SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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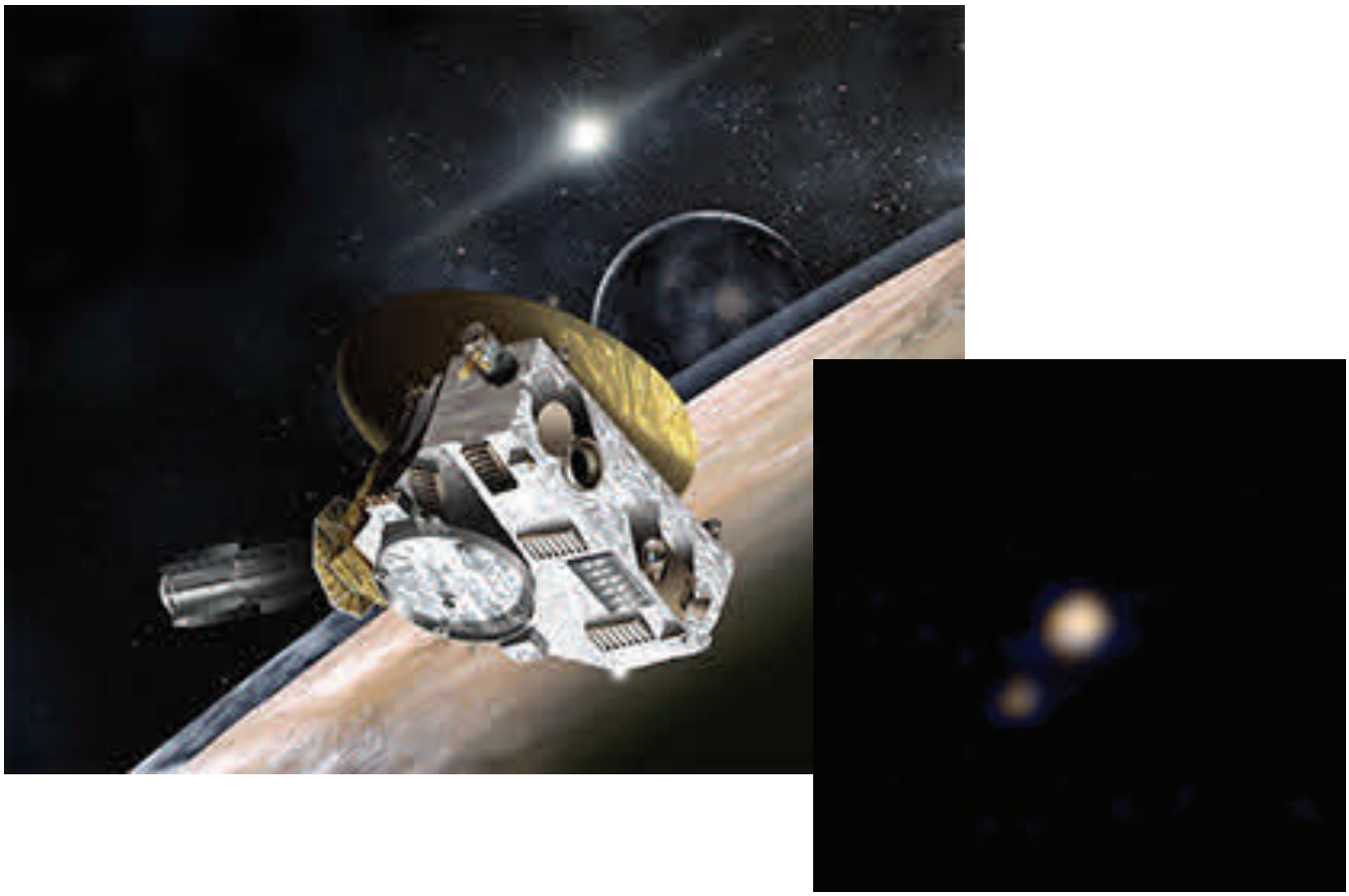


The New Horizons mission to Pluto will arrive at its destination on July 14, 2015. Still nearly 100 million kilometers from its objective, the probe is already returning color images of Pluto and its largest satellite, Charon. The inset was taken April 9 by the RALPH imager on the probe at a distance of 115 million kilometers. In addition, light curves for smaller satellites Nix and Hydra have already been obtained. This promises to be a very exciting mission! For more information, attend this month's General Meeting, where Dr. Fran Bagenal will tell us what we hope to learn from this first-ever mission to Pluto!

