma-ray burst with a redshift of 8.2. This puts the object at 13 billion light years in lookback time. http://www.astronomy.com/asy/default.aspx?c=a&id=8214

APR-21-2009 ***Lightest exoplanet*** The record for the lightest exoplanet has been found. Designated Gliese 581e, this planet is estimated to be two earth masses. It was discovered using the High Accuracy Radial Velocity Planet Searcher (HARPS) spectrograph attached to the 3.6 meter ESO telescope at La Silla, Chile. http://www.astronomy.com/asy/default.aspx?c=a&id=8169

APR-20-2009 ***Vista on Rovers?*** The Mars rover Spirit has been having a lot of difficulty with its onboard computer. A number of reboots and bouts of "amnesia" have bedeviled the rover but it continues in most ways. http://jpl.nasa.gov/news/news.cfm?release=2009-071

APR-16-2009 ***Kepler Takes a Peak*** Although the Kepler's scientific mission has not yet started, the calibration of the cameras and other equipment on board has started. Kepler will look at 100,000 stars over the next 3-4 years looking for transits made by Earth-size planets as they pass in front of their star. http://www.jpl.nasa.gov/news/news.cfm?release=2009-068

APR-01-2009 ***Earthlike Planet Forming?*** With the aid of images from the Spitzer Space Telescope, astronomers discovered a new earth-like planet 430 light years away forming around a distant giant star. The star is 10-16 million years old and analysis of a dust cloud around the star suggests it may coalesce and become a rocky planet like earth. According to astronomers, 10-16 million years is the perfect age for forming Earth-like planets. http://www.sciencedaily.com/videos/2008/0401-discovering_a_new_earth_430_light_years_away.htm

Shallow Sky
Continued from page 3

perturbed away by some other passing planet and ended up on a collision course with Earth: the impact thought to have created the moon, discussed by Dr. Kevin Zahnle at SJAA a few months ago.

Which brings me to the excuse for last month's press release. The STEREO pair aren't really that close to Earth's theoretical L4 and L5 points — STEREO A will make its closest pass to L4 in September, while STEREO B passes closest to L5 in October.

So why was there a press release about this in April? Well, the spacecraft have just started to scan the regions with their cameras looking for asteroid-sized leftovers from Theia. They haven't found anything yet ... but as we move toward September and October, they should get increasingly better views of the region, and it should be interesting to see what they find.

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

June 20-24 - Golden State Star Party - http://www.goldenstatestarparty.blogspot.com/

July 22 - Total Solar Eclipse; Asia and Pacific Ocean. Next one is July 11, 2011

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

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	M83	13h 37m 00s	-29° 53' 04"
Great barred spiral galaxy in Hydra. Mag 8.2			
Medium	N5084	13h 20m 16s	-21° 49' 39"
Elongated galaxy with bright nucleus - in Virgo. Mag 11.6.			
Difficult	N5134	13h 25m 18s	-21° 08' 04"
Fairly large oval galaxy with mottled halo - Vir. Mag. 12.1			

Q: How many stars are within 10 light-years of Earth?
A: 10 counting the sun and all components of double stars. Add just two more light-years and the number is 30. (RASC 2009, pg. 291)

"I think that the story of the creation of the universe is the most inspiring and exciting story science can tell." – Sandra Faber, UC- Santa Cruz astronomer who discovered the flaw in the Hubble Space Telescope, leading to its first repair in 1993.

Publication Statement
SJAA Ephemeris, newsletter of the San Jose Astronomical Association, is published monthly.

San Jose Astronomical Association,
P.O. Box 28243
San Jose, CA 95159-8243

The SJAA Ephemeris is published in three formats: hardcopy, Adobe Acrobat PDF, and HTML. The PDF and HTML versions are found at http://ephemeris.sjaa.net.

Articles for publication should be submitted by the 10th of the previous month. The PDF version is generally available by the 24th of the previous month and the HTML version by the last day of the previous month.

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