SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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Comet ISON has passed inside the orbit of Jupiter on its way to what is predicted to be a spectacular appearance in Earth's skies starting in November of this year. As of March 2 it was at magnitude 15.3 and was located in the constellation Gemini. Pat Knoll obtained this image using the Kuhn telescope on the night of March 2nd; the times displayed mark the beginning and end of the observing session.

OCA CLUB MEETING

The free and open club meeting will be held April 12 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Dr. Kevork Abazajian of UCI will discuss Cosmological Large Scale Structure Surveys

NEXT MEETINGS: May 10, June 14

STAR PARTIES

The Black Star Canyon site will open on April 6. The Anza site will be open on April 6. 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 April 5. The following class will be held May 3.

GOTO SIG: TBA
Astro-Imagers SIG: Apr. 16, May 21
Remote Telescopes: TBA
Astrophysics SIG: Apr. 19, May 17
Dark Sky Group: TBA

AstroSpace Update

April 2013

Gathered by Don Lynn from NASA and other sources

Van Allen Probes have caught the outer Van Allen radiation belt splitting into 2, but the situation lasted only 4 weeks until a blast of solar wind blew away both parts of the split belt. So temporarily the Earth had 3 Van Allen belts instead of the usual 2. Later a single outer belt formed again. The 3 belts were already present when the electron proton instruments were turned on shortly after launch of the twin probes.

Mars rover Curiosity started misbehaving in late February, failing to go to sleep when scheduled and failing to relay stored data back to Earth. Controllers switched the rover from using its A computer to its B computer, which puts the rover into safe mode. Before entirely returning to normal operation, the Sun blew a coronal mass ejection toward Mars, and as a precaution, controllers put Curiosity back in safe mode for a short time. It is believed that radiation caused the initial problem, and tests are proceeding to determine how to return the A computer to correct operation.

Curiosity conducted analysis of the 1st rock drilling sample ever done on Mars. The drilling was done in early February. Surprisingly, drilling into the red oxidized rock typical of mars produced gray rock powder. This probably indicates that the interior of the rock is not oxidized or only partially so. The rock drilled is a red-colored slab of flat, fine-grained, sedimentary bedrock shot through with mineral veins of calcium sulfate, which formed in water. Elements found in the drill sample included sulfur, nitrogen, hydrogen, oxygen, phosphorus and carbon, key chemical ingredients for life. Minerals identified indicate the rock formed in water, possibly a lake, that was not salty or acidic like other places Mars rovers have analyzed. Evidence was found for multiple periods of wet conditions. It is thought that these wet conditions were billions of years ago, though that cannot be measured from current results. The scientists involved proclaimed this area in the past was hospitable to microbial life, if such developed on Mars. The drill sample was fine-grained mudstone containing sulfate minerals and about 20% clay minerals. Curiosity will continue working in the area for many more weeks before heading off to its main goal of Mount Sharp.

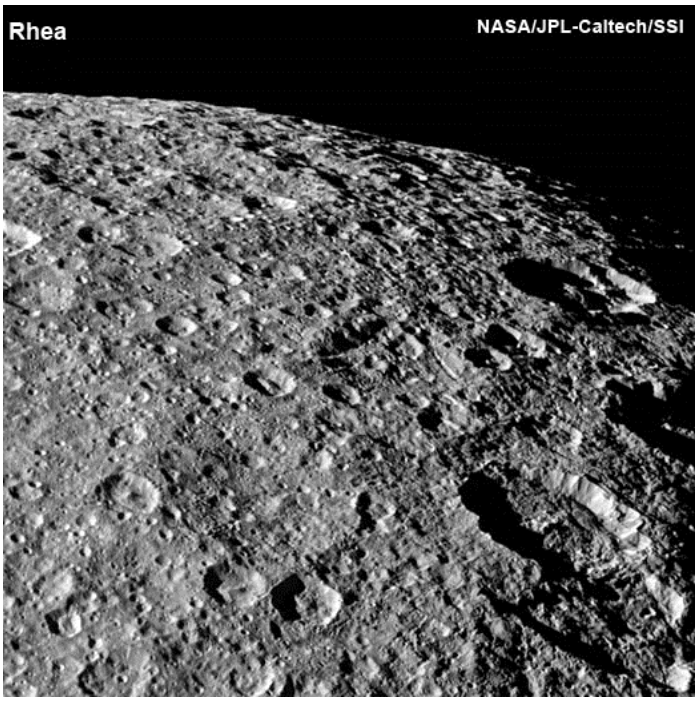
Mars Reconnaissance Orbiter has provided radar images of ancient water channels now buried below the Martian surface. The channels are believed to have been created by a catastrophic flood, comparable to the ancient flooding that created the Channeled Scablands in eastern Washington. Some parts of the Martian channels were known before the radar observation, but the scale of erosion has now been found to be vastly larger than thought. The channels lie in Elysium Planitia, an expanse of plains along the Martian equator and the youngest volcanic region on the planet. Extensive volcanism throughout the last several hundred million years covered this area. The channels are known as the Marte Vallis channel system, and are found to be 620 miles (1000 km) long. The shape of these channels is similar to more ancient channel systems on Mars, especially those of the Chryse basin. Many scientists think the Chryse channels likely were formed by the catastrophic release of ground water, although others suggest lava can produce many of the same features. The radar observations showed enough detail to see evidence of 2 different phases of channel formation. One phase etched a series of smaller branching channels that are now on a raised bench next to the main channel. A second phase carved the deep, wide channels. The new data showed the flood originated from a now-buried portion of the Cerberus Fossae fracture system. The water could have accumulated in an underground reservoir and been released by tectonic or volcanic activity.