OCA CLUB MEETING

The free and open club meeting will be held May 8 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. Fran Bagenal of the University of Colorado at Boulder, who will speak on the New Horizons Mission to Pluto

NEXT MEETINGS: June 12, July 10

STAR PARTIES

The Black Star Canyon site will open on May 9. The Anza site will be open on May 16. 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

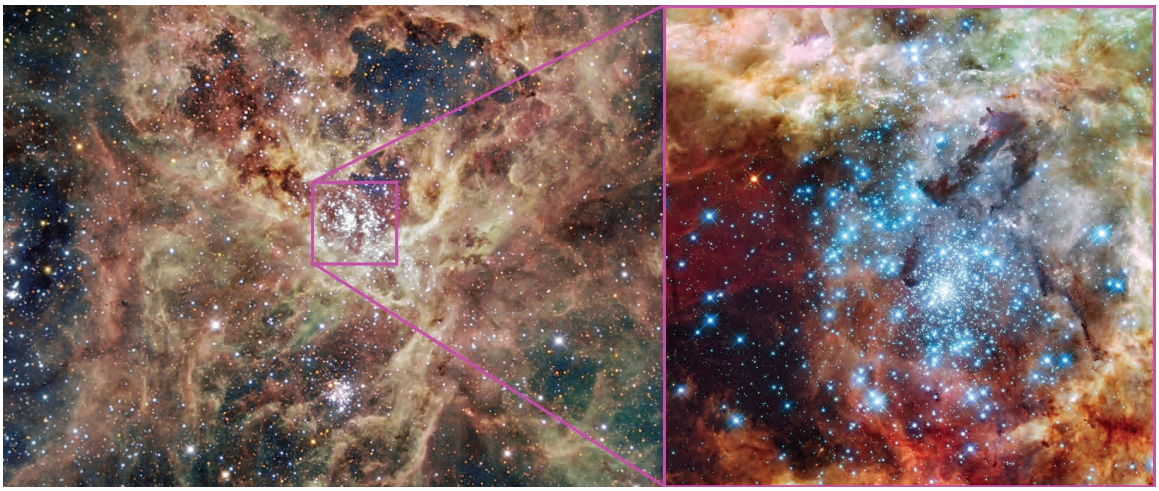
The next session of the Beginners Class will be held at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana on May 1. The following class will be held June 5.

GOTO SIG: TBA
Astro-Imagers SIG: May 12, June 9
Remote Telescopes: TBA
Astrophysics SIG: May 15, June 19
Dark Sky Group: TBA

Is the Most Massive Star Still Alive?

By Ethan Siegel

The brilliant specks of light twinkling in the night sky, with more and more visible under darker skies and with larger telescope apertures, each have their own story to tell. In general, a star's color correlates very well with its mass and its total lifetime, with the bluest stars representing the hottest, most massive and *shortest-lived* stars in the universe. Even though they contain the most fuel overall, their cores achieve incredibly high temperatures, meaning they burn through their fuel the fastest, in only a few million years instead of roughly ten billion like our sun.



Images credit: ESO/IDA/Danish 1.5 m/R. Gendler, C. C. Thöne, C. Féron, and J.-E. Ovaldsen (L), of the giant star-forming Tarantula Nebula in the Large Magellanic Cloud; NASA, ESA, and E. Sabbi (ESA/STScI), with acknowledgment to R. O'Connell (University of Virginia) and the Wide Field Camera 3 Science Oversight Committee (R), of the central merging star cluster NGC 2070, containing the enormous R136a1 at the center.

Because of this, it's only the youngest of all star clusters that contain the hottest, bluest stars, and so if we want to find the most massive stars in the universe, we have to look to the largest regions of space that are actively forming them right now. In our local group of galaxies, that region doesn't belong to the giants, the Milky Way or Andromeda, but to the Large Magellanic Cloud (LMC), a small, satellite galaxy (and fourth-largest in the local group) located 170,000 light years distant.

