SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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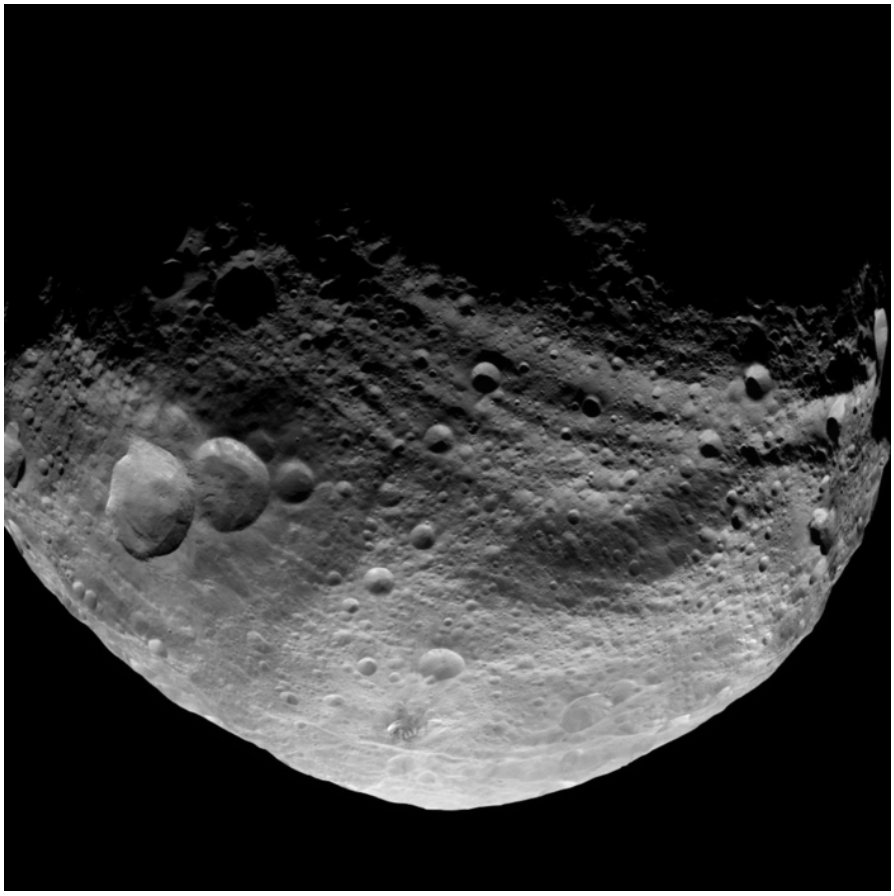

NASA's Dawn spacecraft obtained this image with its framing camera on July 23, 2011. It was taken from a distance of about 3,200 miles (5,200 kilometers) away from the giant asteroid Vesta. Dawn entered orbit around Vesta on July 15 and will stay for one year before moving on to the dwarf planet Ceres. Image credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

OCA CLUB MEETING

The free and open club meeting will be held August 12th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, our featured speaker is Robert Stevens from the Center for Solar System Discoveries discussing *Amateur Astronomers in the Age of Discovery*

NEXT MEETINGS:
September 9th, October 16th

STAR PARTIES

The Black Star Canyon site will be open on August 20th. The Anza site will be open on August 27th. Members are encouraged to check the website calendar, for the latest updates on star parties and other events.

Please check the website calendar for the outreach events this month! Volunteers are always welcome!

You are also reminded to check the web site frequently for updates to the calendar of events and other club news.

COMING UP

The next session of the Beginners Class will be held on Friday, August 5th at the Heritage Museum of Orange County (formerly the Centennial Heritage Museum) at 3101 West Harvard Street in Santa Ana. Next month the class will be offered on August 5th.
GOTO SIG: TBA
Astro-Imagers SIG: Aug. 16th, Sept. 20th, Oct. 20th
Remote Telescopes: TBA
Astrophysics SIG: Aug. 19th, Sept. 16th, Oct. 9th
Dark Sky Group: TBA

Around OCA for August, 2011

By Barbara Toy, OCA Observatory Custodian and Member Liaison

As this is written, we've had the first Star Party in July but not the second, which is this year's annual Starbecue. The first July Star party was notable as one of those "you should've been here last night" times out at Anza. Friday, which was when we had the "How To Use Your Telescope" class, was clear, warm and generally a delight. Saturday night, the night of the star party, started off clear but we had increasing issues with clouds over the course of the evening as the monsoon condition developed. Sunday night, which a lot of people had high hopes for as Monday was a holiday, proved to be even worse. Right now – the weekend before the Starbecue – the weather is looking great, but there are some indications that another monsoon condition may be moving in…raising concerns that area all too familiar as we approach a star party!

The Clear Sky Charts:

I've noticed over years of conversations at club events and discussions in the club's e-mail groups that an interest in amateur astronomy seems to result in an almost equally intense interest in weather forecasting. I know I've become a lot more conscious of weather patterns and conditions since I started looking at what is up in the night sky for myself, but I'm definitely on the low end of expertise in this area. There's one club member I know of who has a degree in meteorology and whose observations about the weather are always valuable, and others who have delved into what is going on behind our weather pretty deeply on amateur basis, some of whom have their own weather stations. With the resources available on the Internet, many of us rely on multiple websites as we try to work out our best guess for what weather to expect when we are planning a night under the stars, starting with the Clear Sky Chart.

Just in case some of you haven't been using this excellent weather tool that you can access from the homepage of the club website, here's a brief primer:

The icons for the Clear Sky Chart (CSC), formerly known as the Clear Sky Clock, are on the left side of the homepage, one for Anza and one for Black Star Canyon. If you click on one, you'll go to the CSC page for that location; the charts displayed on these pages are generated through a script written by Attilla Danko, an amateur astronomer in the Ottawa area, using forecast maps generated by the Canadian Meteorological Center. The boxes on the charts show the expected conditions at the times shown at the top of each column by color code, and time runs from earlier on the left to later on the right based on a 24 hour clock. If you scroll down on the CSC page, you'll find a lot of information about how to interpret what's in the little boxes on the charts. You can also enable a pop-up that will give you numerical values for each of the boxes as you mouse over them. Generally, the redder a box the worse it is for us for that condition at that time, and the bluer the box the better it is.

If you want to see the entire map a particular box is based on, double-click on the box. You can access the entire sequence of maps and animate them, to get a better idea of how the forecasters think things will develop for the different conditions covered by the CSC (cloud cover, transparency, seeing, wind, humidity and temperature). I've also used the maps to get a better idea of how close our site is to what is forecast as better or worse conditions, as the resolution of the specific charts is pretty large.