Close comet – A newly discovered comet, designated C/2013 A1 (Siding Spring), has been found to be on a course that will pass quite close to Mars on October 19, 2014. Until more measurements refine the orbit, astronomers cannot rule out a slight possibility that it will collide with Mars. If so, it would have a billion times the energy of the Tunguska collision of 1908, and leave a crater 300 miles (500 km) across. Even a near miss should look spectacular from Mars, and Martian spacecraft and rovers will probably shoot images as it passes. The view of the comet from Earth is expected to be fairly good.

Europa – New analysis of old Galileo observations of Jupiter's moon Europa provide strong evidence that chemicals from the subsurface salty ocean are deposited on the surface. So scientists who wish to know what is in the ocean need only scrape up surface material. This means that surface material or energy could also be making its way into the ocean, which could be conducive to life forming in the ocean. Recent Earth-based spectra of Europa have done better than the Galileo data at identifying the materials on that moon's surface; magnesium sulfate was found. However, that is likely the result of sulfur thrown of by neighboring Io reacting with other magnesium salts, likely magnesium chloride, that came up from Europa's ocean. Magnesium chloride has no spectral features in the infrared wavelengths in which Europa has been observed, explaining why it has not been detected before it reacts with the sulfur.

Jupiter hot spots – In Jupiter's atmosphere, cloudless patches are unusual. Through these patches can be seen lower layers that are hotter, so the patches are known as "hot spots". Exactly how these clearings form and why they're only found near the planet's equator have long been mysteries. Using archived images from Cassini when it passed Jupiter on its way to Saturn, scientists have studied the hot spots and determined that they fit the pattern of a Rossby wave, a pattern also seen in Earth's atmosphere and oceans. The wave responsible for the hot spots glides up and down around the planet like a carousel horse. This is the 1st tracking of hot spots over a long period (about 2 months). The atmospheric probe released by the Galileo mission in 1995 happened to hit a hot spot, so most of the information about hot spots came from that encounter. The new study found that typically 8-10 hot spots line up, roughly evenly spaced, with dense white plumes of clouds in between. This pattern is explained by a wave that pushes cold air down, breaking up any clouds, and then carries warm air up, causing the heavy cloud cover seen in the plumes. To separate motions from the jet stream in which the hot spots reside, the scientists also tracked the movements of small "scooter" clouds, similar to cirrus clouds on Earth. This provided what may be the 1st direct measurement of the true wind speed of the jet stream, which was clocked at about 300-450 mph (500-720 kph), much faster than anyone previously thought. The hot spots amble at the more leisurely pace of about 225 mph (360 kph). The researchers estimate that the wave creating the hot spots may rise and fall 15-30 miles (24-50 km).

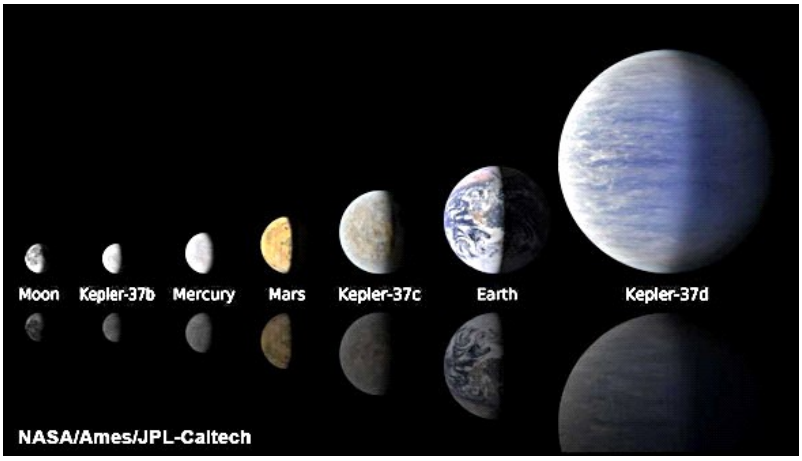
Cassini (Saturn orbiter) made its last pass close to Rhea (620 miles or 997 km), taking close-up images and measuring the gravity field of the moon to determine if the interior is homogeneous or layered. The spacecraft is expected to run low on fuel in 2017, and the chosen orbital path until then will have no more passes near Rhea. Images taken were not only in visible light, but also ultraviolet and infrared. 2 more passes each by Dione and Enceladus will round out the flybys of medium-sized Saturnian moons. Cassini has been orbiting Saturn since 2004, and will end its mission after 4 more years by plunging into the planet's atmosphere.



Messenger (Mercury orbiter) – Scientists analyzed Messenger data and identified 2 distinct compositions of rocks on the planet's surface. The team recreated the 2 rock types on Earth and did lab experiments to determine how they could have formed. The scientists came up with only 1 phenomenon to explain these: a vast ocean of melted rock must have existed shortly after Mercury's formation, solidified, and eventually remelted and erupted onto the surface. The original magma ocean likely was created by the heat of the planet's formation.