Despite containing only one percent of the mass of our galaxy, the LMC contains the Tarantula Nebula (30 Doradus), a star-forming nebula approximately 1,000 light years in size, or roughly seven percent of the galaxy itself. You'll have to be south of the Tropic of Cancer to observe it, but if you can locate it, its center contains the super star cluster NGC 2070, holding more than 500,000 unique stars, including many hundreds of spectacular, bright blue ones. With a maximum age of two million years, the stars in this cluster are some of the youngest and most massive ever found.

At the center of NGC 2070 is a very compact concentration of stars known as R136, which is responsible for most of the light illuminating the entire Tarantula Nebula. Consisting of no less than 72 O-class and Wolf-Rayet stars within just 20 arc seconds of one another, the most massive is R136a1, with 260 times the sun's mass and a luminosity that outshines us by a factor of *seven million*. Since the light has to travel 170,000 light years to reach us, it's quite possible that this star has already died in a spectacular supernova, and might not even exist any longer! The next time you get a good glimpse of the southern skies, look for the most massive star in the universe, and ponder that it might not even still be alive.

AstroSpace Update

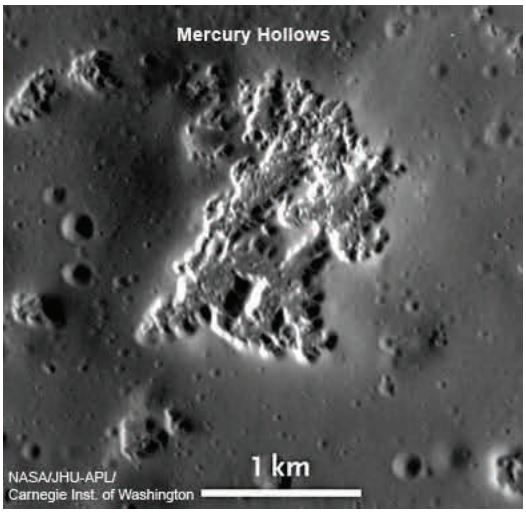
May 2015

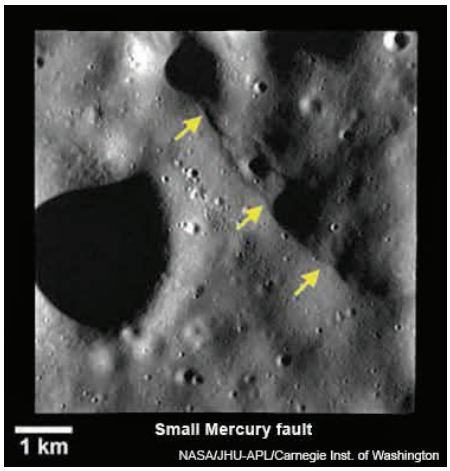
Gathered by Don Lynn from NASA and other sources

Venus cloud – The cause of the Y-shaped dark cloud of Venus, usually seen in ultraviolet light, may have been solved. It was discovered more than a half-century ago. The feature moves like a single entity, at a different speed than its environment. Scientists think the Y feature is caused by waves in the atmosphere of the planet. A new computer simulation, the 1st to take into account centrifugal force, appears to reproduce the feature. The dark material wells upward due to centrifugal force. In the equatorial and middle latitudes there is a strong wind blowing westward at nearly constant speed. But at higher latitudes the winds are faster, which distort the rising wave into the Y shape. It is still not known specifically what chemical makes up the cloud.

Mercury – Two new maps of the planet Mercury made from MESSENGER spacecraft data have identified never-before-seen formations on the planet. These formations have different compositions than the crust around them. Data came from the X-ray spectrometer and the gamma-ray spectrometer. These provide information about the concentrations of various elements on the surface. Previous work with spectral reflectance and geographical mapping had missed seeing these formations. One feature that covers more than 3 million square miles (7 million sq km) has high ratios of silicon to magnesium, sulfur and calcium, and a low ratio of aluminum to silicon. The distribution of magnesium varies wildly: in come locales it's as common as silicon, but in fresh exposures near young craters, the magnesium nearly disappears. 4 distinct geochemical terrains are identified in the 2nd map. The Caloris Basin, Mercury's largest well-preserved impact basin, is filled with volcanic flows with different composition than the other volcanic plains.

