SIRIUS ASTRONOMER
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The Newsletter of the Orange County Astronomers

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KEEP THAT GRILL HOT! STARBECUE RESCHEDULED TO AUGUST 15!

A mystery no more, this image of the surface of Pluto was taken by the New Horizons probe from a distance of 476,000 miles (768,000 kilometers) just prior to the historic flyby on July 14th. The prominent heart-shaped feature, since informally named Tombaugh Regio for Pluto's discoverer, consists of a large plain of methane and nitrogen ice criss-crossed by fine, shallow grooves. This combined with mountains in excess of 11,000 feet in height indicates Pluto is a much more active world than originally anticipated. MUCH more on Pluto in this month's issue!

OCA MEETING

The free and open club meeting will be held August 14 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month's speaker is Dr. Alan Dressler from the Carnegie Observatories, who will discuss the new generation of space telescopes!

NEXT MEETINGS: September 18, October 9

STAR PARTIES

The Black Star Canyon site will open on August 8. The Anza site will be open on August 15. 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 at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana on August 7. The following class will be held September 2.

GOTO SIG: TBA
Astro-Imagers SIG: Aug. 11, Sept. 8
Remote Telescopes: TBA
Astrophysics SIG: Aug. 21, Sept. 11
Dark Sky Group: TBA

On The Brightness Of Venus

By Ethan Siegel

Throughout the past few months, Venus and Jupiter have been consistently the brightest two objects visible in the night sky (besides the moon) appearing in the west shortly after sunset. Jupiter is the largest and most massive planet in the solar system, yet Venus is the planet that comes closest to our world. On June 30th, Venus and Jupiter made their closest approach to one another as seen from Earth—a conjunction—coming within just 0.4° of one another, making this the closest conjunction of these two worlds in over 2,000 years.

And yet throughout all this time, and especially notable near its closest approach, Venus far outshines Jupiter by 2.7 astronomical magnitudes, or a factor of 12 in apparent brightness. You might initially think that Venus's proximity to Earth would explain this, as a cursory check would seem to show. On June 30th Venus was 0.5 astronomical units (AU) away from Earth, while Jupiter was six AU away. This appears to be exactly the factor of 12 that you need.

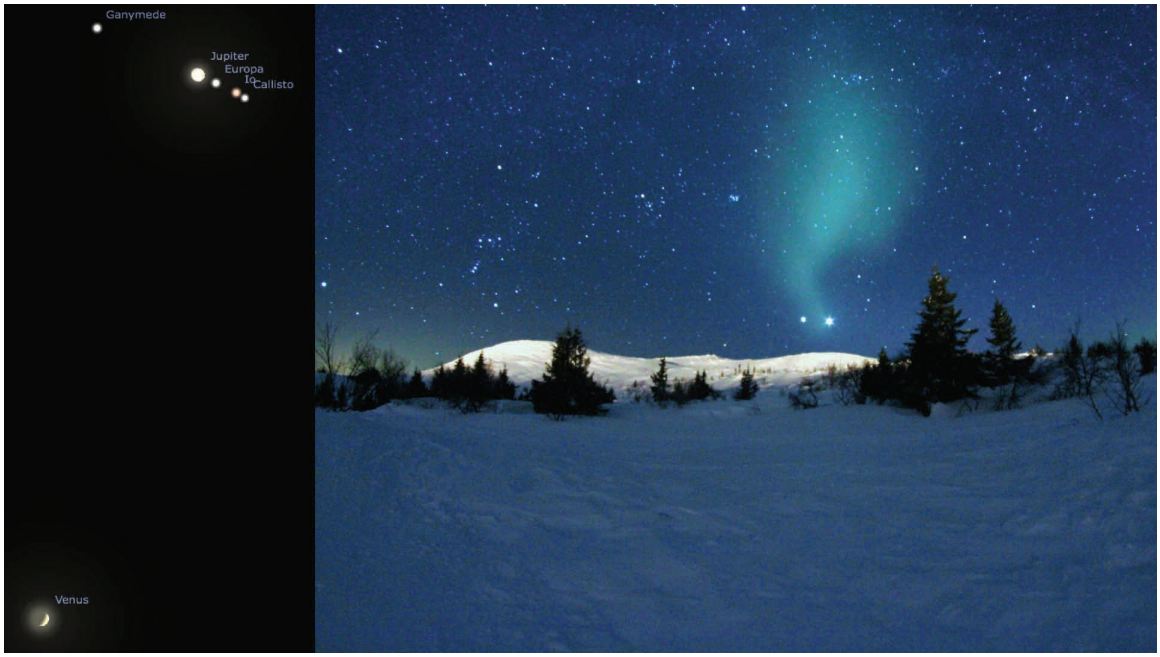


Image credit: E. Siegel, using the free software Stellarium (L); Wikimedia Commons user TimothyBoocock, under a c.c.-share alike 3.0 license (R). The June 30th conjunction (L) saw Venus and Jupiter pass within 0.4° of one another, yet Venus always appears much brighter (R), as it did in this image from

Only this doesn't explain things at all! Brightness falls off as the inverse square of the distance, meaning that if all things were equal, Venus ought to seem not 12 but 144 times brighter than Jupiter. There are three factors in play that set things back on the right path: size, albedo, and illumination. Jupiter is 11.6 times the diameter of Venus, meaning that despite the great difference in distance, the two worlds spanned almost exactly the same angular diameter in the sky on the date of the conjunction. Moreover, while Venus is covered in thick, sulfuric acid clouds, Jupiter is a reflective, cloudy world, too. All told, Venus possesses only a somewhat greater visual geometric albedo (or amount of reflected visible light) than Jupiter: 67 percent and 52 percent, respectively. Finally, while Venus and Jupiter both reflect sunlight toward Earth, Jupiter is always in the full (or almost full) phase, while Venus (on June 30th) appeared as a thick crescent.