Planet forming – Astronomers using the Very Large Telescope in Chile have obtained what is likely the 1st direct observation of a forming planet still embedded in a thick disk of gas and dust. If confirmed, it will greatly improve our understanding of how planets form. A team of astronomers studied the disk surrounding the young star HD 100546, located 335 light-years away. They were surprised to find what appears to be a planet in the process of being formed still embedded in the disk. It is probably a gas giant. Another planet is already known to orbit this star much closer than the disk. The new observations were made at near-infrared wavelengths using adaptive optics and a coronagraph to suppress the star's glare. The new planet is fairly distant from its star (70 times the Earth's distance from the Sun), so there is some controversy over whether a planet could form there or would have formed closer and migrated out. Although a protoplanet is the most likely explanation for the observations, follow-up is required to confirm its existence and rule out other scenarios.

Smallest exoplanet – The Kepler planet-finding space telescope has discovered the smallest planet known to orbit an ordinary star (the only smaller known orbit neutron stars). The planet, Kepler-37b, is smaller than Mercury, but slightly larger than our Moon. The discovery was made by a collaboration between Kepler scientists and asteroseismologists, those who study the oscillations in a star's brightness caused by waves moving through the star. Kepler-37 (the star) is the coolest and smallest star that has been studied with asteroseismology. It is ¾ the diameter of our Sun. The asteroseismic study yielded a precise diameter for the star, which in turn allows precise calculation of the diameter of the planet eclipsing a tiny bit of its light. 2 other planets were found orbiting Kepler-37, 1 slightly smaller than Earth and 1 twice as large. Kepler-37b is likely a rocky planet, but not very Earth-like, having no atmosphere and being smolderingly hot, about 800° F (425° C). It orbits every 13 Earth days and is 3 times closer to its star than Mercury is to our Sun. Its companion planets orbit in 21 and 40 days. Planets as small as Kepler-37b can be detected by Kepler only under ideal conditions. But finding 1 planet this small suggests that very small planets are common.

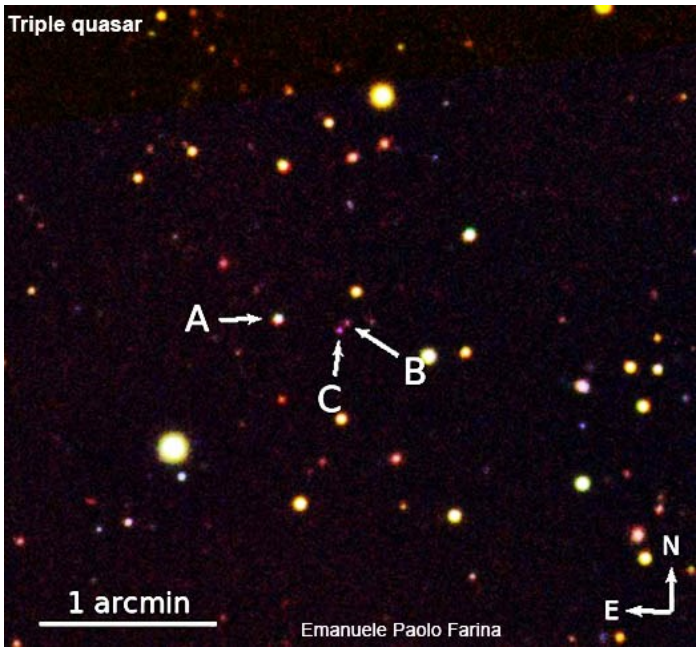


Exoplanet atmosphere – A team of scientists using the Keck II Telescope in Hawaii has made the sharpest spectrum ever obtained of an exoplanet. They found the spectrum of a cloudy atmosphere containing water vapor and carbon monoxide. Comparing the amount of carbon and oxygen provides clues as to how the planet formed. 2 leading theories on planet formation are core accretion and gravitational instability. Core accretion should result in reduced oxygen in the atmosphere. The findings show reduced oxygen, so support core accretion. The planet is 1 of 4 gas giants known to orbit a star called HR 8799, 130 light-years away. The planet is known as HR 8799c, and the same team discovered these 4 over the last 5 years. Unlike most other planetary systems, whose presence is inferred by their effects on their parent star, these 4 planets can be individually imaged. This is so because they are large, young (and therefore bright in infrared), and far from their star. Like any gas giant, the planet has no solid surface. It is hot, over 1000° F (500° C), glowing with the energy from its formation. All 4 planets are more massive than any in our Solar System, with 3-7 times the mass of Jupiter. The system is believed to be only 30 million years old. Their orbits are all large, with HR 8799c being farther from its star than Neptune is from our Sun.

WISE (infrared space telescope) data was used to find a double brown dwarf that turned out to be extremely close, 6.5 light-years away, making it the 3rd closest star system to the Sun. The last time a star this close was discovered was in 1916 when Barnard's Star was discovered. Follow-up observations were made to confirm the discovery with the Gemini 8-meter telescope. The previously known closest brown dwarf was 11.1 light-years distant. Once they knew exactly where to look, the binary brown dwarf was found in the Deep Near-Infrared Survey of the Southern Sky, the Two Micron All-Sky Survey and the Sloan Digitized Sky Survey in images taken from 1978 to 1999. Its proximity to star rich regions probably kept it from being discovered before. Because it is a double, observations of them orbiting will allow the orbit and masses to be calculated. The pair is separated by 1.5 arc sec and takes 25 years to orbit. Brown dwarfs have masses too low to sustain fusion of hydrogen that powers stars, though brown dwarfs briefly fuse deuterium (heavy hydrogen). Brown dwarfs are generally too cool to be seen in visible light, so must be found in infrared. Since we are still discovering nearby brown dwarfs, it is possible that 1 even nearer will be found, possibly even closer than the nearest star.