You may notice sponsors listed in a box on the upper left of the CSC page. These are generally fellow club members who have paid to sponsor that page, which has the benefit of getting us faster updates. Neither Attilla nor the Canadian Meteorological Center charge us to use the CSC, but there are costs involved in generating the CSCs and the contributions these sponsors make help keep the service going. So, please thank the sponsors you see listed and think about becoming a sponsor yourself (there can be more than one at a time). As I write this, Tom Munnecke is the current sponsor for the Anza page, and we have no sponsor for the Black Star Canyon page (which is still titled for our original Silverado observing site). The sponsors are all listed on Attilla's sponsor page, **http://cleardarksky.com/csk/sponsors.html**, as well as having an acknowledgment show up on the sponsored page. Attilla's sponsor page also has the information about how to become a sponsor.

By the way, if you want a bit of entertainment or to learn more about Attillo Danko, there are links to his website on the CSC pages and other pages you can access through them. Also, you can access full indices of CSCs that he is generating through the links on the upper right of the CSC pages (which you can do by distance from the site for the CSC you're on or you can go to the entire index of locations, which can be helpful if you want to observe outside your usual area). He's got CSCs for all of the major regional star parties as well as club and observatory sites, and is willing to generate more if people send him a request (which is why there are a lot of listings for private observatories).

For current weather, there is also a link to the weather station at Anza on the right side of our website homepage. That is one of the services that Charlie Oostdyk maintains, so please let him know if you find it useful.

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TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE

2 A Supernova

By Helen Mahoney

Supernovae are very special to my family. My husband Doug Millar co-discovered SN 1994i in M-51 (along with past OCA president Wayne Johnson), and my son Robert Quimby made Supernovae the subject of his doctoral dissertation, and continues to conduct research on them.

Supernovae are brilliant explosions at the end of the life of massive stars. They give off so much light, that they can outshine all the light of all the other stars in a galaxy. The forces within them are powerful enough to form new elements (in fact, almost all of the elements with a mass greater than Helium were made in supernovae), and the shock waves they produce help to start the process of new stellar formation.

Seeing a supernova is not that easy. It is estimated from supernovae remnants that the Milky Way galaxy has about 2-3 per century. The last one to happen in our own Milky Way galaxy was about 140 years ago, and it was obscured by dust at the center of the galaxy. It was only identified in 2008 by X-ray images from the Chandra X-ray Observatory.

Supernova in M51 imaged June 12, 2011 (Don Lynn)

Most of the supernovae we see are in other galaxies. On April 1, 1994, Doug and Wayne were using the OCA's Kuhn telescope with a Starlight Express CCD camera attached to the 4 inch finder scope. They slewed the Kuhn around to photograph M 51. When they downloaded the image, Doug noticed that there was something different about the stars visible in the field. They compared the image to those in Burnham's Celestial Handbook and other books with galaxy photos. They took several more pictures to confirm its position and that it was not moving. When they were convinced that they had discovered a supernova, they called Palomar Observatory to inform them. It was April Fool's Day, but being OCA observers gave them credibility. Palomar put the 200 inch on it and confirmed that it was indeed Supernova 1994i. Another supernova (2005cs) was found in M51 only 11 years later.

The first supernova I was able to see was the first of many discovered by my son Robert. He found it on Thanksgiving Day in 2004. In a tiny, distant galaxy in Virgo called IC 3311, SN2004gk was magnitude 13.8. I had to see it. On December 12, Doug and I went to Anza, where Dave Radosevich treated us to a view through his 24 inch scope. The supernova was easy to see, but the galaxy could only be seen with averted vision; the entire galaxy being less bright than the supernova! Many people got images of the supernova, but few were lucky enough to see it visually as I had. In a display of serendipity, as I was putting down some ideas for this article, yet another supernova (SN2011dh) was discovered in M-51. (I had been observing M51 from RTMC just a few days before the discovery. I couldn't help but think how cool it would have been if it had been I that discovered another supernova in the same galaxy as my husband!) When I heard about it, and that it was about magnitude 13, I thought that I had a good chance of seeing another one. My good friends, OCA members Bill and Suzanne Hall, said they had seen it at Anza, and also from their backyard. Their home in Orange County has a much darker sky than mine in Long Beach.

Somewhere in between twilight and the arrival of the marine layer was the golden window in which 2011dh was visible. Using their Orion 12 inch f/4.9 Dobsonian, I stared at M 51 and saw the spiral arms. It helped that Bill had another telescope with a CCD camera hooked up nearby, so we could see the location of the supernova compared to the galaxy and the Milky Way foreground stars. I stared at the galaxy center and, with averted vision, the foreground stars popped into view, and along with them was the extra star—which was the supernova! I watched for a long time to be sure I wasn't seeing it with averted imagination. It was really there!

Although SN2011dh is fading, it may still be visible by the time this article is published. If it is, I encourage you to try to see or photograph it. While imaging it is fun and leaves you with a lasting documentation of the supernova, there is nothing like seeing with your own eyes the light of a single star that travelled over millions and millions of light years. A star that exploded in a magnificent death a long, long time ago in a galaxy far, far away.

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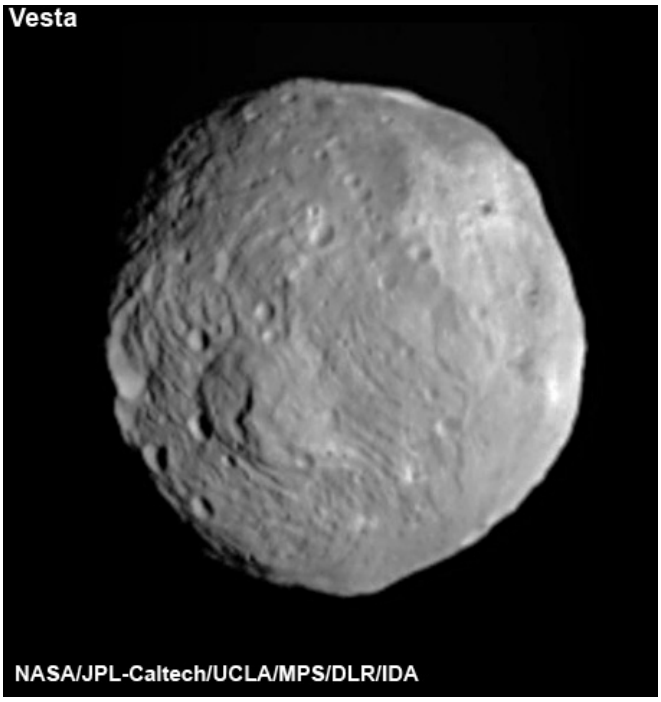
AstroSpace Update

August 2011
Gathered by Don Lynn from NASA and other sources

Integral (European orbiting gamma-ray telescope) has placed stringent new limits on the size of quantum "grains" in space, showing them to be smaller than some quantum gravity theories suggest. Quantum gravity theories attempt to reconcile General Relativity, which considers space as continuous, with quantum theory, which implies space should be made up of some minimum size "grains". Calculations have shown that those quantum grains should twist the polarization (direction of vibration) of extremely high energy photons (gamma rays) when they traverse extremely large distances. The Integral measurements show no measurable difference in polarization between low and high energy gamma rays emanating from a very bright and distant gamma-ray burst. To have negligible effect on this measurement, the quantum grain size would have to be smaller than 10^{-48} meter, much smaller than many quantum gravity theories, including some versions of string theory. Some theories had put the quantum grain size at the Planck scale, 10^{-35} meter, but that is now ruled out.