All told, it's a combination of these four factors—distance, size, albedo, and the phase-determined illuminated area—that determine how bright a planet appears to us, and all four need to be taken into account to explain our observations.

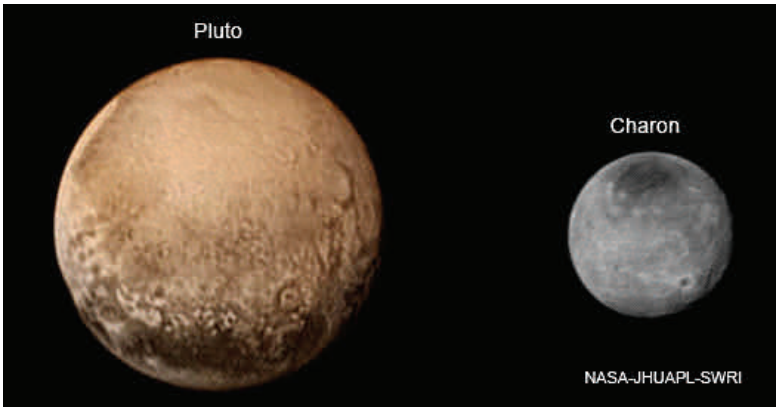
Don't fret if you missed the Venus-Jupiter conjunction; three more big, bright, close ones are coming up later this year in the eastern pre-dawn sky: Mars-Jupiter on October 17, Venus-Jupiter on October 26, and Venus-Mars on November 3.

Keep watching the skies, and enjoy the spectacular dance of the planets!

AstroSpace Update

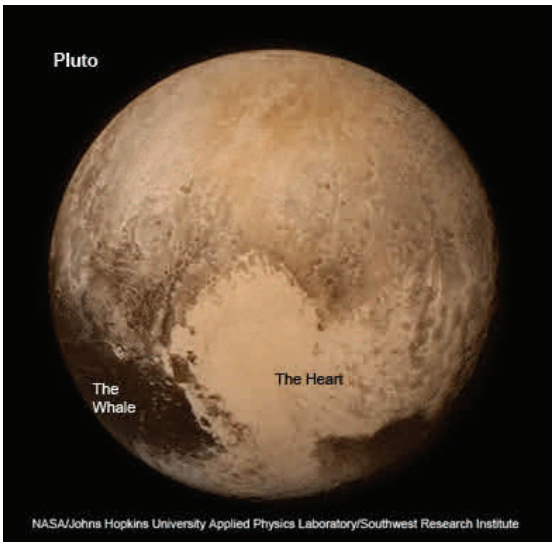
August 2015

Gathered by Don Lynn from NASA and other sources

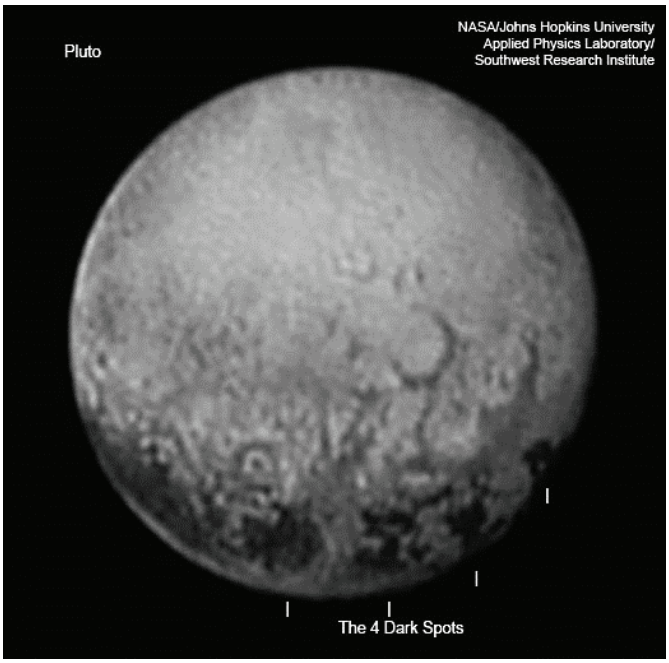


New Horizons (Pluto mission) – At the end of June the New Horizons team examined all data from the search for more moons, rings or dust near Pluto, and decided that the originally planned path through the Pluto system was safe from such hazards, and would be followed. The great distance and small radio on New Horizons mean that it takes nearly an hour to send each picture back (plus 4.5 hours light travel time). The great speed (about 31,000 mph = 50,000 km/hr) of the spacecraft means that all high-resolution data is taken for only a day or 2 around closest approach, which occurred July 14. New Horizons cannot take data and send it to Earth at the same time, since those operations require pointing the spacecraft different directions. So it was planned to store almost all observations on board and radio them back later. This will probably take over a year. But that means the joy of seeing new Pluto discoveries will last for a year or so.

More Pluto – Some facts known before the New Horizons flyby: Charon (Pluto's largest moon) and the 4 smaller moons were probably formed by a collision billions of years ago between some other object and Pluto, which knocked huge amounts of material into orbit about Pluto, which then coalesced to form the moons. Charon is about 750 miles (1200 km) across, just over half the size of Pluto, making it the Solar System's largest moon relative to its planet. But Charon and Pluto are quite different. A high-contrast array of bright and dark features covers Pluto's surface, while Charon is more uniform light gray, except its dark polar region. The reddish materials that color Pluto are absent on Charon. Pluto has a significant atmosphere; Charon does not. On Pluto, exotic ices like frozen nitrogen, methane and carbon monoxide have been found, while Charon's surface is made of frozen water and ammonia compounds. The interior of Pluto is mostly rock, while Charon contains equal measures of rock and water ice.