Chandra and other X-ray space telescopes observed 8 neutron stars undergoing bursts of X-rays that caused their atmospheres to expand. By following the cooling of the star, scientists can calculate its surface area, and therefore its diameter. The goal was to more precisely measure how neutron star diameters vary with mass. Different models of the internal structure of neutron stars predict different diameters. The new measurement showed that a neutron star with 1.4 times the mass of our Sun has a radius between 6.5-8 miles (10.4-12.9 km). The observations also provided new information about the so-called "symmetry energy" for nuclear matter, which is the energy cost required to create a system with a different number of protons than neutrons. Neutron stars contain almost 10 times as many neutrons as protons. Heavy atoms on Earth, like uranium, feel this effect. The result shows that symmetry energy does not change much with density.

Chandra was also used to observe a distorted supernova remnant, and analysis indicates it may contain the most recent black hole formed in our Milky Way. The remnant is called W49B, and would have been seen from Earth to explode about 1000 years ago. It is located 26,000 light-years away. The remnant is distorted because material near the poles of the star was ejected at much higher speed during the supernova explosion. Chandra data was used to trace the distribution of different elements in the remnant. It matched what was theoretically predicted for an asymmetric supernova. A careful search of the Chandra data produced no evidence for a neutron star. The only thing a supernova can leave other than a neutron star is a black hole.



Rare quasar – For only the 2nd time ever, scientists have discovered a rare triple quasar system. In systems of multiple quasars, they are held together by gravity and are believed to be the product of galaxies colliding. But 1 of the 3 is distant from the other 2, so collision is unlikely. The light from the quasars traveled 9 billion years to reach us. Analysis confirmed that there are 3 distinct sources of quasar energy, not multiple images of one. Another unusual feature is that no evidence was seen of any Ultraluminous infrared galaxies (galaxies with strong emission in infrared light), which is where quasars are commonly found. As a result, the discovery team proposed that this system is part of some larger structure that is still undergoing formation, rather than a collision product.

Rare supernova – Explosions from massive stars going supernova are common in spiral galaxies where new stars are forming continuously. They are almost never seen in elliptical galaxies, where there is almost no star formation. Astronomers were surprised to find a supernova that appears to be a massive star type in an old elliptical galaxy. The Pan-STARRS telescope in Hawaii found this supernova, and it is being designated PS1-12sk. It is the 6th Type Ibn supernova ever discovered, and the 5 others were all in spiral galaxies. It is located about 780 million light-years away. The site of the explosion shows no signs of recent star formation. Theories on how this could be include: there is a hidden star formation region, the massive star was formed by collision of smaller stars (1 of which would have to be helium rich to have a Type Ibn spectrum), or that it was a runaway star that formed elsewhere. Further study is needed.

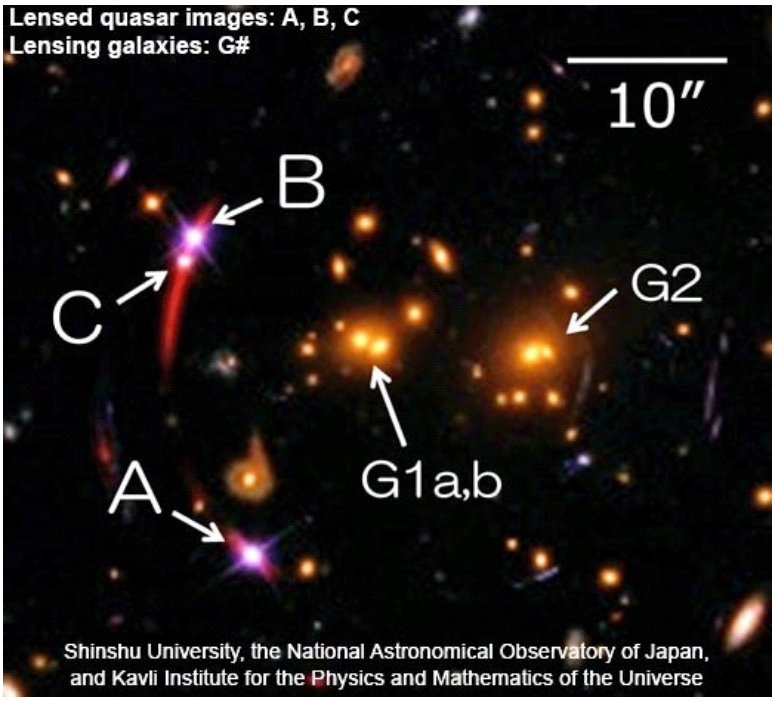
Hubble Space Telescope was used to determine the age of a star (HD 140283), which was found to be the oldest known star with a well-determined age. The age calculated to be 14.5 billion years, with uncertainty of 0.8 billion. This may sound bad, since most of that range is older than the best determinations of the age of the Universe. But it's better than the previous determination of that star's age, which was 16 billion years. A big unknown that affects calculating the age was the distance to the star. The Hubble observations pinned down this distance as 190.1 light-years using an extremely precise parallax measurement. The star is at the 1st stages of expanding into a red giant, and can be seen with binoculars in Libra. The star's motion carries it from the halo of our Milky Way through our neighborhood. The star was likely born in a primeval dwarf galaxy, which was eventually gravitationally shredded and sucked in by the emerging Milky Way over 12 billion years ago.