Herschel (European orbiting infrared telescope) has detected huge amounts of dust expelled by supernova 1987A, dust weighing in the range of 160,000 to 230,000 times the mass of the Earth. It has been known for some time that the early Universe quickly filled with dust, but the source has been a mystery. Previous attempts to measure the dust expelled by supernovas came up short of the amount seen in the early Universe. But the previous measurements had been made in shorter wavelength infrared than Herschel is capable of seeing, and colder dust emits infrared at longer wavelengths. So the new measurement implies that supernovas expel enough dust to account for that seen in the early Universe, but it was just too cold to see in previous observations. The discovery of the dust was made accidentally during planned observations of the Large Magellanic Cloud, a neighboring galaxy that was the location of 1987A.

Neutrinos – A Japanese experiment has produced evidence that muon neutrinos change into electron neutrinos. Changes between these and the 3rd type of neutrino (tauon neutrino) have been seen in the past, so this completes observational evidence for the theory that all types of neutrinos can oscillate into the other types. Only 6 electron neutrinos had been detected by the time that the experiment was shut down by damage from the March earthquake in Japan. This is not as strong a proof as scientists would like. A few days later, scientists from the Fermilab in Illinois announced they also had detected the same neutrino change, and in greater quantity (because they ran more neutrinos through the experiment.) The rate at which the oscillation occurred was measured to be slightly lower than the Japanese experiment. Also the observations did not match theory, unless CP violation exists in neutrino oscillation. The "C" part of CP violation refers to antiparticle symmetry, which says that the same behavior should occur in antiparticles as happens with particles. Particle physicists have long been looking for CP violation because the fact that the Universe is filled with matter far in excess of antimatter implies the CP violation occurred when the Universe was created. The very few CP violations discovered in the past (such as with kaon particles) simply don't explain our Universe of matter. Also measuring the rate at which neutrino oscillation occurs will allow calculating limits on the masses of the 3 types of neutrinos. Those masses are so small that they have not been accurately measured yet. Theory has it that there are either 2 light neutrinos and 1 heavy one, or vice versa. So you can bet that further experiments in neutrino oscillation will be performed.

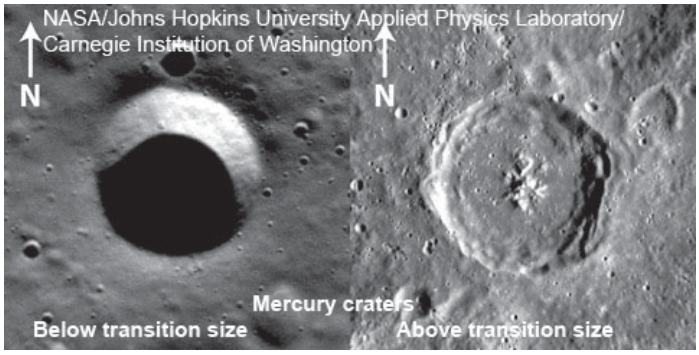


Dawn – On July 15 Dawn went into orbit about the main-belt asteroid Vesta, a first (though near-Earth [non-main-belt] asteroids Eros and Itokawa have been orbited). Expect a lot of great pictures of Vesta over the next year of planned orbiting. Dawn will also orbit main-belt asteroid (and dwarf planet) Ceres in 2015. Dawn is powered by ion engines, which provide weak but long-lasting thrust, so it has been slowing down to Vesta's speed for months, unlike other spacecraft that go into orbit by means of minutes of rocket burn.

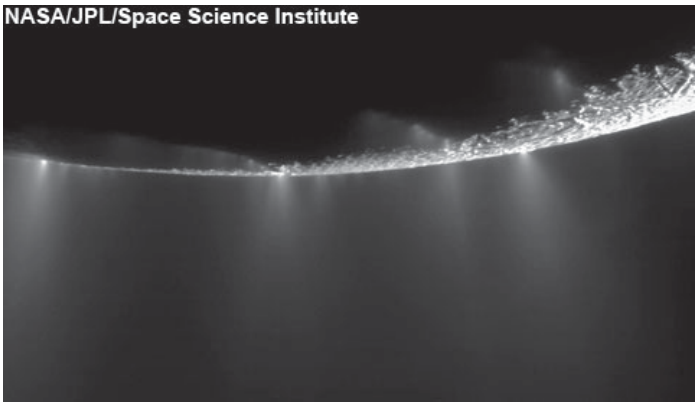
Messenger (Mercury mission) has completed ¼ of its primary mission of orbiting Mercury for a year (Earth year). Data returned include global images (over 20,000 of them), measurements of surface chemical composition, topography, evidence supporting water ice existing at the poles, and magnetic field and solar wind measurements.

- Earth-based radar decades ago appeared to show water ice near the poles. New Messenger data show that there are craters deep enough near the poles so that their depths are permanently in shadow. This could allow water ice to persist even though Mercury is generally a very hot planet.
- Messenger has discovered vast volcanic plains, much in the northernmost regions, where lava flows have nearly covered pre-existing craters. The broad expanse of these plains implies that volcanism continued through much of Mercury's history. Theory had implied that the overall contraction of the planet evidenced by many features should have impeded continued flow of volcanic material to the surface, but apparently this was not significant.

• The spacecraft has confirmed that bursts of particles in Mercury's magnetosphere result from interactions of the solar wind with the planet's magnetic field. As a result of the north-south asymmetry in the planet's internal magnetic field, the geometry of magnetic field lines is different at the north and south polar regions. The area between lines that is open to the interplanetary medium is much larger near the south pole. So the south polar region is much more exposed to charge particles. The impact of those charge particles onto Mercury's surface contributes to the generation of the planet's tenuous atmosphere and to the "space weathering" of surface materials. The magnetic equator was found to be well north of the planet's geographic equator. It appears that the magnetic field is off center by about 300 miles (480 km).
• Imaging is filling in the north polar regions that had been previously unseen.
• Among the unusual features seen during flybys were bright patchy deposits on some crater floors. Higher resolution images from orbit reveal these patchy deposits to be clusters of rimless, irregular pits ranging in size from hundreds of yards (meters) to several miles (km). These pits are often surrounded by diffuse halos of higher-reflectance material, and they are found near central peaks, peak rings, and rims of craters. The appearance of these landforms is unlike anything seen before. Astronomers are still debating their origin.
• Ratios of various elements on the surface show that, unlike the Moon, Mercury's surface is not dominated by feldspar-rich rocks.
• Observations also reveal substantial amounts of sulfur. This suggests that the material from which Mercury was assembled may have been less oxidized than that which formed the other terrestrial planets. The sulfur may have contributed to past explosive volcanic activity on Mercury.
• The overall range of heights was measured to exceed 5 ½ miles (9 km).
• When Mariner 10 flew by Mercury in 1974, a few bursts of energetic particles were seen in the magnetosphere. Puzzlingly no such strong events were seen during the 3 flybys made by Messenger. But from orbit, these events have been seen regularly. The generation and distribution of particles (principally electrons) in the magnetosphere are different from those in the Earth's magnetosphere, due to Mercury's smaller magnetosphere and its lack of substantial atmosphere. More study is needed to determine the mechanism that generates the energetic Mercurial electrons.
• The ratio of potassium to thorium was found to be similar to that of other terrestrial planets; theory had said that volatiles should have been depleted in Mercury due to higher temperature during formation, but that would have changed the potassium/thorium ration.
• There is a particular size of impact crater (called transition size), different for different planets, at which the shape changes from bowl shaped to flat-bottomed with possible central peak. This transition size has now been measured for Mercury at 6-7 miles (10-12 km). At Mars it is only 4-5 miles (6-8 km), even though the surface gravity of the 2 planets is nearly the same. This implies that either the average speed of impact (known to be greater at Mercury) affects the transition size, or else the surface material strength of Mercury is much different than Mars.