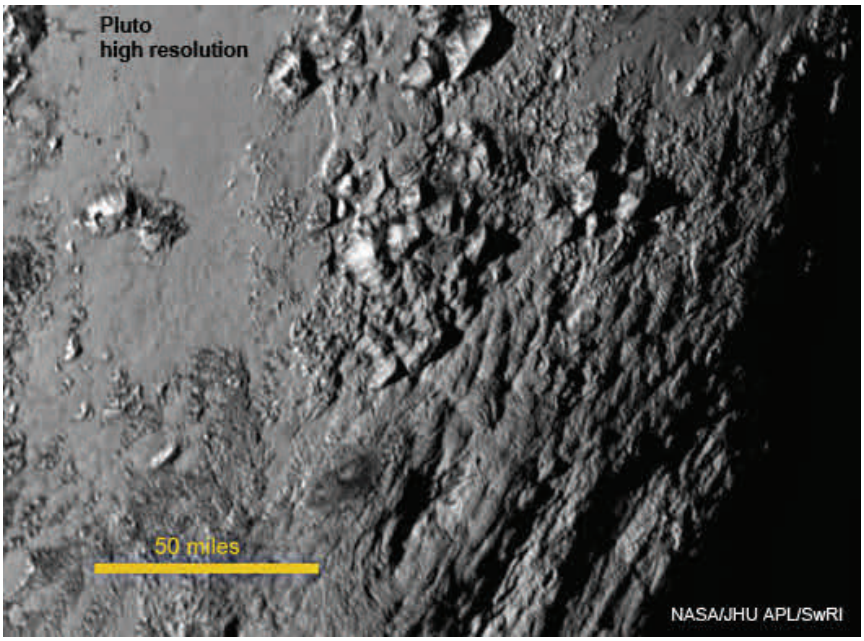
New Horizons Results – Charon has been found to have a dark polar cap, so it's clearly not ice like other polar caps. Whatever the dark material is, it appears to be only a thin layer, since craters are seen to punch through to lighter material. Charon also has a system of chasms larger than Earth's Grand Canyon. Pluto has a huge dark area about 1800 miles (2900 km) long lying along much of its equator, which has been dubbed "the whale" (it has a tail-shape on the left end). Right of the whale is a light heart-shaped area. Team members have already made a bumper sticker using an image of the heart, reading "I  Pluto". The New Horizons team is suggesting to the IAU naming body that The Heart be named Tombaugh Regio, in honor of the discoverer of Pluto. It is the brightest and most prominent feature on Pluto. This area and some others were surprisingly found to have very few impact craters. This implies that these areas have been resurfaced by some means geologically recently, probably less than 100 million years ago. The other icy bodies in the Solar System that show resurfacing were all done by heat from tidal interactions. But there is no source of tidal heat in the Pluto-Charon system because they have been in tidal equilibrium for billions of years. The best candidates for heat sources are radioactive decay or some as yet unknown mechanism that vastly slowed loss of the original heat of planet formation. The 1st very high resolution image was of about 1% of the body near the bottom of The Heart. It surprisingly showed mountains as high as 11,000 ft (3300 m). Earlier observations showed most of the surface is nitrogen ice and methane ice, and neither of these is strong enough to support mountains this high. This means the mountains are water ice (which is strong enough at this temperature) poking up through the other ices on the surface. The method of forming high mountains is still a mystery. Farther around the equator are 4

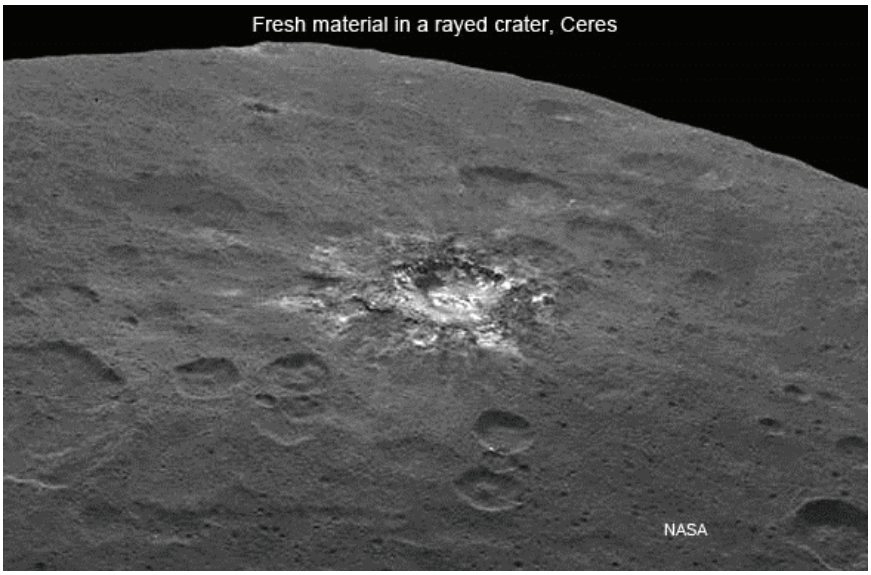


irregularly-shaped dark spots, perfectly in line and evenly spaced, about the size of Missouri. Not clear what any of these features are until data from the other instruments and closer images are returned.