More Hubble – Past Hubble studies have been made of the Andromeda Galaxy, and of course a lot of stars in our own Milky Way, including distant halo stars, got in front of these images. Astronomers decided to study these halo interlopers in the archived images. Finding the halo stars was tedious, since each Hubble image contained more than 100,000 stars. Examining the colors, brightnesses, and motions across the line of sight ("tangential motion") allowed the halo stars to be distinguished. They located 13 stars in the images that were all at about the same distance: 80,000 light-years. The team was surprised to find that they had substantial tangential motions, unlike most halo stars identified in the past. Most of those were found to orbit almost straight out, then almost straight back toward the galaxy center, resulting in little tangential motion. The astronomers attributed this to the existence of a shell of stars in the halo at the 80,000 light-year distance, likely caused by accretion of a small satellite galaxy. Further searches for halo stars in Sloan Digital Sky Survey data also uncovered an excess of stars at this distance, confirming the existence of a shell.

NuSTAR (orbiting X-ray telescope) teamed up with another X-ray telescope, XMM-Newton, to definitively measure for the 1st time the spin of a supermassive black hole (in galaxy NGC 1365). NuSTAR covers much higher frequencies of X-rays than other X-ray telescopes, so the combination allowed a much wider spectrum to be taken. The narrower spectra previously taken of supermassive black holes could be matched by either rotational effects or by effects of obscuring gas. The new wider spectrum matches only a rotational cause. The spectrum comes from matter as it swirls into the black hole, becomes very hot from friction, and emits X-rays. The rotation of the black hole in the center warps space and distorts the spectrum. The disk of matter falling into the black hole actually gets closer to the black hole with increasing warpage from the black hole's spin. The spin measured was near the maximum possible according to Relativity.

Quasar outflow – A team of astronomers has used the Subaru Telescope in Hawaii to observe a very distant quasar (about 10 billion light-years distant) that is gravitationally lensed by a foreground galaxy cluster (about 5 billion light-years). Spectra of the multiple images of the quasar showed differences that were interpreted as being caused by the differing lines of sight passing through different parts of the outflow of material from the quasar. This indicates that complex small structures exist inside the outflows. A quasar's light source is a bright gaseous disk surrounding the supermassive black hole at the center of the galaxy. Outflows are gas streams moving outward from the disk. Two of the multiple images caused by gravitational lensing lie about 22 arc seconds apart, the current record for the farthest separation.

Fermi bubbles – A new theory has been proposed to explain the huge bubbles (known as Fermi bubbles) emitting X-rays and gamma rays above and below the center of our Milky Way. The theory also explains the presence of 3 massive clusters of young stars near the center of our galaxy and the lack of old stars in that area. The theory is that in the (astronomically) recent past there was a substantial amount of material falling into the galaxy's central supermassive black hole, that is, the Milky Way had an active galactic nucleus. Jets and tidal forces from this activity would have blown away old stars, disrupted gas clouds to form new stars, and heated the areas above and below until they emitted X-rays and gamma rays. The activity was probably caused by the shredding of a small satellite galaxy. To validate the theory, astronomers will search for older stars speeding away from the galaxy center.



LMC's distance – The distance to the Large Magellanic Cloud (LMC) was remeasured with more precision (163,000 light-years with uncertainty of only 2%), which in turn adds precision to the calibration of Cepheid variables, some of which are located in that neighboring galaxy. Cepheids are used in determining distances to more distant galaxies, and are the basis for measuring the Hubble Constant, the rate at which the Universe is expanding. Telescopes in Chile were used to observe eclipsing double stars in the LMC. Tracking the changes in brightness when 1 star passes in front of its companion and measuring spectroscopically the orbital velocities and spectral types allows calculation of

their orbits, masses and distances. The astronomers believe that further work can reduce the uncertainty of the LMC's distance to 1%.

Russian impact – More on the small asteroid that struck near Chelyabinsk, Russia, on February 15, reported here last month: Some fragments of the object, meteorites, have been found. The asteroid was about 55 feet (17 m) across and weighed roughly 10,000 tons. It struck at 40,000 mph (64,000 k/h) and broke apart 12-15 miles above the Earth's surface. It had about 30 times the energy of the WW II atomic bombs. It came from the main asteroid belt. The impact with the atmosphere was detected by the infrasound sensors operated to detect nuclear explosions. It was the strongest ever detected by the infrasound network. It was detected in Antarctica, 9000 miles (15,000 km) away. From these detections it was determined the object entered the atmosphere at a shallow angle of about 20 degrees and lasted more than 30 seconds before it exploded, agreeing with videos of the object. The loud report was heard and felt for hundreds of miles.