Neptune rotation – An astronomer at the University of Arizona believes he has made the 1st very accurate measurement of Neptune's rotation period. Astronomers had long believed that measuring the rotation by timing radio signals from the magnetic field was the most accurate method for gas giants. Since cloud features on gas giants move among themselves, timing the only visible features (clouds) was clearly not very accurate. But the recent discovery that Saturn's magnetic field rotation varies somewhat (about 1%) has called into question the accuracy of the radio method. Apparently the magnetic field, at least at Saturn and possibly at all gas giants, gets kicked around by external forces, so does not keep synchronized with the core of the planet. The astronomer doing the new work noticed that 8 cloud features of Neptune kept synchronized with each other, and he believes that is because they are staying synchronized with the core rotation. Those features also have varied rotation speed very little over the years. Two of those cloud features, the South Polar Feature and the South Polar Wave, have been tracked for more than 20 years in archived images from the Hubble Space Telescope. Using these he calculates the rotation period as 15.9663 hours. This is almost 1% shorter than the 16.11 hours measured from the magnetic field. Most clouds in the polar areas rotate in about 12 hours, and most in the equatorial regions in about 18 hours.



Cassini (Saturn orbiter) has discovered the best evidence yet for a large-scale saltwater reservoir beneath the icy crust of Saturn's moon Enceladus. The spacecraft analyzed salt-rich grains that it collected flying over the geysers on the moon. Grains closest to Enceladus were rich in sodium and potassium, indicating that most, if not all, of the expelled ice and water vapor comes from the evaporation of liquid salt water. If the plumes emanated from ice rather than liquid, they should have very little salt in them. The data suggest a layer of water between the moon's rocky core and its icy mantle, possibly as deep as about 50 miles (80 km) beneath the surface. The water dissolved salt from the core and

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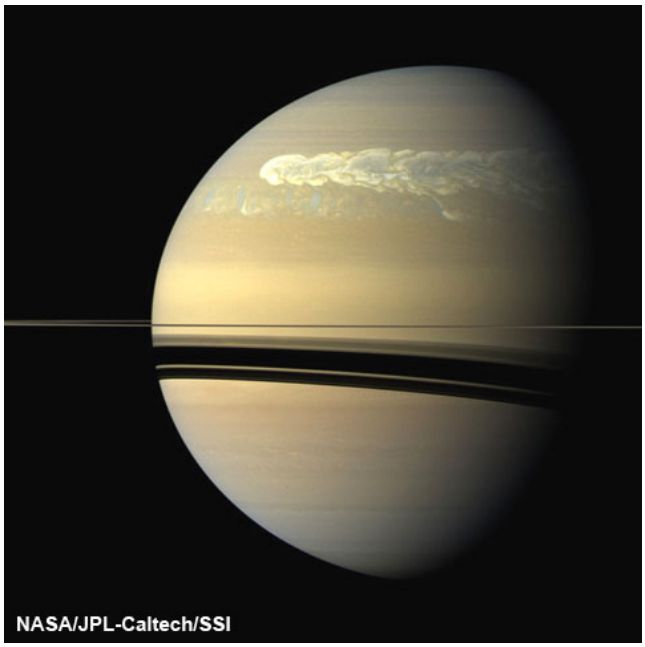
rises through fractures in the overlying ice to form reserves nearer the surface. When the outermost layer cracks open, the decrease in pressure from these reserves causes a plume to shoot out.



Cassini data show the first-ever closeup of a Saturn storm that is 8 times the surface area of Earth. The storm was first detected last December, and has just grown since then. Clouds from the storm have been swept by jet streams entirely around the planet, making a new stripe about 35 degrees north latitude. The storm is 500 times as large and has lightning strikes 10 times as often as any seen previously by Cassini. The only other Saturnian storm of about this size was seen in 1990, but that occurred when no spacecraft was at the planet, so had to be observed from Earth. When this storm was first seen, notice was sent to the amateur astronomy community to submit images of Saturn, and this has resulted in a good record of the growth and development of the storm. Storms on Saturn generally occur in the mid latitudes having summer. Storms seen early in Cassini's mission were in the southern hemisphere, but they have switched to the north since northern Saturnian spring began.

Rocky exoplanet – Using gravitational microlensing, astronomers have discovered an exoplanet just over 10 Earth masses that is likely rocky (as opposed to gas giant or other). It is orbiting a star with roughly ½ the mass of the Sun at a distance of 3.2 AUs (Astronomical Units), or about where the asteroid belt is in our solar system. It is 1 of the 1st planets in this mass range beyond the "snow line", the distance during formation of a planetary system beyond which ice can form due to temperature. It is expected that presence of ice assists in the formation of planets by adding solid material to the planetary core. Simulations of planet formation predict that at this distance the core should rapidly grow to about 10 Earth masses. Such planets can go through a gas accumulation phase then to become gas giants. But this newly found planet apparently did not become a gas giant. Theory says that smaller stars should produce fewer planets that go through the gas accumulation phase, due to length of time before the gas around the star dissipates.

Binary star planetary system – Astronomers have found evidence for the existence of an unusual planetary system where 2 giant planets are orbiting a close pair of stars. The stars are a red dwarf and a white dwarf, each smaller than our Sun. They are so close that they take only a couple of hours to orbit each other. The stars are so close that the pair would fit within our Sun. By chance, the system is oriented such that the stars eclipse each other every orbit as viewed from Earth. Astronomers noted that the eclipses were not occurring on time, sometimes too early or late. This led them to hypothesize that planets were causing the stars' orbit to wobble and consequently slightly alter the eclipse times. They were able to calculate that such planets would have to be at least 6 and 8 times the mass of Jupiter, and that they take 16 and 5 years respectively to orbit the 2 stars. Due to the closeness of the stars, the gravity of the white dwarf is constantly stealing material from the surface of the red dwarf. This stream crashes onto the white dwarf, where it gets heated to millions of degrees and subsequently floods the entire planetary system with enormous amounts of X-rays.