More results – Nitrogen has been detected escaping from Pluto's atmosphere, at distances from the planet much larger than predicted theoretically. It is known that Pluto is currently losing atmosphere through the process known as hydrodynamic escape. It is important to study this loss here at Pluto, because it no longer occurs at any other planet in the Solar System, though it likely played a big part in changes in Earth's and Mars's atmospheres soon after they formed. Preliminary estimates are that nitrogen lost since Pluto formed amounts to 300-3000 yards (m) deep of nitrogen ice. Since there is still substantial nitrogen ice, the element must be replenished from inside. So scientists will be looking for signs of nitrogen geysers. Pluto's north polar cap has been spectroscopically measured as being water ice and nitrogen ice. Pluto's diameter was found to be about 30 miles (48 km) larger than the best previous measurement, which means the density of Pluto is about 6% smaller than thought, so it contains more ice and less rock than thought. It also means that the lower layers of the atmosphere are not as high as thought (since the top of the atmosphere is where we thought, but the bottom, at the surface, is higher). The diameter of Pluto has been notoriously difficult to measure from Earth-bound instruments, because the Plutonian atmosphere blocks and refracts light in its lower reaches, so occultation data does not really show where the atmosphere ends and the surface begins. It also means that the dwarf planet Eris is just slightly smaller than Pluto, whereas the previous best measurements showed it was just slightly larger. Thus Pluto is the largest known object in the Kuiper Belt, the doughnut-shaped region of objects orbiting beyond Neptune. The variety of terrain seen on Pluto and on Charon is surprising scientists. There are not enough processes seen on other icy bodies that should occur here to explain all these terrains.

Yet more Pluto – New Horizons measured radio and other wavelengths of light passing through Pluto's atmosphere during its flyby, to determine the properties of that atmosphere at various altitudes. But a couple of week earlier, another opportunity to make similar measurements arose, because, by chance, Pluto passed in front of a 12th magnitude star, as seen from Earth. That may sound dim, but it is the brightest star that Pluto has ever been known to occult. The path of this occultation passed over Tasmania and New Zealand, and teams of astronomers there observed it. Also SOFIA, the infrared airborne observatory, flew through the path and observed also. Though full analyses have not yet been made, the effects of Pluto's atmosphere were definitely seen, and a central flash was also seen. Central flashes occur if located exactly on the center line of the occultation path, and are caused by light refracting through the atmosphere in a ring around the planet. Central flash data allows astronomers to deduce properties of hazes in the atmosphere. There has been concern the last few years that Pluto's receding from the Sun in its orbit might cool it down enough to freeze out its atmosphere by the time New Horizons arrived. It is clear that this has not happened yet, at least not completely.



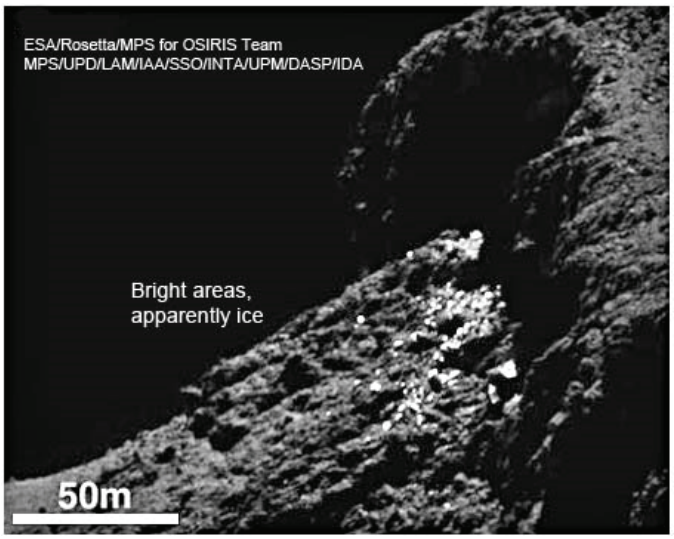


Dawn (asteroid mission) has been lowering its orbit about Ceres and is getting more detailed pictures. One area of bright spots has been determined to be splash from an impact crater, but the other bright spots, particularly the brightest pair, are not located at craters. Their cause is still a mystery. Ice and salt remain the most likely of several suggested explanations for these brightest spots, but ice should evaporate (sublimate) and there is no reason for salt to be there. Dawn observations have revised the size of Ceres to about 599 miles (963 km) across the equator and 554 miles (891 km) through the poles. The temperature has been found to range from about minus 100°F (-73°C) in the daytime to -225°F (-143°C) at night.

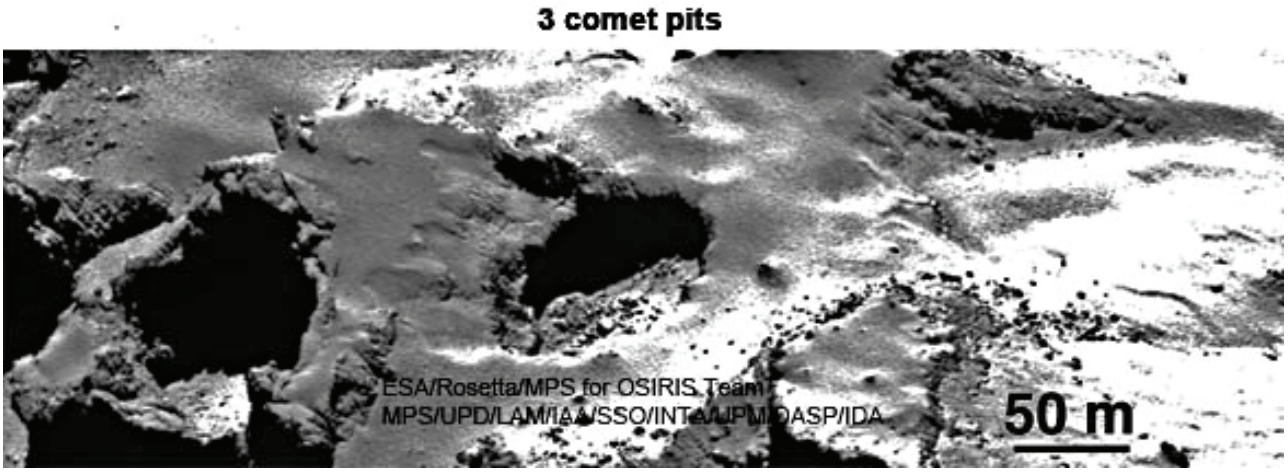
Venus volcanoes – Radar observations made through the clouds of Venus in the past have shown mountains in the shape of volcanoes and areas of past lava flows. Much of the evidence was for extensive lava flows about ½ billion years ago. A study published in 2010 found hot spots in volcanic regions that were shown to be lava less than 2.5 million years old. The question remained as to whether volcanoes are still erupting on Venus today. A rise in atmospheric sulfur dioxide in 2006-7 hinted that eruptions were still occurring. New observations by Venus Express made in infrared showed large changes in temperature in images taken days apart that are likely lava flows occurring. The hot spots were found along the Ganiki Chasma rift zone close to the volcanoes Ozza Mons and Maat Mons. Rift zones are results of fracturing of the surface, which is often associated with upwelling of magma below the crust.

