SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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DON'T FORGET TO VOTE! OCA BOARD ELECTION BALLOT INSIDE!

Jupiter continues to dominate the evening sky during December, and transits of the Galilean satellites are some of the most exciting events in planetary observing. This image of Ganymede making a transit of Jupiter's disk was created by Pat Knoll on 11/22 using a 10-inch Meade LX200 from Kearny Mesa, California (near San Diego--yet another example of top-grade imaging in urban skies). Careful inspection of the image reveals surface detail on Ganymede.

OCA CLUB MEETING

The free and open club meeting will be held December 9th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month our speaker is Wally Pacholka, who will present 'America the Beautiful at Night'

NEXT MEETINGS:

Jan. 13th, Feb. 10th

STAR PARTIES

The Black Star Canyon site will be open on December 17th. The Anza site will be open on December 24th. 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, December 2nd at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana. Next month the class will be offered on December 2nd.
GOTO SIG: TBA
Astro-Imagers SIG: Dec. 20th
Remote Telescopes: TBA
Astrophysics SIG: Dec. 16th
Dark Sky Group: TBA

Around OCA for December, 2011

By Barbara Toy

OCA Observatory Custodian and Member Liaison

Here we are, nearing the end of another busy year, one that has seen some changes at our Anza site, with the addition of several member observatories, as well as some pretty extreme weather in addition to a frustrating number of clouded-out star parties. This year is notable for having its last two star parties on holiday weekends – the Saturday after Thanksgiving and Christmas Eve. By the time you see this, the November star party will already be past; I suspect that there will be lower attendance for the December party than for the one in November, even though it's right on the night of the new moon. Whoever does make it out there for that star party – I hope you have great viewing and a wonderful night!

Although we had good weather conditions for both Anza star parties in October, attendance was surprisingly low. We haven't done a poll, but it seems likely that this was because of concerns about the dirt road going to the site, which was badly washed out in the freak rain-and-hail storm in September. As of the time I'm writing this, I am advised that the area that was most severely washed out hasn't been repaired yet, apparently because of problems with utilities that were exposed by the deep ditch the waters left in the roadway. Even though this made driving in to our site more difficult, the area of the washout was passable because of the bypass that the neighbors put in along the damaged roadway – it was narrower and a bit rougher going than the usual road when it was in good repair, but passable with care and consideration for oncoming traffic. Even though it was passable, it made traveling the road harder after dark, and members who didn't want to stay all night might have stayed away because of it.

Current information about the road conditions is being posted to the club's email groups by various members as they learn it. If you aren't on them yet, you should join them, to get current club information and as a great resource for getting answers to questions you might have or to get other help. Our main groups are ocastronomers@yahoogroups.com, which is the most general of the club's email groups, and AstroImagers@yahoogroups.com, which is primarily for imaging but, because most imagers spend time out at Anza when they can, also shares information about the site.

Beginners Astronomy Class

The club has a Beginners Astronomy Class that has been running since long before I joined the club over ten years ago. It has gone through a number of variations over the years, but has generally been two cycles of six sessions each year, starting in September and March (roughly coinciding with the start of the fall and spring semesters of the academic year). The current instructor, Dave Pearson, has been reorganizing some of the material covered in the class as well as the class schedule.

The sessions are regularly set on the first Friday of each month, which works well in most months, but inevitably conflicts with events around New Years and the Fourth of July holidays. Those have been the months when we've been doing the "How to Use Your Telescope" portion of the class, and it is often a challenge to get both volunteers and public turnout for those sessions, even though they are among the most popular with the class attendees.

Under the new schedule, the two sessions on equipment are consolidated into a single session, the "How to Use Your Telescope" class is moved up a month, and we plan to take January and July off. The "How to Use Your Telescope" classes will be at the beginning of December and beginning of June, and the Beginners AstroImaging sessions that Kyle Coker has done such a good job of developing and presenting will continue on their original schedule, in February and August. The starting month for each cycle of classes will remain in September and March.

If you'd like to get a good overview of the hobby, and haven't yet tried the Beginners Class, you really should. The first session of each cycle is an overview of various areas of interest in astronomy, including information about what can be seen when you are looking at various types of objects, and how they fit in the cosmic scheme. The second session is on equipment used for observing, including the basics on different optical systems, the third session is on how to find what's up there, the fourth session is the "How to Use Your Telescope" class, where people bring their telescopes to get some hands-on instruction on how to set them up and use them, and the last class is the Beginners AstroImaging class. All of the sessions are independent of each other, so you could go to any that interest you, or pick up any that you missed in the next round. Dave makes his power point presentations available to the class members who request them, and they are filled with good information.

