SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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The June 5 Venus transit was imaged by Richard Knapp from Mountain View Park in Fullerton. Richard used a Sony NEX-7 camera with a Sony 18-200mm zoom and a Thousand Oaks Optical black polymer solar filter.

OCA CLUB MEETING

The free and open club meeting will be held August 10 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Scott Kardel will discuss 'Light Pollution—What You Need To Know'

NEXT MEETINGS: September 14, October 12

STAR PARTIES

The Black Star Canyon site will be open on August 11. The Anza site will be open on August 18. 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 3rd at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana. The next two sessions will be on September 7th and October 5th.

GOTO SIG: TBA
Astro-Imagers SIG: Aug. 21, Sep. 18
Remote Telescopes: TBA
Astrophysics SIG: Aug. 17, Sep. 21
Dark Sky Group: TBA

A Close Encounter with Meade's "StarLock"

by Bob Buchheim

At PATS last year Meade was showing off their new telescope design, featuring their StarLock system, a built-on guide 'scope with integral camera. "Nice idea, but not a big deal" was my thought at the time.

I've changed my mind – it *is* a big deal. I recently spent several nights with a prototype of the 16-inch LX-600 (thanks to OCA's John Hoot), which gave me a chance to experience the Star-Lock technology first-hand. It simplifies and enhances the way you use the telescope, it eliminates the need for many add-on gadgets that we've all gotten used to buying, and it may cause you to change the way you think about the "design quality" of a telescope mount. (That 16" 'scope is a big, wonderful, robust machine, but don't be intimidated. The smaller members of the LX-600 family – 10" through 14" – are roughly the same size, weight and portability as their LX-200 counterparts, and all of them include the same "StarLock" technology).

The telescope was set up to be fairly well polar-aligned, but not precisely adjusted (no drift alignment was done). Every 'scope will require some sort of initialization before the observing session: the modern Meade and Celestron telescopes offer several alternatives for this process, but they generally have at their core finding and "synchronizing" on one – or possibly, two – known stars. The StarLock uses a similar approach. I tested just its single-star alignment method. Starting at the "home" position (Dec =0 and HA=0), you select a convenient, reasonably bright star and command the telescope to slew to it. The telescope's on-board computer and GPS take a fix, and slews to the designated star. There's a pretty good chance that it will be within your eyepiece or camera field; but if it isn't, you adjust the pointing (using the hand-control, finder 'scope, and camera) to bring the star to the center of your field-of-view and then command the telescope to synchronize the pointing. That's it: if all goes well, the telescope will now slew to any object that you enter into the hand control, and place it in the center of the field – very accurately.

I had synchronized the pointing on Antares, low in the southeast. My first slew to a target introduced me to one of the unique features of StarLock. I selected the Whirlpool galaxy (M-51) – high in the northwest – and hit enter/Go-To. The scope slewed off in the correct general direction, but stopped short; the hand control reported "centering on eta UMa ...", the LED on the StarLock telescope blinked and I could faintly hear the telescope's motors doing a little dance ... then after a few seconds the 'scope slewed again, a short distance this time, and the galaxy slid neatly into the center of the field-of-view. What was going on? StarLock was doing its thing – aiming the telescope by "closing the loop" on the sky.

Every previous generation of computerized telescopes aimed at the target in an "open loop" fashion, based on the commands to the motors and/or the reading of the mount's encoders, but without actually "looking" at the sky. With this type of "open-loop" aiming, the pointing accuracy depends on the mechanical quality of the mount's components, and on the accuracy of the polar alignment. Recent generations of computerized telescopes have done a very good job in this way, but usually the operator needs to do a little "fine tuning" with the hand control to precisely center the target.

StarLock "closes the loop" on the sky. When you command a slew to a target, the telescope searches its database for two pieces of information: the coordinates of your target, and the identity of a nearby star. It slews to that nearby star, carefully centers the star in the StarLock's internal imager (which is invisible to the operator, but the computer knows how to do this task, apparently flawlessly), and (if necessary) updates the "sync" of the mount. That done, it does a sort of "offset pointing" calculation and slews to your designated target. The whole process takes just a few seconds (plus the slewing time), and requires no operator action; the telescope does it all by itself. The result is that your target is centered in your field of view. Not just "near the center" – I mean "dead center". On a couple of nights, I was using an SBIG SGS Spectrograph, whose slit subtended about 6 arc-seconds. When I slewed from one target to the next, StarLock would place the new target practically *on the slit* – typically within a couple of slit-widths – never more than about 15 arc-seconds off. That is accurate pointing!

And the target stayed there. The other feature of StarLock is that it is an integral autoguider. Whenever the telescope is not being commanded (via the hand-control), StarLock examines its internal image, and initiates autoguiding on the "best available" star. There is not the slightest jump or jerk when this begins. The human operator doesn't notice anything, except that the target object stays right where you put it.