STRaND 1 (British nano satellite) is being controlled by a slightly modified smart phone. The satellite is about the size of a toaster oven. It is testing plasma thrusters and an experimental water-alcohol propulsion system. The cost of the satellite has not been divulged, but the claim is that it was comparable to that of a car, orders of magnitude less than a typical satellite. The phone modifications were only to keep its battery warm and to shield it from space radiation. The phone is running an app of recorded screams to prove the old saying "in space no one can hear you scream", an app that measures magnetic fields, and an app that takes images tagged with their position. The public can request images to be taken. Amateur radio operators should be able to listen to STRaND's signal when it is overhead.

ALMA (submillimeter radio telescope array) completed construction of its 66 antenna dishes and inaugurated the telescope with a ceremony. Construction began in 2003. However, ALMA has been making observations with some of the dishes since October 2011. Even partially completed, it was the most advanced submillimeter wavelength radiotelescope in existence. ALMA is located at 16,400 feet (5 km) altitude in Chile in order to get above much water vapor, oxygen and carbon dioxide that can interfere with observations. Observations are expected to reveal details about the birth of stars, infant galaxies in the early Universe, planets coalescing around distant suns, and the distribution of molecules in space. A special supercomputer combines the signal from all the antennas so they act as a single huge radiotelescope. The 66 antennas can be arranged in different configurations, where the maximum distance between antennas can vary from 150 yards (150 m) to 10 miles (16 km).

More ALMA – New observations taken with ALMA show that the 1st bursts of star formation after the Big Bang may have begun earlier than thought. Observations were made of starburst galaxies at various distances in order to determine the rates of star formation at different times in the history of the Universe. The more distant the galaxy, the further back in time one is looking. They found star forming galaxies beginning 12 billion years ago. 2 of the galaxies observed not only broke the records for the most distant of their type, but water molecules were detected within them. ALMA's sensitivity means that measurements of each galaxy could be made in minutes, about 100 times faster than previous radiotelescopes. In some cases, galaxies were observed through gravitational lenses, which brighten the image and make observations easier. Only a few gravitationally lensed galaxies have been previously found at submillimeter wavelengths, but dozens of new ones were found in this study.

AIDA (asteroid impact mission) has chosen its target: Didymos, a near-Earth asteroid. This mission is being planned by the European Space Agency (ESA) to reach its target in 2022. Didymos is a binary asteroid, and AIDA is a binary spacecraft. One spacecraft will impact the smaller of the asteroid pair while the other observes. The goal is to measure the effects of an impact on the asteroid and its orbit, as well as learn about the asteroid constituent material.

ExoMars – The European and Russian space agencies have signed an agreement to partner on the ExoMars missions of 2016 and 2018. NASA had some time ago backed out of ExoMars during a budget cut, except for supplying a few instruments. This left an opening for someone who could supply launch rockets and space hardware, and Russia filled the gap. They will of course share in the science results. The 2016 mission has an orbiter and a lander. The orbiter will search for methane and other atmospheric gases and relay data from landers. The 2018 mission is a rover that will drill down over 6 feet (2m) to collect samples from below the material attacked by radiation and oxidation.

JUICE (JUpiter ICy moon Explorer) – NASA has agreed to provide an ice-penetrating radar for ESA's JUICE mission. It is scheduled to launch in 2022, arrive at Jupiter in 2030, and slip into Ganymede orbit in 2032. The spacecraft will include at least 10 instruments, including cameras, spectrographs, altimeter, magnetometer, particle detector, radio and plasma instrument, and gravity meter in addition to the radar.

Instant AstroSpace Updates

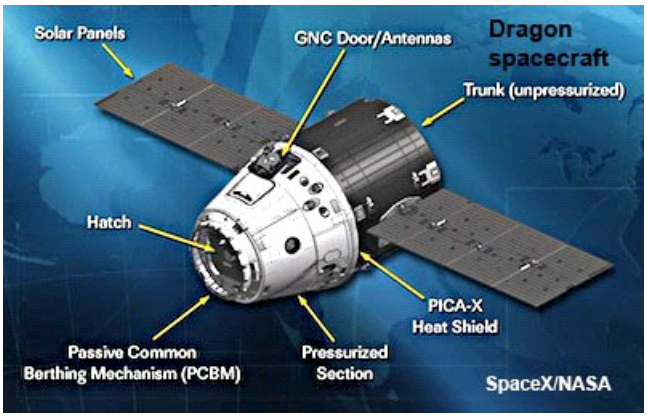
Herschel (infrared space telescope) has discovered that the Sun's neighbor Alpha Centauri A has a layer in its atmosphere that is cooler than the star's surface and than the outer corona. Such a layer has long been known for our Sun, but this is the 1st such cool layer found on another star.

A study last year of planets orbiting red dwarf stars, by far the most common star type in our galaxy, concluded **Earth-like planets** are very common. The study has been updated with new calculations of planetary temperatures, finding that Earth-like planets (about the size and temperature of Earth) are even more common, and that likely 1 exists within 7 light-years of us.

Volunteer **citizen scientists** have found 24 more pulsars, including 6 binary pulsars, in old (1990s) radiotelescope data that had already yielded 800 pulsars by standard search methods. Theoreticians had long claimed that more binary pulsars should have existed in the data.

SpaceX's Falcon 9 rocket successfully propelled another **Dragon** spacecraft loaded with a ton of cargo toward the International Space Station in early March, but failure of ¾ of the Dragon's thrusters canceled approach and docking. Controllers cured the problem by repeated actuations of sticky valves, and the cargo arrived only a day late.