More Mercury – The 4th anniversary was celebrated of MESSENGER entering orbit about Mercury. The spacecraft has been maintaining a very low orbit (about 20 mile [30 km] low point) to get the highest resolution data. The magnetometer and neutron spectrometer collect far better data, due to both better resolution and stronger signal. Excellent images are being taken of the "hollows", which are clusters of small pits, usually brighter than their surroundings, and are typically seen on the floors of impact craters. It is believed that some compound in the surface rocks, perhaps a type of sulfide, is vaporizing away to leave the pits. The hollows exhibit fewer impact craters than their surroundings, so are newer features. The high-resolution images have shown many small compression fractures across the surface, many less than 6 miles (10 km) long and only tens of yards (m) high. These also formed recently geologically, judged by crater counts. It was expected soon that MESSENGER would run out of hydrazine, used in jets to stabilize the spacecraft and move its orbit, and indeed it ran out April 6. Controllers are now blowing helium out the jets instead. The helium was used to pressurize the hydrazine. So by the time you read this, the spacecraft will probably have run out of helium and lost control and crashed into the planet, ending an extremely successful mission.





MAVEN (Mars orbiter) has observed 2 unexpected phenomena in the Martian atmosphere: an unexplained high-altitude dust cloud and aurora that reaches deep into the Martian atmosphere. The cloud has been present since MAVEN arrived at the planet. It is not known if the cloud is temporary or permanent. The cloud density is greatest at lower altitudes. However, even the densest areas are very thin. Possible sources for the dust cloud include dust wafted up from the atmosphere; dust coming from the 2 moons of Mars; dust moving in the solar wind; or debris orbiting the Sun from comets. However, none of these fits the observations well. For 5 days just before December 25, MAVEN saw a bright ultraviolet auroral glow spanning Mars's northern hemisphere. The aurora was surprisingly deep in the atmosphere. The source of particles causing the glow appears to be the Sun. Billions of years ago, Mars lost its global protective magnetic field, so solar particles can directly strike the atmosphere.

Curiosity (Mars rover) made its 1st detection of nitrogen in the surface material of Mars. It was in the form of nitric oxide, and was likely released by the breakdown of nitrates during the heating and analysis performed by the SAM instrument of the rover. Nitrates are a class of molecules that contain nitrogen in a form that can be used by living organisms, which is good if people ever try to grow crops on Mars. Nitrogen is essential for all known forms of life. However, most life cannot directly use the nitrogen gas found in the atmosphere of Earth (and Mars). A few Earthly organisms, as well as lightning, can break apart the nitrogen molecules and form other compounds, such as nitrates, that most life can directly use. The nitrates found by Curiosity are probably ancient, and came from non-biological processes like lightning or meteorite impacts in the distant past. The nitrates were found in windblown sand and dust and material drilled from mudstone. Nitrates are likely widespread across Mars by the windblown dust. The results showed nitrates up to 1.1 parts per thousand in the Martian soil. The amount agreed well with theoretical estimates of what meteorite impacts should produce. Also nitric oxide was detected, which likely was created by heating nitrates during the analysis.

More Curiosity – The rover is using a new experiment to better understand the history of the Martian atmosphere by analyzing xenon. Since such noble gases are chemically inert, they are excellent tracers of the history of the atmosphere. Xenon occurs in the Martian atmosphere at a challengingly low quantity and can be measured only with on-site instruments. When a planet loses its atmosphere, the process can affect the ratios of the isotopes of the gases, as different isotopes tend to be lost at different rates. Xenon exists in 9 isotopes, ranging in atomic mass from 124 – 136. The new measurements traces a very early period in the history of Mars when a vigorous atmospheric escape process was pulling away even the heavy xenon gas. The new measurements closely match those made on tiny bits of Martian atmosphere captured in bubbles within meteorites that fell to Earth after being blasted off the surface of Mars. Curiosity previously measured isotopes of argon. Those results pointed to continuous loss over time of much of the original atmosphere of Mars.