Lunar dust – Data from LADEE (former lunar orbiter) reveals that the Moon is surrounded by a permanent dust cloud likely caused by comet particle collisions with the Moon's surface. The spacecraft recorded 140,000 dust hits during 80 days of observation time. The resulting cloud is irregularly shaped, matching what was predicted to result from comet dust particles, considering the known distribution of such particles. The density of the cloud is strongest around the Moon's morning terminator. LADEE detected about once a week bursts of 10 to 50 particles in less than a minute. This suggested that the particles in those events all originated from the same impact on the Moon shortly before. The impacts spiked during the Geminid meteor shower, for about 1.5 days around the December peak. The cloud is composed of bigger particles and too low density to explain the glow seen at the Moon by astronauts on Apollo 15 and 17 missions. The discovery team suggests that all "airless" (or nearly so) bodies in the Solar System would be engulfed by similar dust clouds, since they would be hit by the same rain of comet particles.

Rosetta (comet mission) – Using the high-resolution science camera on Rosetta, scientists have identified more than 100 patches of water ice a few yards (m) in size on the surface of Comet 67P/Churyumov-Gerasimenko. As comets move closer to the Sun along their orbits, their surfaces are warmed and the ices sublimate into gas, which streams away from the nucleus, dragging along dust particles embedded in the ice. Some of that dust remains on the surface or falls back on the surface, coating it with a thin layer of dusty material and leaving very little ice directly exposed on the surface. Thus comet nucleuses are quite dark. This means that the ice patches seen on 67P are newly exposed. It was calculated that water ice should sublimate at somewhat less than 1 mm (.04 inch) per hour of incident sunlight on this comet. Some of these bright features are found in clusters, while others appear isolated, and when observed at high resolution, many of them appear to be boulders displaying bright patches on their surfaces. The clusters of bright features are typically found in debris fields at the base of cliffs. They are most likely the result of recent erosion or collapse of the cliff wall revealing fresher material from below the dust-covered surface. By contrast, some of the isolated bright objects are found in regions without any apparent relation to the



surrounding terrain. These are thought to be objects lifted up from elsewhere on the comet during a period of cometary activity, but with insufficient velocity to escape the gravitational pull of the comet completely. In all cases, however, the bright patches were found in areas that receive relatively little sunlight, such as in the shadow of a cliff, and no significant changes were observed between images taken over a period of about a month. The bright patches were found to be bluer in color in visible wavelengths compared with the slightly redder background, consistent with being ice. Further study will be required to determine if the ice patches were created recently or during the previous passage of the comet near the Sun.