Triple star planet – A planet has been found orbiting the most distantly orbiting member of a triple star, HD 132563. This is only the 8th planetary system orbiting a multiple star (more than 2) system. Various methods to determine the age of the triple star result in widely different ages, all in the range of 1-5 billion years. In any case, the planet apparently has been orbiting more than a billion years, undisturbed by the other 2 stars in the system. Although only 8 cases are small to reach conclusions, it says that planets in distantly orbiting multiple star systems are roughly as common as those at single stars or at distantly orbiting double stars.

Kepler planet confirmed – The Kepler spacecraft has reported over 1200 planet candidates, based on the apparent transits in front of stars. But because other causes can make what appear to be transits, these candidates must be confirmed by other methods. The 16th to be so confirmed was announced. It was confirmed by the Hobby-Eberly Telescope in Texas, which found the wobble induced in the star by the planet's gravity. The new planet has a mass 2/3 that of Jupiter, a diameter 96% that of Jupiter, and a mean density of about 90% that of water. Its year is only 4.94 Earth days. Its star is quite rich in heavy elements. The Hobby-Eberly spectrograph is being upgraded so that it can detect smaller wobbles in stars, and therefore will be usable to find or confirm smaller planets.

Most distant quasar – A team of astronomers has discovered a bright quasar so distant that we are seeing it as it was only 770 million years after the Big Bang, making it the most distant one known. Its light has been on its way to us for 94% of the age of the Universe. Its redshift is 7.1; that is, features in its spectrum are stretched to 8.1 times the original wavelength. The quasar was 1st spotted by the UK infrared Telescope in Hawaii during a search of over 10 million infrared sources. The quasar is powered by material falling into a black hole of about 2 million times the mass of our Sun. Theorists are having trouble explaining how such a massive black hole can form so soon after the Big Bang. This quasar may help pin down the time of reionization, the time when most of the hydrogen gas in the Universe became ionized (lost electrons, probably due to ultraviolet light). Hydrogen gas immediately in front

of the newly found quasar was found to be partly ionized, perhaps 50 to 90%. Only 100 million years later the light passed through clouds that were 99.9% ionized.

Galaxy growth – A new study using the Spitzer infrared space telescope has determined that galaxies in the distant early Universe ingested their star-making gas over longer periods of time than theorists had predicted. A typical galaxy fed itself on a steady stream of gas for periods of hundreds of millions of years, all the while making stars at a prodigious rate (about 100 times the rate that our Milky Way forms stars today). This appears to contradict the theory that much early galaxy growth was the result of galaxy collisions. Such collisions produce star formation for shorter periods than that measured in the new study. Instead infalling gas appears to be the principal contributor to galaxy growth. This conclusion was based on Spitzer observations of more than 70 remote galaxies that existed 1-2 billion years after the Big Bang. 70% of the galaxies were blazing with hydrogen gas emitting H alpha light, an indication of star formation. Only 0.1% of galaxies today show this type of glow. Previous studies done in ultraviolet to assess the rate of new star formation in early galaxies had found 6 times less of it. Apparently dust was keeping us from seeing all the star formation in ultraviolet. Infrared penetrates such dust better than ultraviolet.

Galaxy star formation – Astronomers have probed the distant Universe and discovered that galaxies are either actively forming stars or are forming nearly no stars, with nothing in between. Galaxies in the nearby Universe have already been known to behave in just these 2 ways, but this new work confirms that the same occurred early in the history of the Universe. Galaxies were observed up to distances that required 12 billion years for the light to reach us. It is believed that something abruptly shuts off star formation at some point, resulting in only these 2 behaviors. It surprised theorists that shut down had occurred in some galaxies as long ago as 12 billion years. The study was done on the 4-meter telescope on Kitt Peak in Arizona, using a new set of filters that sorted out certain wavelengths at different distances. 40,000 galaxies were studied. In the early Universe, many more galaxies were in the star-forming state than the idle state. Today this is reversed.

Water bullets – 750 light-years from Earth, a young sunlike star has been found with jets that blast epic quantities of water into space, shooting droplets about 80 times faster than a bullet. The discovery suggests that such protostars may be seeding the Universe with water. The amount shooting out equals 100 million times the water flowing through the Amazon River. The protostar is in Perseus and is no more than 100,000 years old. It was found in infrared by the Herschel space telescope, since infrared penetrates the large cloud of gas and dust surrounding it. Jets spew out the water as hot vapor, which condenses to liquid when it hits cooler surrounding material. Sunlike stars probably all undergo such a very energetic phase when they are young.

Sunspot cycle – Astronomers have cited unusual behavior in our Sun as it builds up toward the next peak in its sunspot cycle. Some astronomers believe that this behavior means that this or the next cycle may be weak or nonexistent. A complete stoppage of the sunspot cycle is disputed by many astronomers, who point out that we have never seen behavior like this since it became possible to measure it, and so we don't know what it means. However there is precedence in that sunspots essentially disappeared for about 70 years once in the recorded history of observing sunspots, in the late 1600s and early 1700s. The particular behaviors cited are: Jet streams that lie beneath the surface of the Sun below sunspot activity have disappeared (they are detected by study of surface vibrations, or helioseismology), slower movement of other jet streams, and a steady drop in the strength of magnetic fields inside sunspots.

XMM-Newton (European orbiting X-ray telescope) has watched a faint neutron star flare up in X-rays to almost 10,000 times its normal brightness. Astronomers believe the outburst was caused by the star trying to eat a giant clump of matter that came from its enormous blue supergiant companion star. The flare lasted 4 hours. As the gas fell in, it was heated to millions of degrees, which caused it to emit X-rays. The clump was so big that most of it actually missed the neutron star. All stars expel atoms into space, creating a stellar wind. The X-ray flare shows that this particular blue supergiant does this in a clumpy fashion.

Binary white dwarfs – Astronomers have discovered a pair of white dwarf stars spiraling into one another at huge speeds, up to 370 miles/second (600 km/s). They complete an orbit every 13 minutes, and their orbit is oriented such that we on Earth see each star eclipse the other during every orbit. They should be losing energy to emitted gravity waves, and so are expected to fall into each other in about 900,000 years. The 2 stars are about ¼ and ½ the mass of our Sun. The stars are too close to distinguish in images, but their separate spectra can be seen. The stars appear not to be exchanging mass, so careful measurements of changes in their orbit should show us how much energy is being lost to gravity waves (since none is lost to mass exchange), thus should be good test of General Relativity, which predicts gravity waves. This measurement will be made over the next several months. One theory predicts that merging of stars in this mass range will produce an underluminous supernova, an unusual exploding star with too little light to fit the ordinary categories of supernova. I guess we will be able to verify this in 900,000 years.