The system integration is very smoothly done. When you touch a button on the hand control (say, to move the telescope a little bit), StarLock "lets go" of the sky, the telescope's motors obey the command from the hand control, and when you stop pushing hand-control buttons, the StarLock once again autoguides on your new pointing location. No need to command it to start, or ask it to stop; no need to select a guide star. StarLock knows that its job is to (a) always defer to the hand control, so that the telescope will promptly do whatever the human commands, and (b) absent any command from the hand control, keep the telescope locked on the sky. It is an unobtrusive, obedient robot. It doesn't need to bother the human at all, and after a while, you forget that it is there, in the background, taking care of the telescope for you.

StarLock might change the way you think about the quality of a telescope's mount, and it will almost certainly cause you to re-think your purchase of some accessories. For example, pointing/aiming accuracy has been a useful distinguishing feature of top-end mounts, especially when used in a robotic or remote observatory. Designing and fabricating a mechanical system that can slew through a large angle and end up on the commanded position with an accuracy of a fraction of an arc-minute is a serious challenge, and the resulting products are beautiful, impressive, and expensive. Even with a high-end mount, many robotic setups augment the wonderful mechanical precision of the mount with a meticulously-gathered pointing model (T-Point, for example). There are also several software-control products that contain an algorithm that will take an image, match it against a star chart, check the pointing, and re-center the target to ensure accurate aiming. Most astro-imagers have also carefully gathered a model of their mount's periodic error, so that they can initiate a PEC playback to eliminate most of the mount's non-uniformity in sidereal tracking. All of that is sort of "standard procedure" with most mounts. But StarLock is unaffected by modest fabrication tolerances, because it examines the sky itself – not the gears and encoders – to establish the telescope's pointing; and its pre-check by slewing to a nearby star amounts to a built-in "check and re-center" algorithm.

Only the most premier mounts will allow long-exposure imaging; and even with those, most astro-imagers routinely use an autoguider, to deal with residual periodic (or non-periodic) tracking error. You know the drill: slew to your target, make minor pointing adjustments to attractively frame your image, then examine your autoguider image, select a guide star, and initiate guiding ... after the guider has settled down, start your image exposure. Robotic or remote observatories use clever software packages to automate this process. StarLock alters this in two ways. First, you don't need to buy a piggy-back guide scope and stand-alone autoguider (since StarLock *is* an autoguider). Second, you don't go through any of those steps because StarLock always initiates autoguiding, wherever it is pointed, unless the human operator commands the telescope to move. You center and frame your image, wait a couple of seconds for StarLock's LED to stop flashing (which indicates that it is "locked on" to the sky), and begin your image exposure.

After spending a few nights experiencing StarLock, I now see that it is a dramatic and exciting new development, providing easy-to-use, imaging-ready, user-friendly robotic telescope technology. Those of us who already have imaging setups that are working nicely and that we're comfortable with may not need to rush out to get one. But if you are in the market for a new telescope, this StarLock LX-600 series is definitely worthy of consideration.

The LX-600 16-inch prototype in action at Mt. Wilson Observatory, during the CUREA-2012 program.