(continued on page 9)

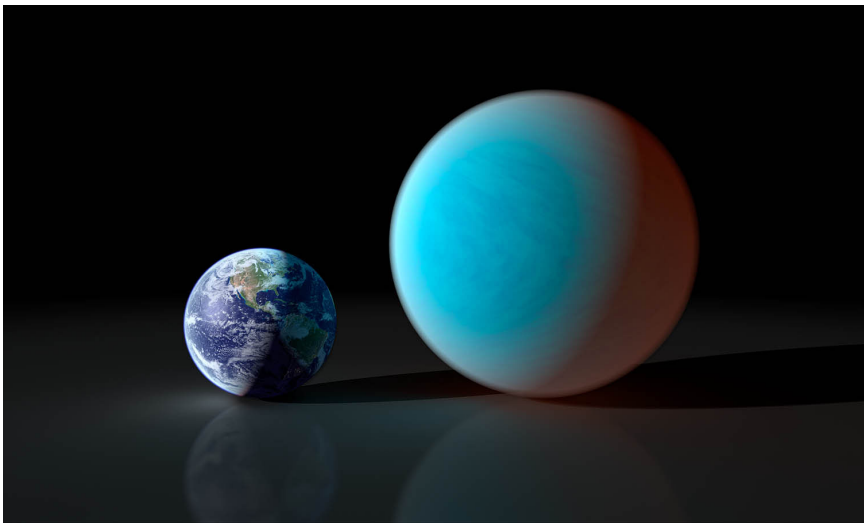
NASA's Space Place

Re-thinking an Alien World: The Strange Case of 55 Cancri e

Forty light years from Earth, a rocky world named "55 Cancri e" circles perilously close to a stellar inferno. Completing one orbit in only 18 hours, the alien planet is 26 times closer to its parent star than Mercury is to the Sun. If Earth were in the same position, the soil beneath our feet would heat up to about 3200 F. Researchers have long thought that 55 Cancri e must be a wasteland of parched rock.

Now they're thinking again. New observations by NASA's Spitzer Space Telescope suggest that 55 Cancri e may be wetter and weirder than anyone imagined. Spitzer recently measured the extraordinarily small amount of light 55 Cancri e blocks when it crosses in front of its star. These transits occur every 18 hours, giving researchers repeated opportunities to gather the data they need to estimate the width, volume and density of the planet.

According to the new observations, 55 Cancri e has a mass 7.8 times and a radius just over twice that of Earth. Those properties place 55 Cancri e in the "super-Earth" class of exoplanets, a few dozen of which have been found. Only a handful of known super-Earths, however, cross the face of their stars as viewed from our vantage point in the cosmos, so 55 Cancri e is better understood than most.



Artist's rendering compares the size Earth with the rocky "super-Earth" 55 Cancri e. Its year is only about 18 hours long!

When 55 Cancri e was discovered in 2004, initial estimates of its size and mass were consistent with a dense planet of solid rock. Spitzer data suggest otherwise: About a fifth of the planet's mass must be made of light elements and compounds—including water. Given the intense heat and high pressure these materials likely experience, researchers think the compounds likely exist in a "supercritical" fluid state. A supercritical fluid is a high-pressure, high-temperature state of matter best described as a liquid-like gas, and a marvelous solvent. Water becomes supercritical in some steam turbines—and it tends to dissolve the tips of the turbine blades. Supercritical carbon dioxide is used to remove caffeine from coffee beans, and sometimes to dry-clean clothes. Liquid-fueled rocket propellant is also supercritical when it emerges from the tail of a spaceship. On 55 Cancri e, this stuff may be literally oozing—or is it steaming? —out of the rocks.

With supercritical solvents rising from the planet's surface, a star of terrifying proportions filling much of the daytime sky, and whole years rushing past in a matter of hours, 55 Cancri e teaches a valuable lesson: Just because a planet is similar in size to Earth does not mean the planet is like Earth. It's something to *re*-think about.

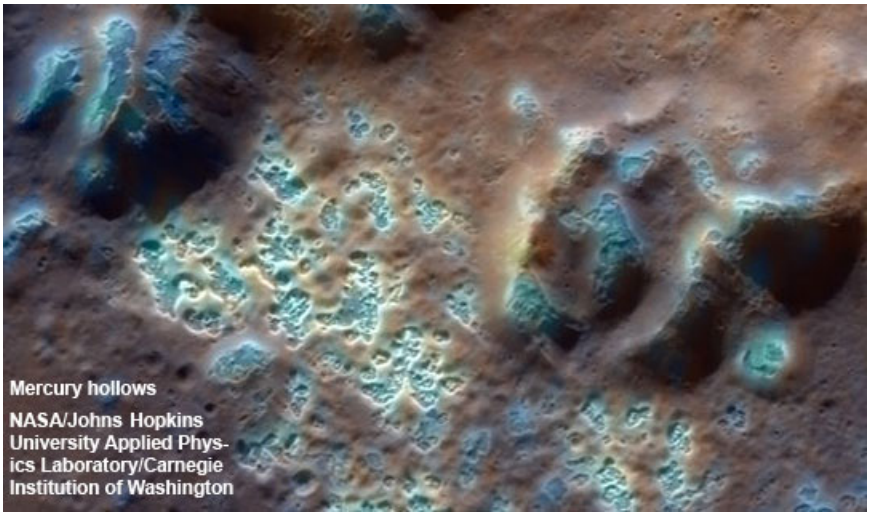
Get a kid thinking about extrasolar planets by pointing him or her to "Lucy's Planet Hunt," a story in rhyme about a girl who wanted nothing more than to look for Earth-like planets when she grew up. Go to http://spaceplace.nasa.gov/story-lucy.
The original research reported in this story has been accepted for publication in *Astronomy and Astrophysics*. The lead author is Brice-Olivier Demory, a post-doctoral associate in Professor Sara Seager's group at MIT.