Nearby brown dwarfs – Scientists have discovered 2 new brown dwarf stars only 15 and 18 light-years away. The nearest known brown dwarf is about 12 light-years distant, but new ones are being discovered frequently. The new discoveries stood out in WISE (infrared space telescope) data, because they were bright in infrared, but almost invisible in visible light. Both were moving rapidly across the sky (proper motion), so were immediately believed to be nearby. Both are in the T class of brown dwarf, but so cool that they are near the boundary of the proposed (cooler) Y class. Brown dwarfs are failed stars, ones with too little mass to sustain nuclear fusion that powers normal stars.

Chandra (orbiting X-ray telescope) – Using the deepest X-ray image ever taken, astronomers found the 1st direct evidence that massive black holes were common in the early Universe. This shows that very young black holes grew more aggressively than previously thought. Chandra made the deep image, known as the Chandra Deep Field South, by pointing to a patch of sky for more

(continued on page 10)

(continued from page 2)

A lot of members have favorite weather websites besides the CSC; Weather Underground comes to mind. I'm interested in what sites you've found particularly helpful – please let me know what sites you use and give any comments you have about their reliability at **btoy@cox.net**.

Dark Sky Group

As you may have noticed on the club contact page, the club has a Dark Sky special-interest group, at least on paper. There is an associated e-mail group, OCAdarksky@yahoogroups.com, which is open to all people interested in dark sky issues, not just to OCA members.

One of the people who has been on the email group from the beginning is Scott Kardel during his tenure at Palomar Observatory, who has periodically advised us about events, conditions and issues in San Diego County that could affect our skies as well as those of Palomar. Scott recently sent out notice that he has left Palomar, where he will be sorely missed, to take up a position with IDA in Tucson, his hometown. While we are all sorry he will no longer be with Palomar, where he developed the docent program among his many innovations to improve relations between the observatories and the public and increase awareness of Palomar as a tremendous resource in the surrounding areas, I expect that his involvement with IDA will really help with efforts to improve night sky conditions and reduce light pollution in general.

When I started the Dark Sky group, I hoped that I would have more time to devote to dark sky activities, including education, monitoring local conditions, possibly encouraging passage of ordinances controlling light trespass and giving better standards for outside lighting, and also helping with practical issues on a day-to-day basis, such as recommendations of good light fixtures that club members or others who are interested in these issues could use, and helping members deal with lighting issues with neighbors. As one of the largest astronomy clubs in the country, it seemed to me that we should have an active presence in this area and that we should have more resources within the club to help members who need assistance with lighting issues.

Unfortunately, I never had the time to devote to this group that it needs for it to be a success. My time for this kind of activity has become even more restricted in my current job, and I don't see any point in the foreseeable future when I will have time to devote to building this group and its activities. I'm hoping that there is at least one person among you who has an interest in pursuing these issues and time to do what's needed to make the group effective, who would be willing to take on the position of Dark Sky Coordinator for the club. If you would be interested in doing this, or would like to discuss what might be involved further with me, please contact me at **btoy@cox.net**.

Pacific Astronomy and Telescope Show (PATS) Is Coming in September…

…September 17th and 18th, to be precise. This is organized by the same fine folks that have brought us the RTMC Astronomy Expo and Nightfall, but, unlike the other two events, it is indoors at the Pasadena Convention Center and generally free of dust and the risk of sunburn, unless you court the latter by spending a lot of time with the solar scopes they set up outside the building.

Some of you may have heard of NEAF (Northeast Astronomy Forum), the big astronomy expo that takes place in New York in April and just celebrated its 20th year. It's mainly known for its vast array of vendors, many of whom use NEAF to introduce new products. PATS is similar, in that its primary emphasis is vendors and talks and not stargazing, though it is not yet as large as the East Coast conference – this is only its 4th year, after all. Of course, it has its own West Coast influences, and is attracting an increasing number of related events. In the last couple years, these have included an astroimaging conference on the day before PATS starts; I don't know at this point if that will be offered again this year. If you haven't tried PATS out yet, you should really plan to attend this year. Although a lot of us think first about the vendors, there are also always a lot of interesting talks at PATS. Be sure to get a copy of the final schedule for the talks and various events occurring in the vendor area when you arrive (these include individual vendor raffles), and check it for any talks you are interested in so you can be sure not to miss them. Sometimes they are able to post the schedule on the website in advance, but I don't know if they will be able to do that this year.

For more information, check the PATS website at **http://www.rtmcastronomyexpo.org/PATS.htm**. The address for the Pasadena Convention Center is 300 E. Green Street, Pasadena, CA 91101. *(Editor's Note: discount tickets are available - see bottom of page 11 for details)*

Our club has had a booth at PATS every year since it started in 2008, and we will have one at the 2011 PATS as well. If you can help out with our booth at all during your time at the conference, please contact me at **btoy@cox.net** or contact Alan

Smallbone at **asmallbone@earthlink.net**. Alan and I can only be there on Saturday, and we will especially need help for Sunday, including someone to bring back the club banners, posters, etc., from the booth.

In the past few months, we've sent out requests for assistance with RTMC (we ultimately did not have a booth there this year as we did not have enough volunteers) and the Southern California Astronomy Expo (SCAE) at OPT. In case you are wondering about what is involved with helping out with our booth, here are the basics: The main purpose for us to have a booth at these events is to let people know about our club, connect with members who may be there, and also show support for these events. At a minimum, we try to have some club flyers available for information and as give-aways (sometimes we have cards, as well), and we try to have other things in or around the booth to attract attention and help show interesting aspects of our club. These include posters showing scenes from Anza and other club events, and Bob Buchheim has designed some new ones for us this year.

We have also had a photo book of prints provided by members of our AstroImage SIG, which we've been using at SCAE and PATS. This has proven a great success, as people really enjoy leafing through it and often have questions or comments about the different images, which can then lead to a discussion about the club and its activities. At PATS, we also usually run a slide show that shows different shots of club activities as well as astroimages and also provides information about the club; that hasn't been an option at other venues, as the slides don't show up well outdoors, even under a canopy. Wally Pacholka has also been very generous in past years in allowing us to use some of his prints to dress up our booth at PATS, and they are also good at grabbing the attention of people walking by.

Although one person could usually handle the traffic the booth gets, we find that it's generally better for all concerned to have at least a couple people in the booth, so they can support each other and also handle those times when we get a bunch of people all at the same time. Their usual role is to answer questions about the club, promote club activities and encourage people to join. Along the way, we often get questions about different aspects of astronomy, queries about members (past as well as present) and questions about various astronomical events, among other things. The people in the booth often get to connect with past members, particularly people who moved out of our area so they couldn't participate in club activities; sometimes we see people who dropped out of astronomy for a while but who are finding a new interest in it and may wind up re-joining the club. Working in the booth also lets you get to know people in surrounding booths (we were next to the Mt. Wilson booth after the Station fire, which was really interesting), connect with people in other clubs, and chat with current club members who stop by to see out what's going on.

If we have enough volunteers, the booth can be covered all day with each volunteer only putting in one or two hours so everyone can also spend time on other activities. So, if you're planning to go to PATS, please help us out with the booth for an hour or more – those of us who regularly handle the booth would really appreciate not having to do it as an all-day affair!