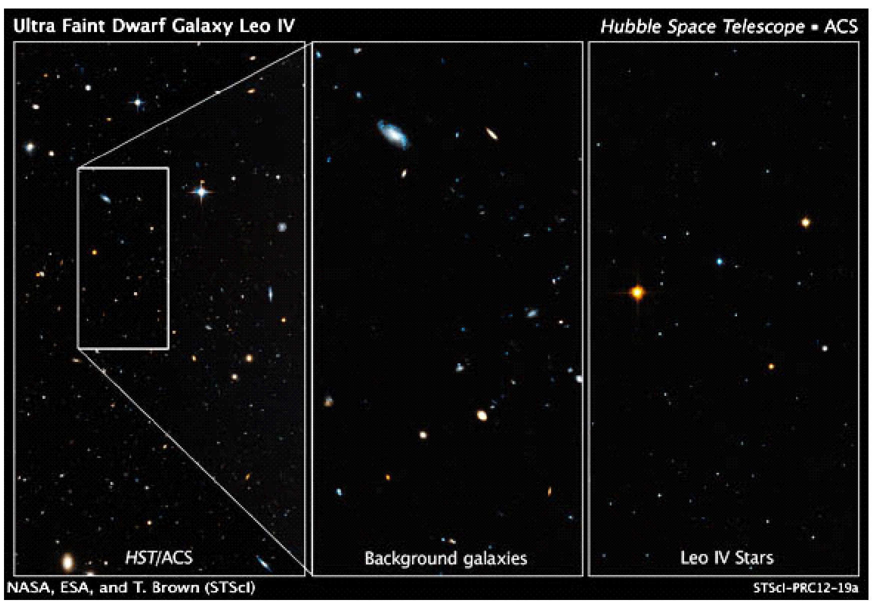
AstroSpace Update

August 2012

Gathered by Don Lynn from NASA and other sources

Higgs Boson – Scientists using the LHC (particle collider in Switzerland and France) have (nearly) announced the discovery of the Higgs Boson. This is the particle that is associated with the Higgs Field, which Peter Higgs proposed in 1964 to explain why subatomic particles have the masses that they do. Precisely what was announced is that the particle experiments have definitely discovered a particle that is likely to be the Higgs. Further experiments will be done to pin down the particle's properties, in order to see if it exactly matches what is expected for the Higgs. Two different particle detectors (ATLAS and CMS) that are parts of the LHC have detected the new particle. What is known so far about the new particle is that it is a boson, and it is the most massive boson known, having about 135 times the mass of a proton. This is the last particle to be found of those that make up the Standard Model of particle physics. Other theories, such as super symmetry, predict more particles, and Dark Matter is likely another particle, so the particle physicists are not out of jobs yet.

Dark galaxies, gas rich ones with few or no stars, have been predicted by theorists, and now astronomers using the Very Large Telescope in Chile believe they have detected them. It is thought that this is a phase in galaxy formation, when matter has collapsed to the size of a galaxy, but star formation is just beginning. The new observation found such gas clouds because they were illuminated by a very bright quasar. Previous observations of absorption imprinted on background light sources have hinted at the existence of dark galaxies. The new observations saw fluorescent glow of hydrogen, emitted in ultraviolet, but red-shifted into visible light by the expansion of the Universe. The team searched the area about a brilliant quasar and found 100 gaseous object candidates nearby, then winnowed out objects that might have star formation within them, leaving 12 certain dark galaxies. These 12 have average masses of gas about that of 1 billion Suns and star-formation activity at least 100 times less than non-dark galaxies. The quasar and dark galaxies are so distant that their light took about 11 billion years to reach us.



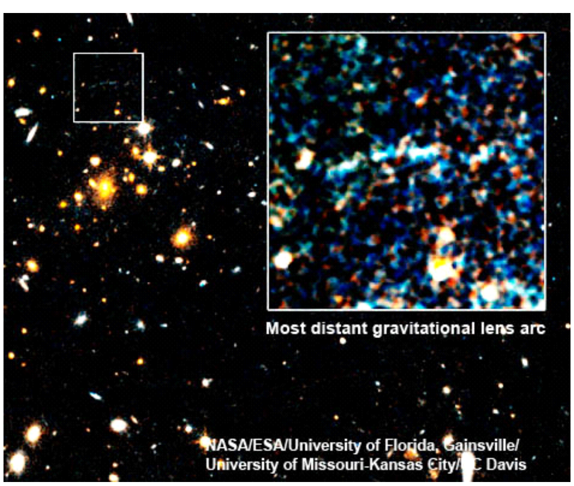
Ghost galaxies – Over the past several years, astronomers have been finding tiny galaxies in the neighborhood of our Milky Way with few stars, which have sometimes been called ghost galaxies. Many have been found by automated computer techniques that sort their few stars out from foreground objects. Astronomers have been puzzling over why they have so few stars compared to other galaxies of similar size and location. Observations by the Hubble Space Telescope (HST) show that 3 of these contain only stars of a certain age. They each started forming stars more than 13 billion years ago, then shut down all star formation before the Universe was 1 billion years old. Astronomers making the new observations believe that the re-ionization of the Universe was the cause of shutting down star formation, since these 2 events occurred about the same time. Re-ionization was when galaxies throughout the Universe first got bright enough to ionize (knock the electrons off) most of the hydrogen gas between galaxies. Many of the tiny galaxies in our neighborhood survived this, and continued to form stars for billions of years, probably because they were a little bigger and more resistant to re-ionization than the 3 tiny galaxies in the new study. These are each roughly 2000 light-years across, while the galaxies that continued to form stars are a bit larger. The Sloan survey has uncovered more than a dozen of the ghost galaxies while covering about ¼ of the sky. So a few dozen more of them likely await discovery. It is possible that even smaller galaxies formed almost no stars before being shut off, so possibly far more even-more-ghostly galaxies exist. The 3 studied galaxies each contain from a few hundred to a few thousand stars, both fainter and brighter than out Sun. They have abundant dark matter.

Ultraluminous infrared galaxies (ULIRGs) were discovered in the mid-1980s, and are the most luminous class of nearby galaxies (quasars are brighter, but farther). Most of their energy output is in infrared, suggesting that they contain a large amount of dust and immense star formation. One such galaxy, known as Arp 220, was studied with the Subaru and Keck Telescopes in Hawaii. Faint tidal tails were found extending more than 50,000 light-years. Hydrogen and star formation were found in them. The study concluded that the tails and star formation within the galaxies could have been formed only by 3 galaxy collisions involving originally 4 spiral galaxies. Study of other ULIRGs is needed to determine if all of them are formed this way.