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

AstroSpace Update

December 2011
Gathered by Don Lynn from NASA and other sources

Messenger (Mercury mission) has continued to observe the "hollows" on Mercury, peculiar depressions in the surface that appear to be young geologically. They somewhat resemble depressions in the carbon dioxide ice at Mars' south pole, but on Mercury they are found in rock and often have bright interiors and halos. With essentially no atmosphere on Mercury, the hollows cannot have been carved by wind or water. One theory is that sulfur or other volatile materials got exposed to the surface somehow, and they evaporated to leave the hollows. Another theory is that the hollows are where interior hydrogen is being vented, and the bright interiors are a result of hydrogen reducing metal, such as iron sulphide, to pure metal. More study is needed to firmly establish the cause of the hollows.



Mercury hollows
NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

Messenger has also found sulfur and potassium of the surface of Mercury. Planet formation theory says that Mercury was too battered and/or too hot for these relatively volatile materials to have survived. Another mystery that will require further study.

Lutetia (asteroid) has been found, from Rosetta spacecraft data and observations by several ground-based telescopes, to be made of the same material as terrestrial planets. This raises the question of why it is in the main asteroid belt. It could have formed only in the area from Mercury to Mars if it has the same constituent material. Spectra of main belt asteroids show that roughly 1% of them are similar to the spectrum of Lutetia. Thus the mechanism that moved Lutetia and similar asteroids out to the main belt happens fairly rarely. Much of the material where the terrestrial planets are now ended up accumulated into those planets, but some was ejected out toward Jupiter, and a little of that would have been deflected by Jupiter into orbits within the main asteroid belt. This is the most likely explanation for Lutetia's location.

Martian rock vein
NASA/JPL/Cornell

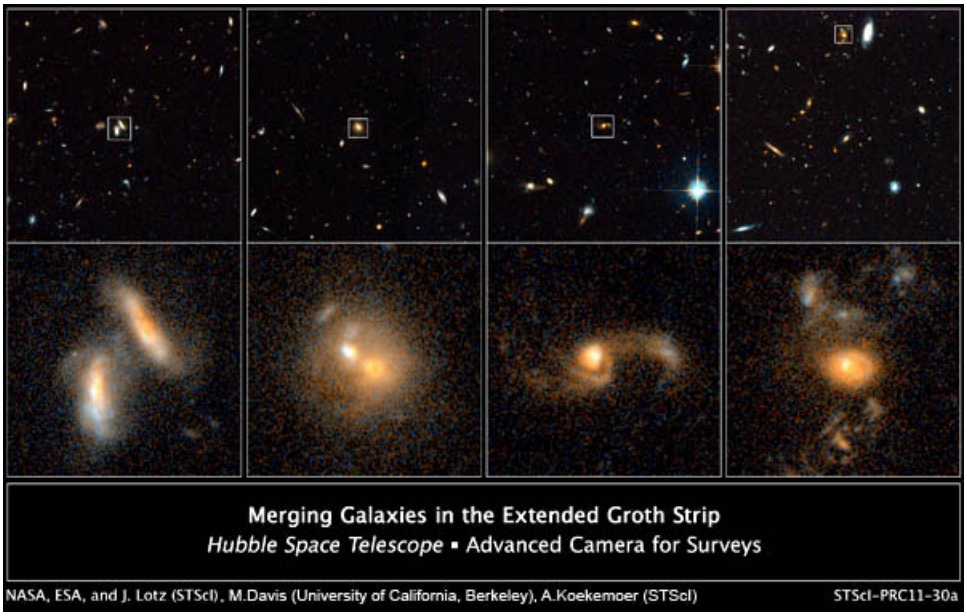
Opportunity (Mars rover) is exploring Cape York, a ridge on the rim of 14-mile-wide Endeavour Crater. It is heading toward the north end of the cape, where controllers will choose a north-facing slope to park on during the time of lowest Sun of the southern hemisphere winter. This will assure enough power from the solar panels to last through the cold of the winter. Opportunity found veins of lighter rock running across the slopes of Cape York. The veins appear to be rock that formed when mineral-laden water came up through cracks in the rock.

More Mars – A new study of mineral maps of Mars made by various orbiters concentrated on 350 sites showing clay minerals. The types of minerals indicate that over most of the planet water flowed on the surface in short episodes, which ended billions of years ago. Only a few locations showed minerals that result from long exposure to water. Those probably resulted from exposure to water under the surface. Gale Crater, the destination of the next Mars rover Curiosity, is one of those places with long-exposure minerals. Clays that develop in short periods of water exposure retain the same elements as the volcanic rocks from which they formed, but long water exposure carries off the more soluble elements. The mineral prehnite was found, and it forms at temperatures above about 400° F (200° C), which can occur only in water underground, under high pressure. Scientists who had hoped that water flowed on the surface of Mars in the distant past long enough for primitive forms of life to develop are probably out of luck, but subsurface water may have persisted long enough for life to develop underground.