And I hope to see all of you out at PATS this year!

Magazine Subscriptions

Subscriptions to the Astronomy magazines are now due for renewal, if you subscribed for one year or would like to subscribe at the club rate. You may also extend an existing subscription that does not end in December for one year at the club rate. Bring your check made out to the OCA to the meeting or mail it to: Charlie Oostdyk, Orange County Astronomers, PO Box 1762, Costa Mesa, CA 92628. *Checks made out to the magazine publishers cannot be processed and will be returned to you.* If you already subscribe, please provide the mailing label or the billing invoice with your check. One-year rates are as follows:

	Club Rate	Regular Rate
Sky & Telescope*	**$33.00**	**$37.95**
ASTRONOMY	**$34.00**	**$42.95**

***Sky & Telescope subscribers please note: Due to a change by the publisher, renewals of current subscriptions should now be made directly through Sky and Telescope! New subscriptions at the club rate must still be made through Orange County Astronomers and then renewed through the publisher.**

The DEADLINE for subscribing at the club rates will be the October monthly meeting, October 7th. The publishers will send expiration notices to all current club subscribers about November 1st even if you renew through the club. It takes the publishers a few weeks to process renewals.

than 6 weeks. The observations found that between 30% and 100% of the distant galaxies contain growing supermassive black holes. Astronomers believe that these black holes grew by a factor of 100 to 1000 to eventually become the giant black holes seen in galaxies today. A population of black holes in the early Universe had been predicted, but was not observed until now. Because these black holes are nearly all enshrouded in thick clouds of gas and dust, optical telescopes frequently cannot detect them. X-rays, however, penetrate these clouds. Physicists studying black holes want to know more how the 1st supermassive black holes were formed and how they grow. Although evidence for parallel growth of black holes and their galaxies has been established at closer distances, the new Chandra results show that this connection starts earlier than previously thought. It has been suggested that early black holes played an important role in reionizing hydrogen clouds that pervaded the early Universe. However, the Chandra study shows that blankets of dust and gas stop ultraviolet radiation generated by the black holes from traveling out to perform this reionization. Therefore stars, not growing black holes, are likely to have caused the reionization. The X-rays seen from the black holes in this study were so faint that they were not individually seen, but were detected statistically by counting X-ray photons near the positions of distant galaxies.

Gamma-ray flare star – An unusual binary star has been found to create a flare in gamma rays twice during each orbit about each other. The stars are a hot massive star and a fast-spinning pulsar, and they revolve once every 3.4 Earth years in an eccentric orbit. The hot star is surrounded by a disk of gas flowing out from its equatorial regions. The pulsar punches through the disk one direction shortly before closest approach, then the other direction after. Particles from the pulsar interact with the disk material and emit gamma rays. Its most recent close approach occurred last December. It was observed over a broad range of wavelengths. Radio and X-rays showed nothing unusual during the gamma-ray flare. Surprisingly the 2nd passage through the disk produced gamma rays 15 times as bright as the 1st passage. Only 3 other pairs of stars that flare in gamma rays on each orbit are known.

Gamma-ray non burst – An event that started March 28 and was at first thought to be a gamma-ray burst (GRB) (which is caused by a certain type of supernova) did not fit the pattern of a GRB. For one thing the event lasted more than 2 months. Also it occurred at the center of a galaxy, not in the star-producing areas. Further observations in X-rays and other wavelengths showed that it fit the pattern of a star falling into a black hole. The star would have to have about the mass of our Sun and the black hole about a million times that mass to fit the observations. Astronomers calculated that about 10% of the mass of the star was converted into X-rays as it swirled through an accretion disk into the black hole. Jets formed along the rotation axis of the black hole, which beamed out gamma rays. Apparently 1 of the jets happened to be pointed at Earth. Events that are probably stars falling into black holes have been seen before in most wavelengths of light (X-ray, ultraviolet, visible), but not in gamma rays. Probably the jets that produce the gamma rays have not been aimed at Earth in any of the previous such events, making this one quite rare.

Active galaxies – A 2nd study has shown that moderately active galaxies were mostly not triggered into that activity by galaxy collisions or mergers, contrary to the leading theory of active galaxies. This study looked at galaxies at all distances out to those whose light took 11 billion years to reach us, so showed that the conclusion has been true for the last 11 billion years. The previous study looked back only 8 billion years. Galaxies are active only when substantial material is falling into the black holes at their centers, giving off large amounts of radiation as the material falls, before actually entering the black hole. The new study looked at more than 600 active galaxies in a small patch of sky. The active galaxies were found using data from XMM-Newton (orbiting X-ray telescope), and then they were imaged and their distances measured by redshift from telescopes in Chile. Most of the active galaxies were found to be large massive ones with lots of dark matter. Mergers and collisions would make active galaxies mostly moderate mass ones. Only a small percentage of the observed active galaxies could have been the result of collision and merging.


Genesis (after parachute failed)
NASA/JPL-Caltech

Genesis (solar wind sample return mission) – Analysis of solar wind particles from Genesis showed that the ratios of nitrogen isotopes and of oxygen isotopes in the Sun differ from those found on the Moon and planets that have been measured. Nitrogen from the Sun matches that of Jupiter, but differs somewhat from Earth and other inner planets. Oxygen from Earth, Moon, Mars and asteroids (via meteorites) match each other, but not the new measurements from the Sun. The implication is that the inner planets did not form from the same materials as the Sun, or else have been "polluted" by later bombardment. Genesis crashed in Utah in 2004, due to failure of its parachute to deploy, but some of the samples were recoverable and have been analyzed.

Curiosity (next Mars rover) – The landing site for Curiosity has been narrowed down to 2 sites: either Gale Crater or Eberswalde Crater. Gale has a high diversity of geologic materials, created under different conditions, much of it in layers that are exposed. Eberswalde has clear evidence for a river that entered into a standing body of water at sometime in the past, leaving a delta deposit. The rover recently arrived in Florida in preparation for launch in late November or early December. The choice of landing site is expected to be made in the next few weeks.

J-2X, NASA's new rocket engine, is ready for its 1st round of testing. The J-2X is an update of the J-2 engine that was used on upper stages of the Apollo rockets. J-2X was to be used on the Ares rocket that was going to replace the Space Shuttle as NASA's means to send people into space until Congress and the President canceled Ares. The J-2X will likely be used on the next heavy-lift rocket that Congress has now directed NASA to develop. The test stand used to test Shuttle engines has been modified to hold J-2X engines. The J-2X can start and restart in space to support a variety of mission requirements. It is designed to be more powerful and reliable than the old J-2.