Space collision – Analysis of a glitch in the speed and orientation of Russia's BLITS satellite showed that debris from the Chinese satellite FENGYUAN 1C struck BLITS. FENGYUAN had been intentionally destroyed in an anti-satellite weapon test in 2007, leaving much debris.



The Solar Dynamics Observatory experienced something that never occurs on Earth, or for that matter the Moon: **2 eclipses of the Sun** in 1 day. From the observatory's position in space, both the Earth and the Moon passed in front of the Sun on the same day, though the Moon caused only a partial eclipse.

A recent aerial survey in northeastern Iowa measuring gravity gradients and electromagnetic rock properties has confirmed the suspected **impact crater** there, which is 3.4 miles (5.5 km) across and formed about 470 million years ago. The energy of that impact was 100 times greater than that which formed the Barringer Meteor Crater in Arizona.

Dennis Tito, millionaire and space tourist, is designing a 2-person **mission to Mars**, just a flyby without landing, that he says will be ready for launch in January 2018, and return to Earth 501 days later. It is to be funded by private donations and sales of media rights, and is expected to cost less than a Mars rover.

April 12: A Date of Firsts

By Sheila Cassidy

Baikonur, 12 April, 1961: In the early hours before the scheduled flight of Vostok 3KA-2 (Vostok 1), Vostok engineers feverously struggled to mend the last minute glitches that almost grounded the flight. The first nightmare had been the discovery that the combined weight of Yuri Gagarin, his space suit and the seat was 13.6kg (30 lbs) above the acceptable maximum. So the engineers went to work, stripping away part of the Vostok's internal apparatus, but also managed to disconnect a pressure gauge and a temperature gauge. Now they had a short circuit to fix before the launch.

Shortly before takeoff, they discovered a fault with the Vostok's hatch, which required the engineers to loosen 32 screws and remove the hatch to mend a faulty sensor.

Somehow, everything was fixed in time and Gagarin basted off into space for a 108 minute orbit, becoming the first man in space. According to Gagarin, his ride was too short. Unlike future American flights, Vostoks and their Soyuz successors landed on earth. Gagarin recalled his return, describing the parachuting down close to the capsule to touch down in a field near the village of Smelovka. "Stepping onto firm ground again, I saw a woman and a little girl looking curiously at me. I was still in my orange spacesuit and they were frightened. "I'm a friend," I shouted, taking off my helmet. "Have you come from outer space?" the woman asked. "as a matter of fact, I have."

It was a long way from the place of his birth, near Smolensk, where his mother and father 4 children, including Yuri, had been thrown out of their home during the years of German occupation when a German officer took over their home. They lived in a small mud hut in the garden until the end of the occupation. Yuri's two older siblings were deported to German to work as slave laborers in 1943 and did not return until after the war. There was no food and the schools were also closed. But the teachers managed to pass on all the knowledge they could and so Yuri had a good grounding in the sciences and mathematics, history and literature. He was also fond of history and could relate everything about the history of the region (Smolensk Oblast). His daughter Elena, remembers him describing the battle of Borodino between the Russians and the French in the Napoleonic invasion of 1812 like he was taking part.

He was very much a family man even though, like his American contemporaries, work often kept him away on long hours. He used to get them up for runs and exercise in the early morning when they were together in Star City. And in a country that discouraged church attendance, Gagarin baptized his eldest daughter, Elena, in the Russian Orthodox Church shortly before his space flight. The rector of the Star City Orthodox Church said that they celebrated Christmas and Easter together, and kept icons in the house.

Gagarin's experiences as a child under Nazi occupation fueled a lifelong curiosity about everything and every town he went to school in, including Samara. St. Petersburg (then Leningrad) and Moscow. Daughter Elena said . "He was part of a generation that had had so few opportunities open to them, and then, after the war, they were avid for everything."

Yuri Gagarin was a natural for the Cosmonaut Program. First, he was small - 5'2'' and kept in excellent physical shape. That was good, because the Vostoks didn't have much room in them. Second, he had been interested in space and planets from his youth and had learned to fly a light aircraft while at a technical high school. Third, after finishing technical high school, he entered military flight training in 1955, gained his pilot's wings in a Mig-15, and proceeded up to the rank of senior lieutenant in 1959 years. Gagarin went through the selection process for the Soviet Space Program and was among 20 pilots chosen. The first flight choice was narrowed down to Yuri and Gherman Titov, due to both their performances in prior tests and that they were both small. An Air Force doctor observed that Yuri had a fantastic memory, a sharp and far-ranging attention to his surroundings, a well developed imagination, quick reactions, painstaking preparation for his activities, and that he handled celestial mechanics and mathematical formulae with ease, and excelled in higher mathematics.

After the flight, Gagarin went on a world tour, where he was received very well, especially in England, where he was treated like a rock star. Huge crowds waited in the rain to see him in Manchester. Gagarin asked for the top of the car he was in to be opened, saying that if the crowds were getting wet to welcome him, the least he could do was to get wet, too. The crowds that greeted him in London, according to a shocked American correspondent, were as large as the ones for President John F. Kennedy a month before.