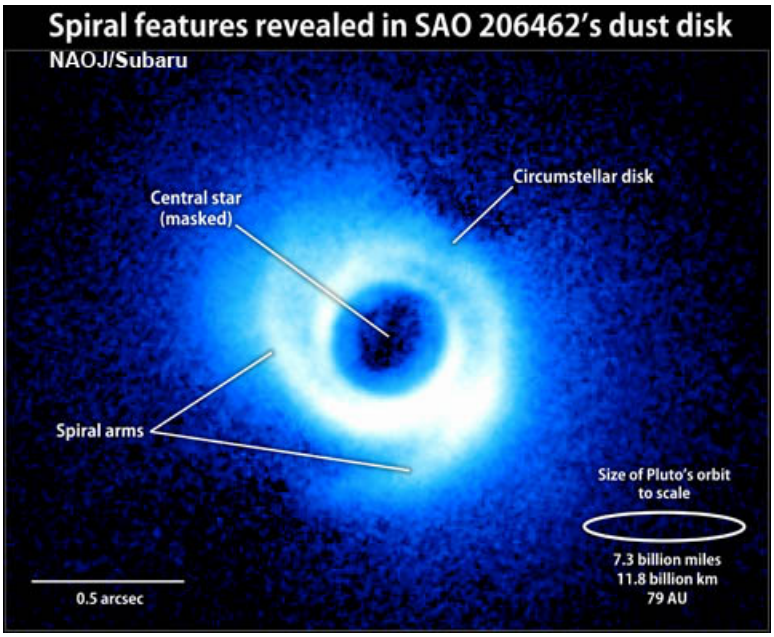
Exomoons – Some recent papers have claimed that soon astronomers will be able to detect moons orbiting exoplanets (planets outside our solar system). At least 1 team is already examining Kepler (space telescope for exoplanets) data to try to find exomoons. Kepler's sensitivity extends only down to objects about the size of the Earth, and those only orbiting certain types of stars. The largest moon in the solar system is only 40% the size of Earth. So it would seem hopeless to detect such with Kepler. But those recent papers show that analyzing timing variations in the transits of exoplanets in front of their stars is sensitive to moons considerably smaller than can be detected by transits alone. Also, the claim is made that other planetary systems ought to sometimes have moons larger than our solar system has. Simulations of formation of planets and their moons show that it is probably

impossible for moons to form as large as Earth. But even in our own solar system we have examples of 2 moons that did not form with their planet. Our Moon formed from an impact of a Mars-sized planet with the Earth early in its history, and Triton was probably captured gravitationally by Neptune after forming elsewhere. These methods of moon formation may have much larger upper limits to the possible size of resulting moon. The team examining Kepler data hopes to catch one of these.

Galaxy merger rate – A new analysis of Hubble Telescope surveys, combined with simulations of galaxy interactions, reveals the merger rate of galaxies over the last 8-9 billion years. Previous estimates of the merger rate varied considerably, from about 5 to 25%, and the new number lies in the range of these. The new study analyzed galaxies at different distances up to 9 billion light-years away, so we are seeing the galaxies as they appeared up to 9 billion years ago. Large galaxies merged with each other on average only once over 9 billion years. Small galaxies were coalescing with large galaxies about 3 times more frequently. The problem with previous measures is that different methods were used to count the mergers. Studies that looked for close pairs of galaxies that appeared ready to collide gave much lower numbers of mergers than studies that searched for galaxies with disturbed shapes, evidence that they have participated in a merger. If looking for disturbed shapes, one needs to account for how long shapes remain disturbed after the merger event. The computer simulations provided this. 57 different merger scenarios were simulated, and results were matched to actual observations. Continued work will try to extend this merger measure back to galaxies 11 billion years ago.



Blue stragglers are stars that appear much younger, hotter and more massive than their neighbors, which should have been born the same time. It has long been known that the cause is acquiring mass long after the stars are formed, but astronomers still disagree about how that mass is acquired. 3 theories are: gravitational attraction of matter from a very nearby companion star, collision with another star, merging with a companion star. A new study of the open cluster NGC 188 examined the 21 blue stragglers contained and found that the majority have companion stars, typically in relatively short (about 1000 days) and therefore close orbits, and of relatively low mass (about ½ that of the Sun), supporting the 1st theory. Though close companions cannot be seen directly, they can be detected by the wobble induced gravitationally on their star as they orbit. This theory results in the blue straggler stripping the entire outer parts of the companion, leaving a small white dwarf. The other 2 theories would not involve white dwarf companions. Further work will be done in ultraviolet, in which close white dwarfs may be visible.



Spiral star – Researchers using the Subaru telescope in Hawaii have found a star with spiral arms in its surrounding disk. The star is SAO 206462, a young star shining at about 9th magnitude, 456 light-years away in Lupus. The star was known to have a disk about it that might be forming planets. The disk is about 14 billion miles (23 billion km) across, about twice the size of Pluto's orbit in our solar system. A high resolution picture showed the spiral arms in the disk. There are 2 arms, not quite symmetric. Computer simulations show that 1 planet forming in the disk can gravitationally create a pair of symmetric arms, but it takes 2 planets to form non-symmetric ones. Previously observations of other disks forming planets have shown effects of the planets in the form of rings, divots and gaps, but spiral arms are unprecedented. Further research will be needed to eliminate possible causes of the arms other than planets.