ALMA (radiotelescope array in Chile) has observed a galaxy so distant its light took 12.4 billion light-years to reach us, and has detected a spectral line of nitrogen in its light. The strength of this line shows that the heavy element content of the galaxy is roughly what is seen in galaxies today. The elements heavier than helium are generated within stars. This observation helps pin down how early large numbers of stars had formed in order to create those elements. The galaxy is a submillimeter galaxy, that is, one that appears bright in submillimeter light (in between radio and infrared light) due to intensive star formation, but does not appear bright in visible light. This is due to dust that obscures visible light, but is penetrated by submillimeter. Not a bad observation for a telescope that is not even finished (only 40 of the 66 ALMA antennas have been completed.)

Dark matter – Scientists have for the 1st time directly detected (by its gravity) a filament of dark matter connecting clusters of galaxies. Simulations of the evolution of galaxy structure show these should exist. Statistically it has been shown that galaxy clusters line up as though those filaments exist. The filament was detected by its bending of light (by its gravity) from more distant objects. Tens of thousands of objects behind a pair of galaxy clusters (Abell 222 and 223) were examined to measure the bending of their light. The mass required to produce that bending was then mapped. It showed a filament of dark matter connecting the galaxy clusters. Other astronomers had felt that the effect would be too small to measure, but for this observation the galaxy clusters were chosen such that the filament connecting them would be nearly parallel to our line of sight. This puts more mass into our line of sight, magnifying the effect.

Most distant galaxy – A team of astronomers has used the Subaru and Keck Telescopes in Hawaii to discover the most distant galaxy known, at a distance of 12.91 billion light-years (that is the light travel time; expansion of the Universe has carried it far more distant by now). The proportion of neutral hydrogen gas near the distance of the galaxy was found to be higher than it is today. These findings help pin down the time of the re-ionization of the Universe. The galaxy was found by first surveying distant galaxies using a wide field camera on the Subaru Telescope. Then a new filter designed to pass the light with a redshift of about 7.3 was used. The color was measured of over 58,000 galaxies, and 4 candidates were found with redshifts of about 7.3. Further investigation showed which was the farthest. Upgrades to the Subaru Telescope planned for this year will allow larger areas of the sky to be searched for even higher redshift (and therefore more distant) galaxies.



Most distant gravitational lens – Astronomers using HST have imaged an arc that is a very distant galaxy being distorted by gravitational lensing of a very massive cluster of galaxies that happens to lie in front. The galaxy cluster is so distant that its light left there when the Universe was about ¼ its present age. The galaxy is obviously more distant. Statistically, astronomers should not have been able to find a lensed object so far away. The chances are extremely small of so massive a galaxy forming so early in the history of the Universe, and then happening to be in front of a galaxy bright enough to see at that distance (bright galaxies were less common in the early Universe). But the cluster is the most massive one yet discovered at that distance. And as luck would have it, there was a bright galaxy behind it. Further observations will be made to try to pin down how far the galaxy is behind the cluster.

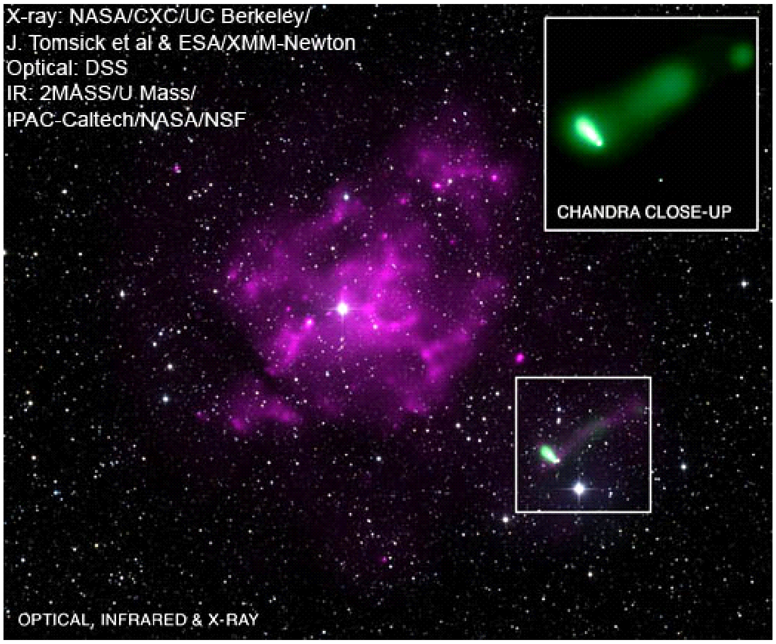
Collision imminent – A giant gas cloud has been determined to be on collision course with the black hole in the center of our Milky Way galaxy. By next year gas should be falling into the black hole. The speed of the gas has already been measured to be increasing, doubling over the past 7 years. The cloud is estimated to have 3 times the mass of Earth. As it falls toward the black hole, it should be stretched by tidal forces and eventually ripped apart. Nothing like this has ever been observed closely before.