In 1962 Gagarin began serving as a deputy to the Supreme Soviet, and later returned to Star City. He also went back to school at the Zhukovsky Academy, where his proposal of a fixed wing spacecraft earned him a diploma. His friend Korolev, the director of the Space Program, felt that Gagarin would have been one of the leading astro-physicists if Yuri had the education. Yuri was back-up for his friend, Vladimir Komarov, on the first Soyuz flight. That flight's crash ended Gagarin's hope for any more space flights. When Gagarin became the Deputy Training Director of Star City, he also began to re-qualify as a fighter pilot. He died in a Mig-15 crash with an instructor in 1968.

20 years later, STS-1, Columbia began the United States Space Shuttle program on April 12, 1981. STS-1 was the first orbital flight of the Space Shuttle program and was the first space project for the U.S. since the Apollo-Soyuz Test Project on 15 July, 1975. Columbia had a two-man crew for this 37 orbit flight, Mission Commander John W. Young and pilot Robert L. Crippen. STS-1 was also the only maiden test flight of a US manned space craft system, although there had been atmospheric tests with the Enterprise. Both Young and Crippen were selected for the STS-1 in 1978. John Young was the most experienced astronaut in NASA at the time and the only member of his class still serving in the program. Young first flew in 1965 as the pilot of Gemini 3, the first in the Gemini series of flights, and later commanded Gemini10 in 1966. John also was the command module pilot for Apollo 10 and walked on the moon as commander of Apollo16 in 1972. He became the Chief of the Astronaut Office in 1974.

Robert Crippen joined NASA in 1969 after the cancellation of the manned Orbiting Laboratory Program. He was a rookie and the first of his group to fly in space. He had participated as a capsule communicator in all 3 Skylab missions and the Apollo-Soyuz Test Project.

Columbia lifted off from Pad A, Launch Complex 39 of the Kennedy Space Center at 7 am, EST. A prior-scheduled launch had to be scrubbed due to a timing problem in one of Columbia's general-purpose computers. On the 25th anniversary of the first Shuttle flight Firing Room 1 at the Launch Control Center at Kennedy Space Center, which at launched STS-1, was re-named the Young-Crippen Firing Room.

The first launch of the Space Shuttle also was the first time that solid fuel rockets were used for a NASA-manned launch. Columbia also holds another record, 610 days spend in the Orbiter Processing Facility (OPF) before launch. This was the time needed to replace many of Columbia's heat shield tiles.

The only payload carried on STS-1 flight was a development Flight Instrumentation (DFI), which contained sensors and measuring devices to record the orbiter's performance and the stresses that occurred during launch, ascent, orbital flight, descent and landing. In fact, the only mission objectives were to perform a general checkout of the orbiter's systems and safely accomplish orbit and return. Although the flight was a success, there were some signs of concern for the future. Some of this involved the thermal protection tiles on the OMS/RCS pods at the orbiter's aft end. John Young reported that two tiles on the nose looked like someone had taken "big bites out of them. A later inspection of Columbia on the ground revealed the loss of 16 undensified tiles. An improperly installed tile next to the external tank's strike plate caused the plate to melt and distort during re-entry.

During the second day of flight, the astronauts received a call from the Vice President George H.W. Bush. President Ronald Regan was still recovering from an assassination attempt that had occurred two weeks before the launch.

But by fat the greatest cause for concern came from the orbiter's heat shield being damaged when an overpressure wave from the solid rocket booster caused an RCS oxidizer strut to fail. The same overpressure wave also forced the Shuttle's "Body Flap," an extension on the orbiter's underbelly that helps control pitch during re-entry - more than 5 degrees out of position and into an angle well beyond the point where cracking or rupture of the hydraulic system would have been expected. John Young later admitted that had the crew known of the potential for catastrophe, the would have flown Columbia to a safe altitude and ejected.

STS-1 was one of only two Shuttle missions to have its external tank painted white. The practice was discontinued when NASA discovered the weight savings of 600 lbs. The report of Astronaut Robert Crippen regarding white stuff coming off the external tank and splattering the windows might have helped the decision. After STS-2 all the external tanks had that orange color that became symbolic of the Space Shuttle launches.

STS-1 landed safely at Edwards Air Force Base Runway 23 on April 14.

Columbia had a connection to the OCA when OCA past president John Sanford filmed the Shuttle's last entry over California as it was breaking up on STS-107. Columbia was one of two Shuttles lost during the Space Shuttle era. Considering the dangerousness of space flight, it is a remarkable record.

April 12 had one more first to celebrate, as STS-51-D blasted off from Kennedy with the first U.S. Senator Jake Garn, the first politician to fly in space. Garn had asked to fly because he was the head of the Senate appropriations subcommittee that dealt with NASA and was a friend to the agency. STS-51-D was to deploy two communications satellites and to perform electrophoresis and electrocardiograph operations among other experiments. Garn was a congressional observer and a subject for medical experiments on space motion sickness. Although Garn experienced severe space sickness, he was not alone in this. Charles D. Walker, a fellow 51-D payload specialist, was an experienced hand and also was sick. In spite of all, he said that Garn had worked out quite well.

Yuri's Night was started in 2001 to celebrate the first Space Shuttle flight and the first flight of Yuri Gagarin. 2004 saw the event celebrated in 34 countries with over 75 events honoring both flights. The main objective is to increase public awareness of space flight and to generate a new group of explorers. Yuri's Night was started by Loretta Hidalgo, George T. Whitesides, and Trish Garner. The global celebration is proceeded by Cosmonautics Day, started in the then Soviet Union in 1962, and which is still celebrated as Cosmonauts Day in the Russian Federation.

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