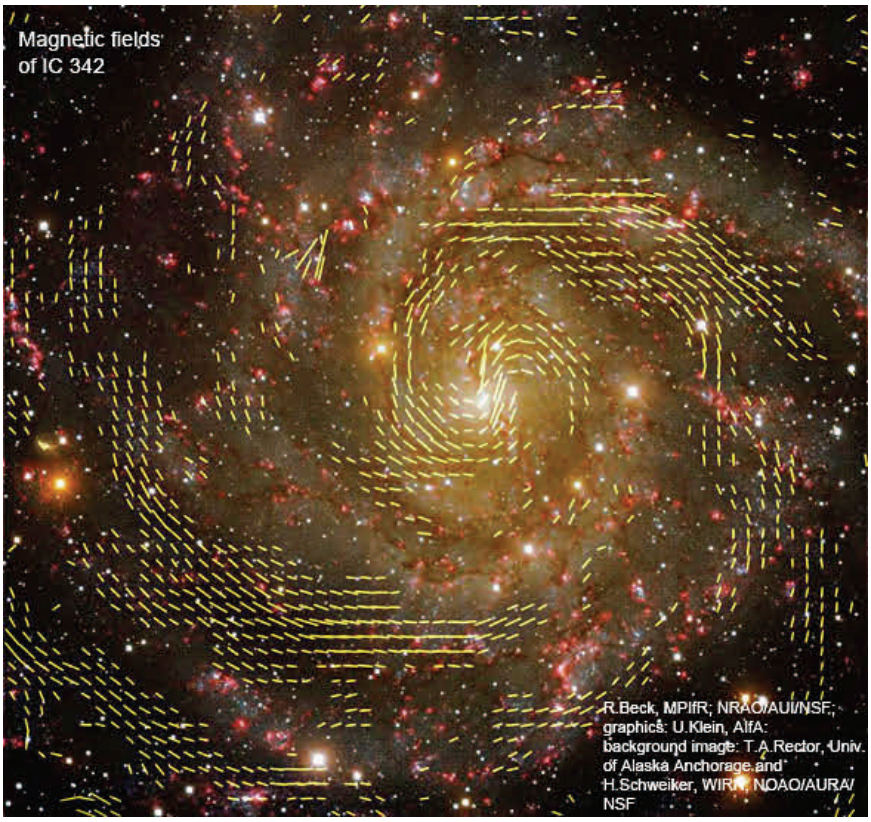


More Rosetta – A number of the dust jets emerging from Rosetta's comet can be traced back to active pits that were likely formed by a sudden collapse of the surface. These sinkholes are providing a glimpse at the chaotic and diverse interior of the comet. A study looked at 18 roughly circular pits, some of which are the source of continuing activity. The pits are a few tens to a few hundreds of yards (m) in diameter and extend up to about 700 ft (210 m) deep, with a smooth dust-covered floor. Material is seen to be streaming from the most active pits. Jets are seen arising from fractures in the pit walls. The fractures mean that volatiles trapped under the surface can be warmed more easily and then escape into space. Scientists analyzing the images think that the pits are formed when the ceiling of a subsurface cavity becomes too thin to support its own weight and collapses as a sinkhole. 3 theories have been suggested as to how the cavities formed: 1) formed when the comet formed, 2) pockets of volatile material sublimated from sunlight heating the surface, 3) water ice changing from amorphous to crystalline liberates heat, which sublimates pockets of volatile material. The new study shows the internal features revealed on the pit walls vary significantly from pit to pit, and include fractured material, terraces, horizontal layers, vertical striations, and globular structures nicknamed "goosebumps". The young active pits are particularly steep-sided, whereas pits without any observed activity are shallower and seem to be filled with dust. Middle-ages pits tend to exhibit boulders on their floors from mass-wasting of the sides. The oldest pits have degraded rims and are filled with dust. The pits are believed to have existed for several orbits already, since outbursts that should occur with a pit collapse have not been seen this orbit.

First generation stars – Astronomers using several ground- and space-based telescopes have discovered by far the brightest galaxy yet found in the early Universe and have found strong evidence that it contains first generation stars. These massive brilliant stars were the creators of the 1st heavy elements in history, the elements necessary to forge stars seen today and the planets that orbit them, and life as we know it. The newly found galaxy, labeled CR7, is 3 times as bright as the brightest distant galaxy known previously. CR7 is so distant that we are seeing it as it was just 800 million years after the Big Bang. The study found a number of surprisingly bright young distant galaxies, of which CR7 was the brightest. The 1st stars to form in the Universe were made of only hydrogen, helium and traces of lithium, since that is all that the Big Bang could create. Theoretically such stars should have been enormous: several hundred or more times as massive as our Sun; blazing hot, and transient; and exploding as supernovas after only about 2 million years. This is the 1st substantial evidence that we have found such stars. Patches of CR7 were found spectroscopically to contain ionized helium, but no heavier elements. Some bluer and redder patches of stars were found, meaning the bluer ones had formed more recently. So first generation star formation occurred in waves, not all at once.

Planetary forming – Hourglass (or bipolar) structures in planetary nebulas are common, but astronomers are debating exactly how that shape forms. New observations of the star L_2 Puppis made with the Very Large Telescope in Chile caught for the 1st time such a shape forming. The observing team used a new extreme adaptive optics instrument designed to resolve and study faint objects very close to bright stars. It is 210 light-years away, and is one of the closest asymptotic giant branch stars: highly evolved giant stars nearing the ends of their lives. It is hoped that further such observations may pin down exactly the means of forming bipolar planetaries.

Integral (X-ray space telescope) has been observing an exceptional outburst of X-ray and gamma-ray light produced by a black hole that is devouring material from its stellar companion. The pair, known as V404 Cygni, is located in our Milky Way, almost 8000 light-years away. The 1st signs of the outburst were spotted by the Swift satellite in the middle of June. This triggered a massive campaign to observe the outburst in many different wavelengths across the electromagnetic spectrum. Radio wavelengths exhibit a continuous series of extremely bright flares. The X-ray observations show flares lasting only a couple of minutes, which is rarely seen in black hole behavior. There are also longer outbursts over time scales of a few hours. During the flashes, it becomes the brightest X-ray source in the sky. V404 has not been this bright and active since 1989, when a previous X-ray telescope caught an outburst. Archives of visible-light images show V404 had outbursts in 1938 and 1956 also. It is believed that material from the companion piles up in an accretion disk, which after many years becomes overloaded and an outburst occurs. The latest report, from early July, shows the outburst continuing.



Magnetic fields – Astronomers using 2 radiotelescopes to observe nearby galaxy IC 342 have made a map of the magnetic field in the galaxy and discovered a magnetic field coiled around the galaxy's main spiral arm. This may help explain exactly how spiral arms form. The map also shows how gas can be funneled inward toward the galaxy's center to feed star formation. The magnetic field at each point was found by measuring the direction of polarization of the radio waves emitted by the galaxy. Observations at several wavelengths made it possible to correct for rotation of the polarization caused by passage through magnetic fields along the path to Earth.

Chandra (X-ray space telescope) has discovered the largest and brightest set of rings from X-ray light echoes ever observed. The rings were produced by an intense flare, observed in 2013, from a neutron star known as Circinus X-1, reflecting off surrounding clouds. The X-ray observations combined with radiotelescope observations allowed calculating the size of the rings and therefore the distance to the neutron star, which was found to be 30,700 light-years. The neutron star is in orbit about another massive star, and is shrouded by thick clouds of gas and dust. This more accurate distance means that Circinus X-1 is inherently much brighter in X-rays and other types of light than many scientists previously thought. The new brightness value is larger than the Eddington Limit, where light pressure should theoretically push away the material that was falling in to create the X-ray flare. Exceeding this limit has been seen in many black holes, but rarely with a neutron star. Jets of high-energy particles were measured by the Chandra observations to be at least 99.9% the speed of light. Circinus X-1 is thought to have become an X-ray source about 2500 years ago (as seen from Earth). This makes it the youngest X-ray binary known. The Chandra observations also mapped out the dust clouds between Circinus X-1 and us, providing a valuable probe of one direction in our galaxy.