Black hole growth – Observations made with Spitzer (infrared space telescope) and HST show that typical black holes at the centers of galaxies in the early Universe fed on snacks of material pulled in (by gravity), not by giant ingestions of material. Many astronomers had favored the theory that such black holes grew in the early Universe chiefly by collisions that result in huge ingestions. The new observations support that most (but not all) growth of these was fueled by smaller gas clouds, small bodies, supernova blasts, or tiny galaxies. The observations included 30 quasars (black holes currently ingesting material) and found that 26 of them showed no signs of major galaxy collisions. The galaxies selected for the observation were so distant that we are seeing them as they were 8 to 12 billion years ago. This period is known to be when much growth of galaxy-central black holes occurred. The masses of the 30 galaxies were each comparable to that of our Milky Way.

Close binary stars – Past studies of binary stars have found none of them were close enough to have orbital periods under 5 hours. It was believed that stars simply could not form any closer without merging during formation. However, red dwarf (low mass) stars are generally not included in studies, because they are too dim to easily observe. A new study of binary stars made in infrared, which picks up red dwarf stars more easily, concentrated on those red dwarfs. The study found several red dwarf binaries with periods substantially faster than 5 hours (out of thousands of red dwarf binaries seen). Theorists have to rethink how binaries form and evolve to explain these. Possibly magnetic activity of red dwarfs can brake the orbiting of binary stars, which causes them to move closer, and therefore have shorter periods.

Fermi (gamma-ray space telescope) was designed to monitor the sky for gamma-ray bursts. One of its telescopes has an extremely wide field of view, about 20% of the entire sky. Since many pulsars give off gamma rays, astronomers have found that Fermi can also be used to find pulsars. Candidates found by Fermi are observed by narrow-field radio telescopes to confirm that they are pulsars. The technique has worked well, finding so far 5 millisecond pulsars (ones that spin in a few milliseconds, that is, hundreds of times per second). One of these is unusual in that it produces 2 pulses of gamma rays each revolution, and the pulse in radio waves occurs between the gamma-ray pulses. A theory was developed to explain this, and it involves 2 sources of emission at different altitudes above the spinning star.

Fastest pulsar – An object has been discovered racing away from a supernova remnant at about 6 million mph (10 M kph), and from X-ray observations it appears to be a pulsar. No pulses have been seen, which would clinch the pulsar diagnosis, but this likely means the pulses are not directed toward Earth. Some other characteristics, such as constant X-ray brightness over time and lack of visible-light detection, also seem to indicate it is a pulsar. It is 30,000 light-years away. In X-rays it appears as a point with a tail trailing 3 light-years behind it. Its speed would make it the fastest moving pulsar known, implying that the supernova explosion kicked the pulsar harder than any other known pulsar. The speed was measured by dividing the distance of the new object from the supernova remnant by the age of the remnant (time since the explosion). Only one other pulsar is moving anywhere near this speed, and theorists are struggling to explain how the supernova explosions kicked these 2 so hard.

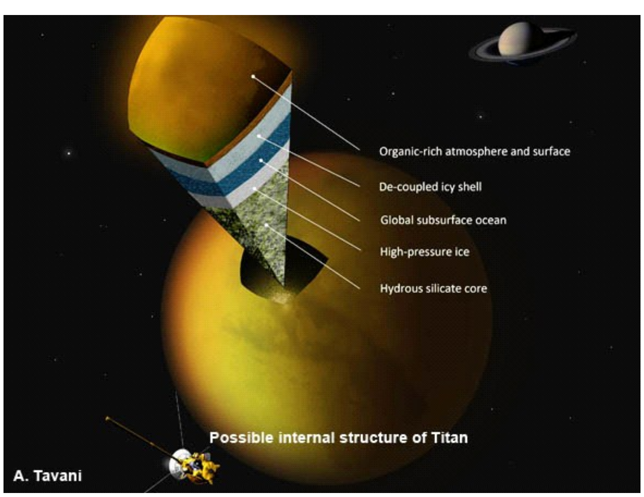


Exoplanet changes – Astronomers using HST have seen dramatic changes in the upper atmosphere of a planet orbiting the star known as HD 189733. The changes were first seen shortly after that star experienced a violent flare, and that is being blamed for causing the planet's change. The planet transits (passes in front of) its star, so the effects of the planet's atmosphere on the starlight can be measured even though the planet cannot be resolved in any image. The planet is a gas giant similar to Jupiter, but it lies extremely close to its star, 30 times closer than the Earth is to our Sun. Its year is only 2.2 Earth days. This proximity heats the atmosphere to 1800° F (1000° C) even when the star is not flaring. After the flare, the planet was seen to be trailing gas being blown off at a rate of at least 1000 tons per second. Before, there was no trace of this. The dose of X-rays from the flare was calculated to be 3 million times stronger than the Earth receives from the Sun during a flare, primarily because the exoplanet is so close to its star. Astronomers have not entirely ruled out other causes for the atmospheric changes, but the flare seems the most likely cause. Several recently discovered large rocky exoplanets near their stars are thought to be remnants of planets like this one, later in life when the entire atmosphere has been blown off. One other close-orbiting exoplanet has been observed to be losing its atmosphere, but continuously.