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First stars – Computer simulations of star formation from the raw hydrogen-helium mixture left by the Big Bang have been showing that all stars under those conditions are very huge, hundreds of times the mass of our Sun. A new simulation that takes into account more physics shows that those 1st stars are only dozens of times the Sun's mass. The new simulation shows that forming stars are hotter than previously thought, which prevents further material collapsing into the forming stars before they reach those higher masses. Very large mass stars should produce different mixes of elements when they explode than not-so-massive stars. The mix of elements observed in very old stars (perhaps 2nd generation) matches the new simulation better than the earlier simulations that produced extremely massive stars. In either the case of dozens or hundreds of solar masses, such stars burn out in millions of years, which is why astronomers have never found any 1st stars still in existence. After those 1st stars created the other elements (besides hydrogen and helium) and distributed them into space through stellar winds and supernovas, the resulting mix of elements caused changes in the way gas clouds collapse into stars, so that later generations of stars come in all masses from small to large.

Supernova – In the year 185 Chinese astronomers noted a "guest star" or supernova, which in the 1960s was identified with a supernova remnant called RCW 86, located about 8000 light-years away. But the remnant was too large to have been seen only about 1800 years previously. New infrared observations by the Spitzer and WISE space telescopes of RCW 86 have solved the mystery. The supernova occurred in a cavity nearly devoid of gas and dust. So the normal slowing of the expanding supernova debris as it plows through interstellar gas and dust did not occur, allowing faster expansion. X-ray observations have recently identified RCW 86 as having come from a Type Ia supernova. Though Type II supernovas have been found to explode in cavities, this is the 1st time a Type Ia has been found in a cavity.

Fermi (gamma-ray space telescope) has discovered the 1st pulsar that emits gamma rays and is in a globular cluster (NGC 6624). About 100 pulsars are known in globular clusters, but until this one, all emitted in other types of light than gamma rays. It is the most distant known gamma-ray pulsar at 27,000 light-years and the youngest millisecond pulsar (one that rotates every few milliseconds) known, and has a much stronger magnetic field than expected. 9 other new gamma-ray pulsars were found in this study, but none as unusual as this. Fermi over its life has found more than 100 gamma ray pulsars. Only 7 were known before Fermi was launched. Millisecond pulsars are believed to form when material from a close companion star falls on a pulsar, which over time speeds up the rotation. Fermi is just barely sensitive enough to detect gamma-ray pulsars. They are found only by accumulating years of exposure and doing extensive analysis on the result.

Primordial gas – Astronomers using the Keck Telescopes in Hawaii have detected 2 clumps of primordial hydrogen and helium gas apparently left over from the Big Bang. The gas clouds are too diffuse to form stars, and show no evidence of contamination by heavier elements which stars produce. Previous efforts had found gas clouds with only 1/1000th the concentration of heavier elements as found in our Sun. The new clouds are at least 10 times lower in heavier elements than the previous best. The heavier elements were below detectability of these observations. The gas was studied in silhouette, by taking the spectrum of quasar light shining through the gas clouds.

Hubble Space Telescope (HST) using infrared has found a population of young dwarf galaxies brimming with star formation, that existed 9 billion years ago. The galaxies average about 100 times less mass than our Milky Way, yet churn out stars so fast that they double their star count 1000 times faster than the Milky Way does. The discovery was made during a 3-year program to study very distant galaxies. The star birth rate was surprising because studies of stars in nearby dwarf galaxies indicate that their stars formed more slowly, over billions of years. Also, computer simulations of star formation are unable to produce such high birth rates.

Dark matter – Computer simulations of galaxy formation show that dark matter clumps up gravitationally, and that ordinary matter collects in these clumps to form galaxies. Measurements of gravity in actual galaxies indeed show that there are concentrations of dark matter around them. Generally dwarf galaxies have been found to possess larger ratios of dark matter to normal matter than large galaxies, but they all seem to have clumps of dark matter. New observations of 2 nearby dwarf galaxies, those in Fornax and Sculptor, showed no clumping about them, just uniform amounts of dark matter out to great distances. These dwarfs each hold 1-10 million stars. The scientists' conclusion is that either dark matter does not behave like theoreticians are telling us, or some unknown effect is smoothing out dark matter after these galaxies formed. Further study will observe the gravity of the dark matter in more nearby galaxies to try to shed light on this mystery.

HST has observed the structure and temperature of an accretion disk surrounding a black hole by using a new technique. Another galaxy happens to lie in the line of sight to the black hole, and as stars in this intervening galaxy one by one pass in front, they create gravitational lenses that amplify one particular part of the black hole, in a scanning sort of motion. Recording this over time gives a strip of image across the accretion disk, in far finer resolution than is possible without the gravitational lenses. The disk is somewhere in the range of 60-190 billion miles (100-300 billion km) in diameter, and the varying temperature of the disk material across this has been measured.

Cool brown dwarf – A direct image in infrared has been made of a brown dwarf, the coldest object imaged outside the solar system. Its surface temperature is in the range 80-160° F (27-71° C). Its mass has been determined to be 6-9 times that of Jupiter, and such a small object would normally be classified as a planet. However its orbit about its star is too large (2500 times the Earth's distance from the Sun) to be a planet, but that is fine for a companion brown dwarf. It is 63 light-years from us. The object was found by searching archived infrared images from the Spitzer space telescope taken years apart to find faint objects that were moving along with a nearby star, and thus were probably orbiting it. Brown dwarfs are stars with insufficient mass to sustain nuclear fusion, the power source of normal stars.