More Chandra – New Chandra X-ray observations show the supermassive black hole at the center of galaxy NGC 5813 has erupted multiple times over 50 million years. This galaxy is the central one of a group, which contain fewer galaxies than a cluster of galaxies. The central black hole of the galaxy has formed jets, which clear out bubbles in the surrounding gas. The new observations found 3 bubble pairs, representing 3 different eruptions in the jets. The energy to create the bubbles seems to be the same, meaning the eruptions were of similar energy. The latest bubble pair seems to be still forming.

ULXs (Ultra Luminous X-ray sources) are known to be close binaries consisting of a black hole and a star. Material is shed by the star, which falls into the accretion disk about the black hole, and becomes so hot that it emits X-rays. But the mass of the black hole is under debate. There are 2 theories: the black holes are 1000 or more times the Sun's mass (which could reasonably pull in enough matter to be so bright in X-rays, but are unbelievably large masses), or the black holes are stellar mass (say 10 times the Sun's mass) and are accreting material at unbelievably high rates (exceeding the Eddington Limit). Theoretically, if the accretion rate is huge, it should be accompanied by a huge disk wind blowing outward. New observations using the Subaru Telescope in Hawaii looked at 4 ULXs and found in their spectra evidence of huge disk winds. This supports the 2nd theory, that ULXs have unbelievably high accretion rates, not unbelievably high masses.

Massive black hole – There is a known ratio between the mass of a galaxy's main bulge of stars and the mass of its central black hole. Astronomers generally agree that this means there is some physical mechanism that makes the black hole and the stars grow in mass together as the galaxy was formed. But new observations show that a quasar named CID-947 that is far too massive for its galaxy (quasars are just supermassive black holes that are pulling in material at huge rates so that they glow brightly). So do the black holes grow first, then the stars later, or is CID-947 a fluke, or are the observations somehow flawed? Further work is needed.

Binary pulsar – A team of astronomers trying to determine why pulsar J2032+4127 wasn't slowing down its spin at the rate almost all pulsars do, found that the reason was a companion star. The companion star theory had been dismissed earlier because the nearest star was farther away than any known pulsar companion. Theoretically, pairs of stars orbiting at great distances should fly apart when a pulsar is formed in a supernova explosion. The orbital period of J2032+4127 is 20-30 years, in a very eccentric orbit. The pair should reach their closest approach in 2018. Stars like the companion star have substantial stellar winds, so the pulsar should smash into that wind near closest approach, which typically spews gamma rays. Astronomers will be watching.

Spitzer (infrared space telescope) – Astronomers have found tentative evidence for hypothesized "rejuvenated planets", giant planets that regain the glow seen from young planets that are still hot from formation. This is accomplished by a Sun-like star coming to the end of its life and blowing out material that hits the planet, causing it to swell in mass and warm up. New research from Spitzer has identified a candidate for a rejuvenated planet. The new study observed a dead star (white dwarf) called PG 0010+280, and found unexpected infrared light around this star. But the observations did not match that expected for a disk or a brown dwarf, leaving a glowing planet as the most likely explanation. If this is confirmed, it would tell us that some planets can survive the red giant stars of stars on the way to becoming a white dwarf, and can be reheated by the experience.

Exoplanet atmosphere loss – Astronomers using the Hubble Space Telescope observing in ultraviolet light have discovered an immense cloud of hydrogen dubbed "the Behemoth" bleeding off a planet (dubbed GJ 436b) orbiting a nearby star. The enormous comet-shaped feature is about 50 times the size of the parent star. The hydrogen is evaporating (technically, escaping to space due to high speed from heat) from a warm Neptune-sized planet because of the extreme heat from the star. A phenomenon this large has never before been seen around any exoplanet. This may offer clues to how hot super-Earths (rocky hot planets larger than Earth) are born through evaporation of their outer layers of hydrogen. In the past, the star, which is a faint red dwarf, was more active. This means that the planet evaporated faster during its 1st billion years of existence. It is estimated to have lost up to 10% of its atmosphere. The huge cloud can exist around this planet because the cloud is not rapidly heated and swept away because the star is a relatively cool red dwarf. GJ 436b is close to its star (less than 3 million miles [5 million km]), and orbits in just 2.6 Earth days. The exoplanet is at least 6 billion years old, and may even be twice that age. Its mass is about 23 times Earth's, and is just 30 light-years from us, one of the closest known exoplanets.

Gravel – Astronomers agree that planets form in disks of gas and dust by that material colliding and sticking until large structures are formed. But theory and simulations have trouble showing how particles stick enough to make gravel-sized objects. For the 1st time, observations found a planet-forming system with gravel-sized particles in it. Further observation may help us fill in the missing theory. The observations were of star DG Tauri, a relatively youthful star just 2.5 million years old and 450 light-years away. Looking at radio wavelengths, the observers discovered a faint glow characteristic of rocks in orbit around the newly formed star. To produce the wavelengths seen, the rocks have to be at least a centimeter (0.4 inch) in size.

International Space Station (ISS) – A SpaceX Falcon 9 rocket taking cargo to the ISS disintegrated about 2 minutes into its flight late in June. This was the 3rd failure of an ISS cargo rocket in 8 months. One was Russian, and 2 American (different types of rockets). ISS was then down to about 4 months of supplies aboard, whereas the usual is a 6 months supply. The next week, the Russian Space Agency launched a supply rocket successfully to ISS. They used an older model of rocket that did not have the same upper stage as the Russian rocket that failed in late April. It was launched about a month earlier than originally planned, in order to get ISS supplies back to near normal. Three failures in 8 months is unprecedented in the history of the ISS program. The next cargo ship scheduled to launch is the Japanese HTV-5 on August 16.