Exoplanet atmosphere – We have information on the atmospheres of only a few exoplanets, and all of those were gleaned during observations of the planets transiting their stars … until now. The star Tau Boötis has a hot Jupiter type planet orbiting about it, but the angle of the orbit is such that it does not transit as seen from Earth. But in high-resolution infrared spectra taken of the star using the Very Large Telescope, astronomers were able to separate the spectrum of the planet from the spectrum of the star, even though they are too close to resolve separately in an image. The planet's spectrum redshifts differently than the star's. Only 0.01% of the light comes from the planet, so this was difficult. The planet's atmosphere was found to contain carbon monoxide, and it is cooler at higher altitudes, the opposite of what has been found in the other atmospheric observations of hot Jupiters. The observations also yielded the orbital tilt (44°), from which the mass of the planet can be calculated (6 times that of Jupiter).

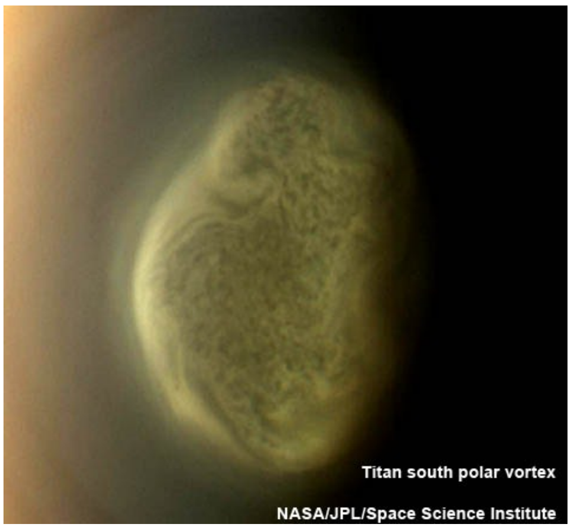
An exoplanet and a brown dwarf have been discovered by a very small telescope (1.6 inch = 42 mm aperture) in Arizona, named KELT. The former transits a very bright star, so planetary atmospheric observations should be easy for either space or ground-based telescopes. The latter is a massive puffed up body, too massive to be a planet, and so is a brown dwarf star. It is slightly larger than Jupiter, but contains about 27 times the mass. The brown dwarf is quite close to its star, and orbits in a little over an Earth day. If you could stand on the surface, the "sun" would take up ¼ of the sky. This blasts it with 6000 times the radiation that our Earth receives from the Sun. Its surface temperature is probably above 4000° F (2200° C). Likely in response to the intense radiation, the brown dwarf has inflated to a larger size than astronomers would predict. The brown dwarf and its star are both tidally locked, that is, both rotate with the same period as their orbit about each other. In a few billion years the star will expand in its red giant phase and swallow up the brown dwarf. There is also a KELT-south telescope in South Africa, and together they monitor many thousands of stars looking for the dimming caused by transiting planets.

Close exoplanets – Kepler (space telescope for exoplanets) has found a pair of planets whose orbits are closer than any other known pair. Every 97 Earth days they pass at a distance only 5 times our Moon's distance from us, and then the larger planet would appear 3 times the diameter our Moon appears. The close approaches stir up tremendous gravitational tides. The system contains 2 planets circling a subgiant star much like the Sun except several billion years older. The inner world is a rocky planet 1.5 times the size of Earth and with a mass 4.5 times as much. It orbits about every 14 days at a distance of less than 11 million miles. The outer world is a gaseous planet 3.7 times the size of Earth, with a mass 8 times as much. It is classed as a hot Neptune, and orbits once each 16 Earth days at a distance of 12 million miles. Researchers are struggling to understand how these 2 very different worlds ended up so close to each other. Within our solar system, rocky planets reside close to the Sun while gas giants remain distant. The discoverers believe that other close planets are waiting to be found. Asteroseismology, study of this stars oscillations, enabled the star's properties to be more precisely determined, which made calculations regarding the planets more precise.