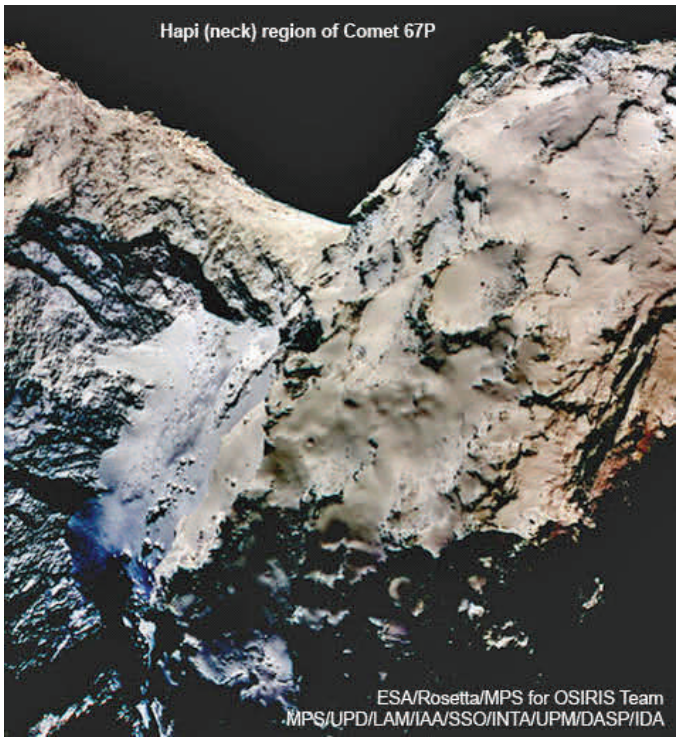
Yet more – 2-tone mineral veins at a site Curiosity has reached offer clues about multiple episodes of fluid movement. These episodes occurred later than the wet environmental conditions that formed lake-bed deposits that the rover examined lower on the mountain. This most recent sample included a silica mineral named cristobalite. The veins appear as a network of ridges left standing above the now eroded-away bedrock in which they formed. Individual ridges range up to about 2.5 inches (6 cm) high and half that in width, and they bear both bright and dark material. The material implies secondary fluids were transported through the region after the host rock formed. Veins such as these form where fluids move through cracked rock and deposit minerals in the fractures. Mud that formed lake-bed mudstone that Curiosity examined near its landing site and later must have dried and hardened before the fractures formed. The dark material that lines the fracture walls reflects an earlier episode of fluid flow than the white, calcium-sulfate-rich veins. The 3 drilled samples from Pahrump Hills have clear differences in mineral ingredients.

Opportunity (Mars rover) has had its flash memory reformatted, and one bank (of 7 banks) of it turned off. That bank exhibited most of the errors that were happening for months. For the last 3 months, the rover had been operating by sending all new data every day to Earth, rather than storing it overnight in the flash memory. This limited how much new data could be taken each day. So far the new actions seem to have cured the problems with memory errors. Opportunity reached marathon distance, having covered 26.219 miles (42.195 km) since landing in 2004.

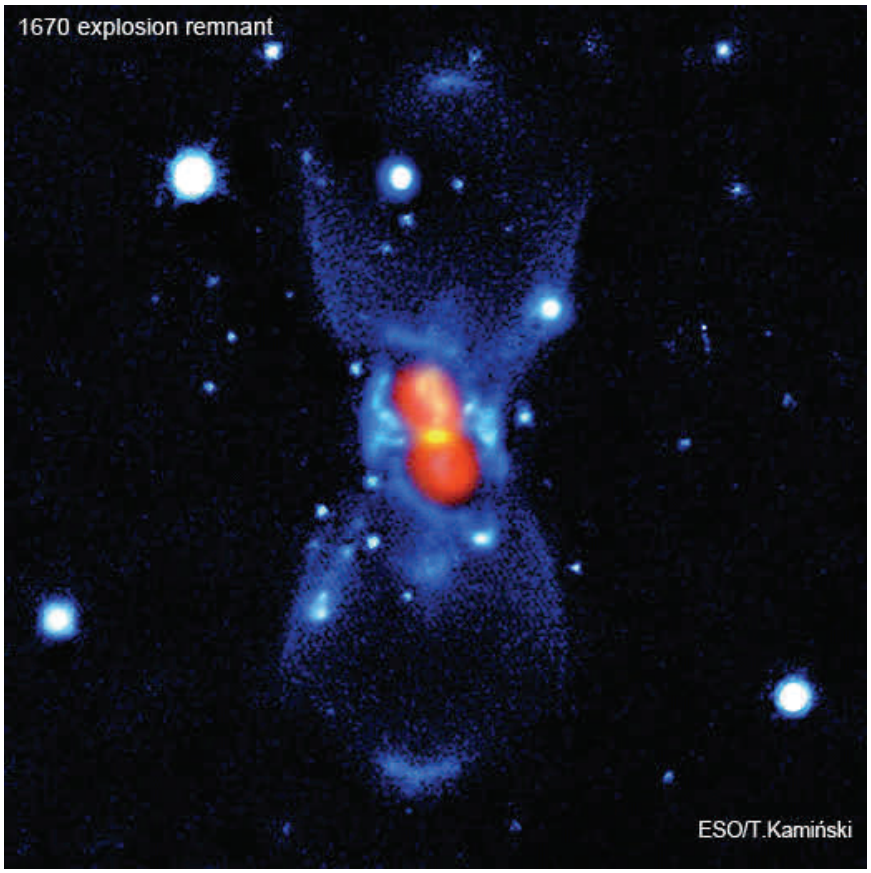
Iron – Why is there iron spattered throughout the Earth's mantle? Why does the Moon's mantle have much less iron? Scientists long thought that iron should have sunk to the Earth's core when the collision happened that produced the Moon. The spattering of iron on Earth must have come later from asteroid collisions. But that would have left the Moon with similar amounts. A new study measured at what temperature under extremely high pressures iron vaporizes. A theoretical value had been used in computer simulations of