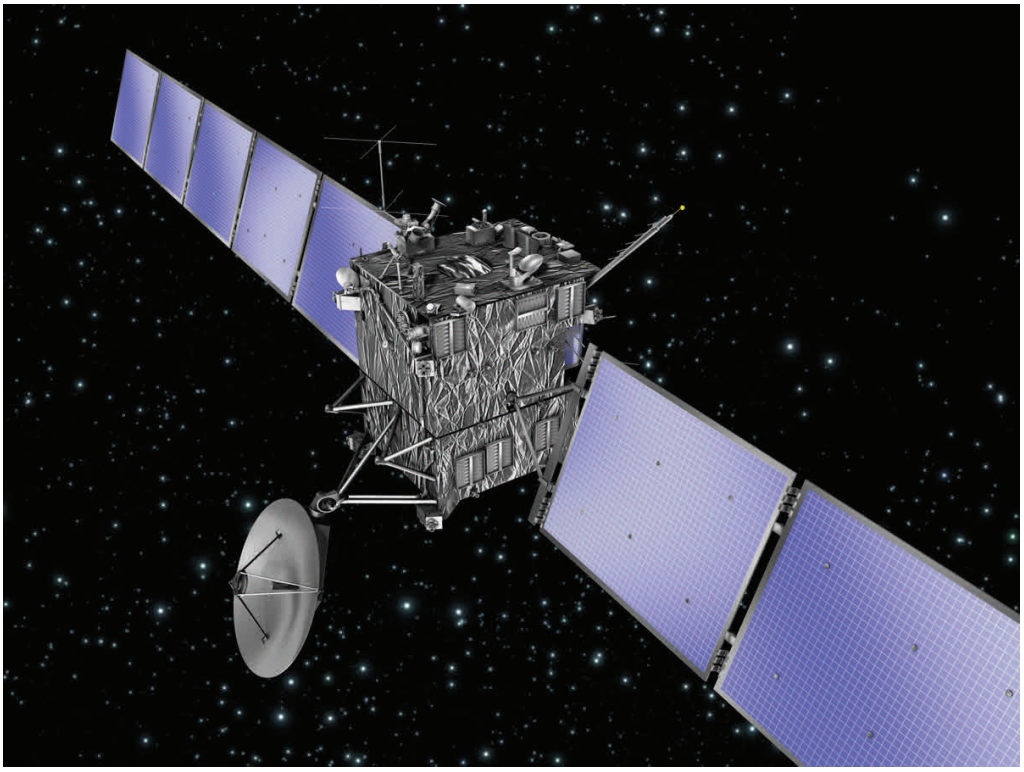
Instant AstroSpace Updates

Curiosity (Mars rover) has been looking at the Sun between examining Martian rocks. Since Mars is on the other side of the Sun from Earth, the sunspot activity visible to Curiosity is not visible from Earth.

ALMA (radiotelescope array) has measured the mass of the black hole at the center of barred spiral galaxy NGC 1097 as being 140 million times the mass of our Sun. The method used was to measure the distribution and motions of 2 types of molecules near the black hole and then match the observations to computer simulations of black holes with different masses.

Scientists using NuSTAR (X-ray space telescope) have detected high-energy X-rays from 5 **supermassive black holes** previously clouded from view at lower-energy wavelengths by dust and gas. Extrapolating, this means there are far more supermassive black holes than previously seen.

Rosetta (comet mission) has been granted a 9-month mission extension, until September 2016, to better observe its comet as it recedes from the Sun. The controller team was also given permission to land the spacecraft on the comet at the end of the mission.



International Observe the Moon Night

September 19, 2015 is International Observe the Moon Night (InOMN) sponsored by NASA. The event is held each year to encourage observation, appreciation and understanding of our Moon. See http://observethemoonnight.org/

This year the Orange County Astronomers will be conducting an Outreach program at the Nix Nature Center, 18751 Laguna Canyon Road in Laguna Beach. The program begins with a lecture by Chris Butler at 7:00 PM and viewing the moon through the telescopes of the OCA Outreach volunteers at 8:00 PM. Everyone is invited to come to hear Chris and to observe the moon.

Chris Butler is extremely knowledgeable about the moon. He grew up during the days of the Apollo missions to the moon. In fact his father worked on one of the teams that built the hardware that NASA used to put the men on the moon.

The moon will be in its first quarter phase, which is perfect for viewing. At that phase the walls of the craters cast shadows onto the floor of the crater thus providing a quasi-three dimensional view of the moon. The length of the shadows inside the basin give an indication of the height of the crater walls.

This is a open event and the general public is welcome to attend. Please spread the word about this event as it is an excellent way to promote interest in astronomy and in the OCA.

Event: International Observe the Moon Night

Host: Orange County Parks Department
Laura Cohen, Resource Specialist

Date: Saturday, 9/19/2015

Time: Chris Butler Lecture at 7:00 PM
Viewing the moon at at 8:00 PM

Place: Nix Nature Center

Address: 18751 Laguna Canyon Rd; Laguna Beach

Location: 33°36'30"N, 117°45'48"W

Directions: Take CA-55 S to I-5 South. Take exit 11A to merge onto I-5 South; go 7.7 mi. Take exit 95 for State Hwy 133 South. Merge onto CA-133 S; go 5.4 mi. Nix Nature Center is on the right (west side of the street).

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**	$42.95
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.**

***Astronomy subscribers can now renew on-line with a credit card. E-mail Charlie@CCCD.EDU for special instructions and the renewal code.**

The **DEADLINE** for subscribing at the club rates will be the **October monthly meeting, October 9th.** 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.

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Vice-President	Reza AmirArjomand	reza@ocastronomers.org	646-494-9570
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Anza Site Maintenance	Don Lynn	donald.lynn@alumni.usc.edu	714-775-7238
Beginner's Astronomy Class	David Pearson	p.davidw@yahoo.com	949-492-5342
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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	startraveler68@yahoo.com	714-699-1243
Telescope Loaner Program	Don Stoutenger	dstouten@yahoo.com	714-271-2646
WAA Representative	Tim Hogle	TimHogle@aol.com	626-357-7770
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