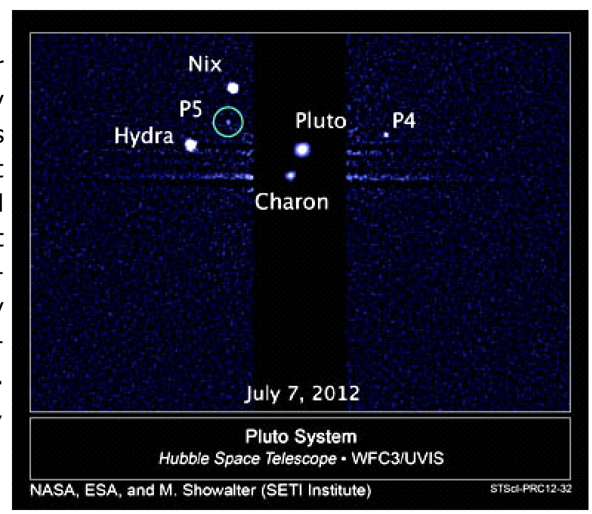
Cassini (Saturn mission) has revealed that Saturn's moon Titan likely harbors a layer of liquid water under its ice shell. The spacecraft was able to measure the tides raised in the solid icy surface. The measurement was about 30 feet (10 m) in height. Those tides are too high for a moon that is solid all the way down, but a liquid layer beneath the surface would allow them. The tides were measured by tracking the path of Cassini very closely during flybys of Titan, and from the spacecraft path calculating the gravity field of the moon. The liquid layer does not have to be very deep to allow the tides observed, so we can't tell how deep the liquid is. It is quite likely liquid water though, since the surface is water ice. Even though Titan loses methane quickly to space, it has measurable methane in the atmosphere, implying there is a source continuously replenishing the methane. A liquid water layer could contain enough ammonia to interact with methane trapped in ice and cause the methane to slowly leak out the surface.

More Cassini – A new study of years of Cassini infrared images of the jet streams of Saturn has settled a debate over the cause of those jet streams. On Earth, the cause is heating from the Sun. But on Saturn the jet streams are caused by internal heat of the planet. The observations were made in 2 different wavelengths of infrared light, which penetrate the Saturnian atmosphere to different depths. The study showed that the jet streams were stronger at the greater depth, so the driving force has to come from the depths. Automated cloud tracking software was used to analyze 7 years of images. The mechanism that best explains the observations involves internal heat stirring up water vapor from Saturn's interior. That water vapor condenses in some place as air rises and releases heat as it makes clouds and rain. This heat provides the energy to create eddies that drive the jet streams.



Cassini has been tilting its orbit, and now has good views of Titan's south pole. Images show a swirling vortex of gas, thought to be caused by convection. Heated cells rise, and clouds form along the edges. The recent formation of the vortex is probably a sign of approaching southern winter. A haze seems to be forming above the south pole, similar to the hood of haze that hung high over Titan's north pole during the northern winter.

Mars Express has been studying rocks blasted out of impact craters on the red planet, and has found evidence that underground water persisted at great depth for prolonged periods during the 1st billion years of Mars' existence. 175 sites were found with minerals (hydrated silicates) that formed in the presence of water. The craters studied range in size from about 0.6-52 mile (1-84 km), and so represent different depths from which material was thrown. Rocks that remained on or near the surface did not show these minerals.



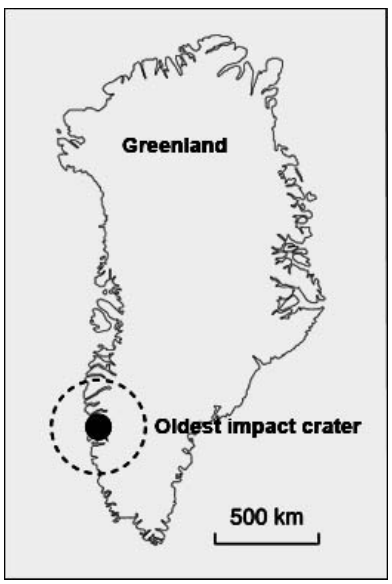
Pluto moon – A team of astronomers using HST have discovered another moon orbiting Pluto, the 5th known. It is irregular in shape and is estimated by its brightness to be 6-15 miles (10-24 km) across, and orbits 29,000 miles (47,000 km) from Pluto. The team is intrigues that such a small (dwarf) planet can have such a complex collection of satellites. The favored theory is that all the moons are relics of a collision between Pluto and another large Kuiper Belt object billions of years ago. The observations were being made to aid in navigating the New Horizons spacecraft through the Pluto system in 2015. So many small moons probably means there are particles too small to have been discovered orbiting Pluto, but large enough to damage a spacecraft during a flyby. The largest of the 5, Charon, was discovered in 1978, 2 more were in 2006, and the 4th last year.