Spitzer (infrared space telescope) has detected signs of icy bodies raining down on a planetary system about the star Eta Corvi, reminiscent of the Late Heavy Bombardment of such bodies upon the Earth and nearby planets that occurred about 3.9 billion years ago. The evidence consists of spectra of dust such as would be the result of a collision of 1 or more comets with a planet. The Eta Corvi system is about 1 billion years old, a little older than our solar system was during the Late Heavy Bombardment. A more massive ring than the one of collision dust is found farther out, and appears to be the equivalent of our solar system's Kuiper Belt of comets.

Eris (Kuiper Belt object) has had its diameter measured accurately for the 1st time, by watching it occult (pass in front of) a star. 26 locations about the world were watching at the predicted time of this event, but due to bad weather and other excuses, only 3 telescopes caught it. The result is 1445 miles ± 7 (2326 km ± 12). Since its discovery, Eris has been thought to be a little larger than Pluto. The best measurement of Pluto is 2306 km ± 20. So Eris is probably barely larger, but the uncertainties overlap, so it is not certain. Eris's mass was measured some time ago, so it is definitely known to be about 27% more massive than Pluto. Thus it is considerably denser than Pluto, indicating it has more rock and less ice. However, the surface must be covered with fresh methane ice, because Eris is quite reflective. Along with Enceladus (Saturnian moon), it vies for the most reflective object in the solar system. The ice on the surface is probably methane atmosphere that froze as Eris got farther from the Sun in its orbit, and therefore colder. The occultation observations showed that Eris is nearly spherical.

Uncomet – It was reported here in June that the asteroid Scheila had developed 2 comet-like tails, but that they did not contain water, so the likely explanation was that Scheila was a dry asteroid that had been hit by a smaller one, throwing off the material that looked like comet tails. Further observations showed a 3rd tail. Further computer simulations of asteroid collisions showed that the 3 tails could be produced (in direction and shape) only by a collision by an asteroid in the range 65-165 feet (20-50 m) hitting from behind at about a 45° angle. The mechanism is a large splash forward and a conical batch of debris upward, with the edges of the cone appearing as 2 more tails. The collision had to have taken place December 3, 2010, ± 1 day.

Herschel (infrared space telescope) has found water vapor emanating from ice on dust grains in the disk around a young star, TW Hydrae. The amount of water is calculated to be thousands of times that found in an ocean on Earth. The star is between 5 & 10 million years old and lies 176 light-years away. The disk about it may be forming planets. It is believed that the vapor was formed when ultraviolet radiation melted ice-coated dust grains in the disk. Continued observations will look at similar young stars with disks possibly forming planets.

Youngest planet – Astronomers have taken an image of the youngest planet yet found, still in the act of forming. It is orbiting the star LkCa15, along with a disk of planet-forming material. The planet is no older than 2 million years, since that is the age of its star. This is 5 times younger than the previous record holder planet. The image was made with the Keck Telescopes in Hawaii, using adaptive optics to counteract the twinkling of atmosphere and aperture mask interferometry to cancel the glare of the star, allowing the dim planet to be found. The energy of material falling into the forming planet has heated it to more than 1800° F (1000° C). The disk still has about 55 Jupiter masses of material that may go into this or other planets as they form. The planet was found during a survey of 150 young dusty stars.

Fobos-Grunt (English: Phobos-Ground/Soil, Russian sample return mission to Martian moon Phobos) launched into Earth orbit on schedule in early November, but the rocket engine to propel it into higher Earth orbit and then on to Mars failed to fire. Spacecraft controllers are trying to determine what went wrong and what can be done to correct it. They have a couple of weeks before they would miss the launch window to proceed to Mars. In a few weeks after that, the spacecraft could reenter Earth's atmosphere and crash (a spectacular crash, since it has several tons of rocket fuel on board). The spacecraft carries foreign experiments, including US, and a piggyback Martian spacecraft from China. So if it is not recovered, this will become a huge international scientific loss.

Progress (cargo rocket) – Russia has successfully resumed launches of Progress and Soyuz rockets, following the failure of the Progress taking supplies to the International Space Station (ISS) in August. Progress and Soyuz essentially share the same rocket stage that failed. A fully loaded Progress was launched to ISS October 30, and a Soyuz with 3 astronauts headed toward ISS on November 13. Another Soyuz is scheduled for December 21, which will put occupation of ISS and its cargo resupply back on a regular schedule, only about 3 weeks behind the schedule that existed before the failure. There is currently no alternative to Soyuz or Progress, so continued use of ISS depended on finding and fixing the problem that caused the August failure.

China has launched a Shenzhou spacecraft that docked with the small Tiangong space station that was previously put in orbit. Both are unmanned, but plans have been announced for 2 Shenzhou craft with people aboard to dock with the station starting in 2012. The 1st female Chinese astronaut will probably be aboard 1 of these flights. Each spacecraft weighs about 8 tons and is 30-35 ft (9-10 m) long.

Instant AstroSpace Updates

Using radiotelescopes, scientists have found large amounts of **water vapor** (about a quadrillion times the water found on Earth) in a star forming region in a very distant galaxy, so far that its light took 12 billion years to reach us.

A survey in infrared toward the center of our Milky Way galaxy to look at variable stars has turned up 2 previously unknown **globular clusters** and several open clusters, hidden in visible light by dust. One globular appears to be the closest known to the Milky Way center, and the other may be in orbit about another globular, a first.