ARTEMIS – 2 of the fleet of 5 THEMIS spacecraft, after they finished their mission studying the Earth's magnetosphere, have completed their move to the Moon to study fields and particles there. They were renamed ARTEMIS P1 and P2. They traveled a very lengthy path to the Moon (took 1.5 years), but with little energy expended, by orbiting the Earth-Moon Lagrange points. These are points where the gravity of the Earth and Moon balance. The points used (L1 & L2) are unstable, so a lot of care had to be taken in guiding the spacecraft around them (90 orbit maneuvers). Using ordinary orbits to the Moon would have required more energy than existed in the spacecraft control rockets. The ARTEMIS spacecraft have enough fuel for 7-10 years of orbiting the Moon.

James Webb (future space telescope) – Polishing of all the mirrors, including the 18-segment primary and several others, has been completed. This is a major milestone toward completion. 13 of the primary segments are already coated with gold (it reflects infrared better than aluminum or silver used on visible-light mirrors). Almost all major parts except the sun shield are completed or being tested or under construction. The design and engineering is done. However, a Congressional committee has threatened to cut off or cut down funding for the telescope because it has overrun its budget. Essentially every cutting-edge technological wonder has overrun its budget. It happens when you do something that has never been done before. The Hubble Space Telescope, by some measures, cost 5 times what it was supposed to. Yet it has been worth far more than the overrun cost. So one has to wonder why Congress is surprised, and why they are threatening what will probably be the most valuable astronomical instrument ever. Cutting the yearly budget will in the long run cost more, since it adds storage and retesting costs, and would definitely delay launch by many years. Severe budget cutting could prevent the project from ever finishing. NASA has already begun an investigation to determine exactly what it will take to fix problems that caused the overruns and complete and launch the Webb Telescope. Let's hope the budget people reject short-sighted reactions to the cost overruns.

Instant AstroSpace Updates

Pan-STARRS 1 (all sky survey telescope in Hawaii) has discovered a **comet**, designated C/2011 L4 (PANSTARRS), that may become naked-eye bright in early 2013. It will approach the Sun about as closely as Mercury.

Molecules of **hydrogen peroxide** have been found near the star Rho Ophiuchi, the 1st time ever for this chemical in interstellar space, using the APEX submillimeter radiotelescope in Chile. The cloud is mostly hydrogen, with only 1 part per billion of hydrogen peroxide.

On June 27 a newly discovered house-size **asteroid** named 2011 MD sped by Earth about 20 times closer than the Moon.

A new study of tens of thousands of spiral galaxies in the Sloan Digital Sky Survey found that more of them (by about 7%) **rotate counterclockwise** than clockwise, contradicting a previous study by the Galaxy Zoo that found the opposite. The contradiction probably means that we are seeing local predominant rotations, not any property of the Universe as a whole.

A leak of orange-colored ethylene glycol coolant has shut down the **Subaru** 8-meter telescope in Hawaii until further notice. The primary mirror is undamaged, but the spill has to be cleaned off the mirror, as well as instruments and the telescope structure and possibly mirror supports and bearings.

The **Allen Telescope Array** (radiotelescope that does SETI [Search for Extraterrestrial Intelligence] at the same time as it does astronomy) in Northern California was put into hibernation due to lack of funds. Raising private money to resume operations is being attempted.

Hubble Space Telescope made its millionth observation on July 4, a spectroscopic measurement of material in the atmosphere of an exoplanet HAT-P-7b. Hubble has been the premier astronomical telescope for 21 years now.

The last Space Shuttle mission has delivered (among other things) to the International Space Station the **RRM** module, whose purpose is to test in space robotic refueling and repair of satellites in orbit, even those not designed to be serviced in space. The tests include manipulating caps, valves and screws, cutting wires, adjusting thermal blankets and transferring fuel on a mock satellite.

Discount tickets for Pacific Astronomy & Telescope Show

The Pacific Astronomy & Telescope Show is one of the premier annual conventions of amateur astronomers. This year's gathering, September 17-18 at the Pasadena Convention Center, will include lectures by interesting speakers, product displays of all types of astronomical equipment, and plenty of opportunity for you to meet and network with other amateur astronomers and organizations. For details, see http://www.rtmcastronomyexpo.org/PATS.htm. Admission is $20 at the door, but you can get discount tickets ($10/person/day) from OCA. Contact Bob Buchheim (OCA Secretary) via e-mail at oca_bob@yahoo.com, or in person at the August General Meeting to purchase your tickets.

SIRIUS ASTRONOMER
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CLUB OFFICERS			
President	Craig Bobchin	ETX_Astro_Boy@sbcglobal.net	714-721-3273
Vice-President	Reza AmirArjomand	reza@ocastronomers.net	949-212-3862
Treasurer	Charlie Oostdyk	charlie@cccd.edu	714-751-5381
Secretary	Bob Buchheim	rbuchheim@earthlink.net	949-459-7622
Trustee	Kyle Coker	kcoker@cox.net	949-643-9116
Trustee	Sheila Cassidy	rivme@pacbell.net	951-360-1199
Trustee	Greg Schedcik	gregsched@verizon.net	714-322-5202
Trustee	Gary Schones	gary378@pacbell.net	951-687-7905
Trustee	Steve Short	nightskytours@hotmail.com	714-771-2624
Trustee	Alan Smallbone	asmallbone@earthlink.net	818-237-6293
Trustee	Barbara Toy	btoy@cox.net	714-606-1825
COMMITTEES, SUBGROUPS, AND OTHER CLUB VOLUNTEERS			
Anza House Coordinator	Doug Acrea	dougcarola@att.net	949-770-2373
Anza Site Maintenance	Don Lynn	donald.lynn@alumni.usc.edu	714-775-7238
Beginner's Astronomy Class	David Pearson	astrodwp@dslextreme.com	949-492-5342
Black Star Canyon Star Parties	Steve Short	nightskytours@hotmail.com	714-771-2624
Explore the Stars - OCA Contact	Bob Nanz	bob@nanzscience.com	760-751-3992
Librarian	Karen Schnabel	karen@schnabel.net	949-887-9517
Membership, Pad Coordinator	Charlie Oostdyk	charlie@cccd.edu	714-751-5381
Observatory Custodian/Trainer/ Member Liaison	Barbara Toy	btoy@cox.net	714-606-1825
OCA Outreach Coordinator	Jim Benet	jimbenet@pacbell.net	714-693-1639
Sirius Astronomer Editor	Steve Condrey	stevecondrey@ieee.org	951-678-0189
Telescope Loaner Program	Mike Myers	loanerscopes@twow.com	714-240-8458
WAA Representative	Tim Hogle	TimHogle@aol.com	626-357-7770
Webmaster	Reza AmirArjomand	reza@ocastronomers.net	949-212-3862
SPECIAL INTEREST GROUPS (SIG's)			
AstroImagers SIG	Alan Smallbone	asmallbone@earthlink.net	818-237-6293
Astrophysics SIG	Bob Sharshan	RSharshan@aol.com	714-845-6573
Dark Sky SIG	Barbara Toy	btoy@cox.net	714-606-1825
Remote Telescopes	Del Christiansen	DelmarChris@earthlink.net	714-895-2215
GoTo SIG	Mike Bertin	MCB1@aol.com	949-786-9450