Lunar Reconnaissance Orbiter (LRO) has returned data indicating ice may make up as much as 22% of the surface material in Shackleton Crater, located at the Moon's south pole. The data was taken with the laser altimeter. Normally just the timing of the laser reflecting off the surface is used, which determines altitude, but this observation used the brightness of the reflection to discriminate different types of composition. Shackleton Crater is named after the Antarctic Explorer, and is 2 miles deep. The geometry at the pole leaves much of the crater in perpetual darkness, with sunlight never hitting it. An impact more than 3 billion years ago created the crater, but these new observations show that it is remarkably well preserved. While the crater's floor was found to be relatively bright, due to ice content, the walls are even brighter. This was unexpected since the walls get some sunlight, which should evaporate exposed ice. The observing team developed a theory to explain the bright walls: moonquakes may continuously expose new material as the covering of the walls is shaken down to the floor. The exposed material could be just unweathered soil (which is brighter), not necessarily ice.

Tiangong 1 (Chinese space station) – The Shenzhou 9 spacecraft launched 3 astronauts from China to the Tiangong 1 space station, where they docked for about 10 days. During the stay, the astronauts re-entered Shenzhou 9, separated and redocked manually with the station to test this capability (all previous dockings with Tiangong 1 had been automated). China's first female astronaut was among the crew. This is only the 4th human spaceflight for China. Tiangong 1 is fairly small, with a habitable volume of about 700 cubic feet (20 m^3), including that inside the docked Shenzhou. China plans to launch larger Tiangong modules in the next few years of about the size of the 1970s era Skylab. Another flight to Tiangong 1 is planned for later this year.

X-37B (military unmanned spaceplane) has completed its 2nd flight and landed at Vandenberg Air Force Base in California. It spent over 468 days on this flight, more than all the flights combined of any one of the space shuttles. This was more than twice as long as the 1st flight of X-37B. It relies on solar power, whereas the shuttles used fuel cells, and their time in space was limited by the fuel carried for the cells. The X-37B resembles the shuttle, but is about ¼ the size. It is launched on an Atlas rocket and lands like an airplane. The US military does not reveal details of X-37B's missions, saying only they are testing new space technologies. The 3rd mission is scheduled to liftoff in October.

Instant AstroSpace Updates



The **oldest known impact crater** on Earth has been discovered on the west side of Greenland, with an age of about 3 billion years and a diameter of about 60 miles (100 km). Craters on Earth tend to weather away before this age.

A team of astronomers studied the distribution of stars above and below the midplane of the **Milky Way**, and discovered that there is a wave in the star positions. This wave is believed to be a sort of **ringing** effect from colliding with a small satellite galaxy or other object perhaps 100 million years ago.

Mars Express has imaged in high resolution a crater filled with layers of sediment exposed by erosion, and the patterns in the layers support the theory that the red planet's climate alternated between wet and dry periods in the distant past, in response to changes in the tilt of the planet's spin axis over many thousands of years.

Using a scanning electron microscope, scientists have discovered another **new mineral** in the Allende meteorite, which fell in Mexico in 1969. It is a form of titanium oxide and was named panguite, after a Chinese mythological giant.

A new analysis of 2 meteorites that originated on **Mars** shows that the **water content** of material within the mantle of the planet was much higher than previous estimates. The new value is comparable to the water content of Earth's mantle.

NuSTAR (orbiting high-energy X-ray telescope) has been focused and took its first image, which was of Cygnus X-1, a black hole siphoning gas off a giant companion star. Science observations were scheduled to begin mid July.

Anza Wireless Network Will Be SSID-Protected Beginning July 1st

By Bob Buchheim, OCA Secretary

Attention all users of the Anza wireless internet system!

Beginning on July 1st, you will only be able to access the network if you have the SSID access code. The fee for this access code will be $50 per year.

This change to the club's policy for management of the wireless internet service was approved at the March 18th meeting of the Board of Trustees. For many years, this service has been subsidized by the general budget of the club and by a few generous members. However, the cost of this satellite-internet link is significant, and it is time to make this internet service self-supporting, with users bearing the cost of providing and maintaining it.

Effective July 1, 2012, you will need to have the SSID in order to access the Anza wireless network. Wireless users will be charged $50/year for the SSID. Several observatories have a wired connection to the Anza network; the fee for this wired access will be $120/year. A few observatories have dedicated IP addresses; the fee for this service will be $175/year.

The SSID will be changed annually.

The SSID-protected access will be implemented on July 1st. If you are a user of the Anza internet, please contact Charlie Oostdyk (charlie@cccd.edu) to pay the SSID-fee and receive the access code.

As current users know, the bandwidth of the satellite system is limited. Please be considerate of the other users on the network, especially on star party nights, by not doing large uploads or downloads, and not using high-bandwidth applications such as Hulu, YouTube, Netflix, and the like.

The Eagle Nebula (M16) was imaged by Jeff Malmrose from Anza on July 15 using a TMB 115mm telescope with a modified Canon XT imager. The image consists of 16 10-minute exposures stacked and processed via Photoshop.

SIRIUS ASTRONOMER
www.ocastronomers.org
The Newsletter of the Orange County Astronomers

NEWSLETTER OF THE
ORANGE COUNTY ASTRONOMERS
P.O. BOX 1762
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