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By measuring the motions of stars near the center of galaxy **M85**, using the Hubble Space Telescope, astronomers have determined that it probably does not have a supermassive black hole at its center, or at most has a relatively small one (less than 65 million solar masses). This may be an exception to the rule that all large galaxies have supermassive black holes.

A comet (designated P/2010 TO20 [LINEAR-Grauer]) was discovered recently that was subsequently found to be the same object as a known Trojan asteroid, one of those asteroids that orbits in Jupiter's orbit at one of the gravitationally stable Lagrange points. Apparently the object emits gas occasionally, developing a comet head, becoming the 1st known **Trojan comet**.

Asteroid 2005 YU55, about 1300 ft (400 m) across, passed closer to Earth than the Moon on November 8 and was observed by many amateur and professional astronomers. The Goldstone radiotelescope imaged it in radar with the best radar resolution ever of a solar system object.

NASA and Japan released the most complete **digital topographic map** of Earth, which was made using data from the Japanese ASTER instrument on the NASA Terra spacecraft. It is online and free of cost.

NASA has announced that it will test the **Orion** spacecraft, which is designed to take 4 people into space, potentially far beyond low Earth orbit, by flying it unmanned into deep space atop a Delta IV Heavy rocket, then water-landing back on Earth, by 2014. Eventually Orion will fly on SLS, the next heavy-lift NASA vehicle.

Mars Express observations were suspended in order to address problems that have involved 5 computer and/or communications incidents since August. Safe modes due to such problems use excessive fuel, so means must be found to stop them, probably involving reprogramming of spacecraft computers.

The US Senate passed a bill funding the **James Webb Space Telescope** for the next year, but the House of Representatives has not yet voted on it. A House committee earlier had recommended against funding the telescope because of cost and schedule overruns. ■

Planning year-end donations? Don't forget OCA!

This is the time of year when your tax advisor may encourage you to make your planned charitable donations, to reduce your 2011 tax bill. If you are fortunate enough to be in a position to do that, do not forget the Orange County Astronomers! OCA is a 501-c-3 non-profit, exempt organization under the Federal tax code.

We can find good homes for your surplus telescopes and accessories (finders, eyepieces, mounts, tripods, etc.) in our Loaner 'scope program and other venues. We can also make good use of your cash donations to support our activities and assets.

If you would like to make a donation, you can contact the Trustees via e-mail at board@ocastronomers.net to arrange the details.

Thank you for your support!

NASA's Mars Science Laboratory spacecraft, sealed inside its payload fairing atop the United Launch Alliance Atlas V rocket, clears the tower at Space Launch Complex 41 on Cape Canaveral Air Force Station in Florida.The mission lifted off at 7:02 a.m. PST, Nov. 26, beginning an eight-month interplanetary cruise to Mars. The spacecraft's components include a car-sized rover, Curiosity, which has 10 science instruments designed to search for signs of life, including methane, and to help determine if this gas is from a biological or geological source. Image credit: NASA/Bill White

(continued from page 2)
The class is free and open to members of the general public, not just club members, and participants are invited to attend one of our star parties, so they can get a real taste of what it's like to observe what's up there for themselves. Some go to Black Star Canyon and others to Anza; if you happen to be at either party when members of the Beginners Class attend, please make them welcome, and, if you are viewing, invite them to share your views.

And if you'd like some help with your telescope, or would like to help out with showing other people how they can best use their equipment, please note the next date for the "How to Use Your Telescope" class – that would be June 1, 2012. Unfortunately, I didn't get announcements out about the December class in time for the November Sirius Astronomer, but, if you were interested in attending, I hope you found out about it in time and were able to do so.

OCA's Special Interest Groups

The club has three very active special-interest groups, the AstroImaging group, the Astrophysics group and the GoTo group. If you haven't checked any of them out, you might make a New Year's resolution to give them each a try in the New Year, as they are a great way to meet other club members who share your interests, as well as giving you a great way to learn what you want to know faster.

AstroImaging Group: This group meets regularly on the third Tuesday of the month, in a conference room at Gibson, Dunn & Crutcher, which they kindly make available to us through the generosity of Joe Busch. The meetings start at 7:00, and people often get there a bit early to socialize – there are also breaks and a post-meeting social session, so there are plenty of chances to get to know people, exchange information, and enjoy the company of your fellow imagers.

The most regular feature of the meetings is a "show and tell" session, where people show recent images they've been working on and often ask for comment or assistance. There is usually also a presentation on a topic of interest, often by members of the group but sometimes with outside speakers, as well. The featured speaker at the November meeting is an experiment in using Skype, which may open the way for a wider range of speakers, as they wouldn't need to be physically present in order to give a presentation.

The AstroImaging group has members at all levels of experience, very beginning to very experienced. Everyone was a beginner at one time or another, so if that is your level, you shouldn't feel intimidated about coming to the meetings – if you stick with it, you'll find that going to the meetings can really help you get up that learning curve to get good images much faster than doing it on your own. Even if you're not an imager, there is a lot of information you can pick up, along with a better appreciation of what goes into making those wonderful images we enjoy so much. I'm not an imager myself, but I go to the meetings when I can, because there's a lot to them that even a non-imager can appreciate.

If you have any questions about the group you can contact Alan Smallbone, the current chair, at asmallbone@earthlink.net, Bruce Waddington, the current secretary, me, or any of the imagers who attend regularly. You should also check out the group's website, at www.oc-aisig.org, which you can access from the link on the OCA website's homepage above the thumbnail images on the right side of the screen.

Astrophysics Group: This group meets on the third Friday of every month, in the classroom at the back of the Heritage Museum of Orange County, at 3101 West Harvard, Santa Ana. This is about a block west of Fairview, between Edinger and Warner (the same place we have the Beginners Astronomy Class). The meetings start at 7:30, but there are usually people showing up soon after 7:00, and quite a bit of conversation before the meeting itself starts.

The group's interest is in how the different parts of the universe work, which we approach in strictly lay terms. The main activity in each of the meetings is watching a couple of lectures from one or two different lecture series on different aspects of astronomy and cosmology. In the past, we've seen lectures from the extensive series on different aspects of astronomy by Alex Filipenko of UC Berkeley, a series on dark energy and dark matter from Sean Carroll, and we are nearing the end of the series from Mark Whittle on Cosmology – these are just a sample of what we've been treating our minds with. Our current chair, Bob Sharshan, sends out a regular preview of what we expect to view shortly before each meeting; at the November meeting, we are planning to have a live presentation from Reza AmirArjomand on his experiences and the work he was doing during his internship at CERN.

In addition to the main presentations, we have group discussions of the lectures, matters of interest that may be in the news, cosmological questions raised by different members of the group, and a lot of related matters. Another regular feature is Don Lynn discussing the most recent pictures he has culled from NASA and other sites on the Internet; although he also shows the pictures at the general meetings, it's at the astrophysics meetings that he really explains what they are and what makes them

(continued next page)

of particular interest. A number of members also bring cookies (this started with Steve Short bringing Oreos, always a nice touch to an evening of astrophysics), so this is one group that usually features refreshments at its meetings, thanks to the generosity of those members.

If you have any interest in the various phenomena you can observe out there in the wider universe, or the various discoveries that have been increasing our understanding of what's going on in the universe around us, including how it may have started and how it may end, you should definitely check this group out. If you have questions or would like to get on the mailing list for what we will be seeing in the upcoming meetings, please contact Bob Sharshan at rsharshan@aol.com.

GoTo Group: This group's meetings are set more irregularly than the other groups, and are generally every other month with the specific dates worked out between Mike Bertin, the group chair, and Craig Bobchin, who hosts them at his home. The group is interested in all types of goto telescopes, and started as a group of members who had the original small goto scopes that Meade introduced several years ago, their ETX line, with a specific interest in getting the best performance possible from these scopes. The group's interests have expanded well beyond those roots, but it never lost its focus on what people can do to improve the accuracy and functioning of their scopes, or make using them easier.

Mike Bertin sends out emails to the group members before the meetings with the topic for the meeting and usually some helpful information related to the topic – actually, he sends a series of emails, as reminders, all of which have helpful tips. You can get on his mailing list by contacting him at mcb1@aol.com – even if you don't make it to many meetings, you'll most likely find his emails very helpful. As the meetings get closer, he sends the directions to the location, which we don't post generally as it is a private residence.

The meetings usually start with introductions, particularly if there's anyone new to the group in attendance, and a general discussion of the topic of the evening. This is a collaborative effort, and we welcome input from anyone with information or insight on the issue at hand. The discussions are usually informative, frequently go in some surprising directions, and there's usually a lot of laughter and good will shared as well. After the discussion session, weather permitting, everyone moves outside for an observing session and chance to put some of the things have been discussed into practice.

Often people will bring a scope they're having problems with, and either the group as a whole or some of the members will help out with diagnosing the problem and trying to figure out a good solution. Some of these helping sessions have led to really interesting discussions – so in the end we all learn more, and the person who had the original problem has at least a roadmap for getting a solution if we aren't able to figure out a way to deal with it there. This dovetails into another regular activity of the group – volunteering to help out with the "How to Use Your Telescope" sessions of the Beginners Astronomy Class, where group members (and other club volunteers) help folks who are having problems with their scopes learn to set them up and find things with them. As one of the people involved in organizing those sessions, I'm particularly grateful to my fellow GoTo-ers for their help with this.

If you have a goto scope or are thinking of getting one, this group is great resource and, as with all of these groups, is a really great and helpful group of people.

As we look forward to a fresh new year, I hope you'll take advantage of the opportunities these special interest groups offer, and at least try coming to a few of their meetings to get a feel for what they are and what they do – if you're like most of us, you'll find them helpful, informative and a great way to add to your enjoyment of our hobby and our club. ■

Don Lynn stacked three one-minute exposures to create this image of Asteroid 2005 YU55 as it passed inside the Moon's orbit on 11/8. A Canon 50D imager was used in conjunction with an Internet scope based in New Mexico. A much more detailed image of the asteroid may be found in Don Lynn's AstroSpace Update in this issue.

No matter what holiday you and your family may be celebrating this year, this image of the Christmas Tree Cluster and the Cone Nebula (NGC 2664) is always a crowd pleaser! Located in Monoceros, this object is available for your viewing pleasure throughout the holiday season. (Photo Credit: Stevan Hart)

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