planet collisions, because it had never been measured at extreme pressures. They shot metal at iron plates at extreme speeds and measured the vaporization. It's 40% lower temperature than the theoretical value. The adjusted simulations showed much of the iron in a planetary collision vaporizes, spreads out in a plume, and rains onto Earth as small iron droplets. Now the collision that formed the Moon can be simulated to well match the iron distribution of today.

Rosetta (comet mission) – The region located between the 2 lobes of the nucleus of Comet 67P/Churyumov-Gerasimenko has in the past months shown to be particularly active in emitting dust and gas. Rosetta imaging instruments confirm that this region is unique. Its slightly bluish coloring might indicated frozen water mixed in with the surface dust. Spectral measurements will be taken to confirm this. The region may have been able to retain ices at its surface during past orbits due to being more shadowed than other regions.



Active asteroid – A team of astronomers used the Keck Observatory in Hawaii to observe and measure one of a rare class of "active asteroids", ones that spontaneously emit dust. The team was able to measure the rotational speed of one of these objects (P/2012 F5, a comet designation given when it showed dust emission), suggesting the asteroid spun so fast it burst, ejecting dust and newly discovered fragments in a trail behind it. Two hypotheses have been presented to explain active asteroids: 1) collision with another minor object, 2) rotational disruption. The new observations clearly favor hypothesis 2. It is known that the YORP effect can spin asteroids faster. The YORP effect changes the rotation of small bodies due to asymmetric emission of heat. The team discovered at least 4 new fragments. The dust emission occurred in mid 2011, and presumably the fragments were created then. The rotation rate, measured from the light curve, is only 3.24 hours, which is fast enough to break apart an object this size.



Nova Vulpecula – New observations made with APEX radiotelescope of the remnant left from the nova seen in Vulpecula in 1670 revealed that it was not a nova after all, but a much rarer, violent kind of stellar collision. When it 1st appeared, Nova Vul 1670 was easily visible with the naked eye and varied in brightness over the course of 2 years. It then disappeared and reappeared twice before vanishing for good. During the 20th century, astronomers came to understand that most novas were the runaway explosion of close binary stars. But Nova Vul 1670 did not fit this explanation well. In the 1980s astronomers detected a faint nebula surrounding the suspected location of the 1670 outburst. New radio observations found the surroundings of the remnant bathed in a cool gas rich in molecules with an unusual chemical composition. The mass of the cool material was found to be too great to be the product of a nova, and the isotope ratios measured were different from those expected from a nova. The explanation that fits is a collision between 2 stars, producing something called a red transient, more brilliant than a nova, but less so than a supernova. These are rare events in which stars explode due

to merging with another star, spewing material from the stellar interiors into space, eventually leaving behind only a faint remnant embedded in a cool environment, rich in molecules and dust.

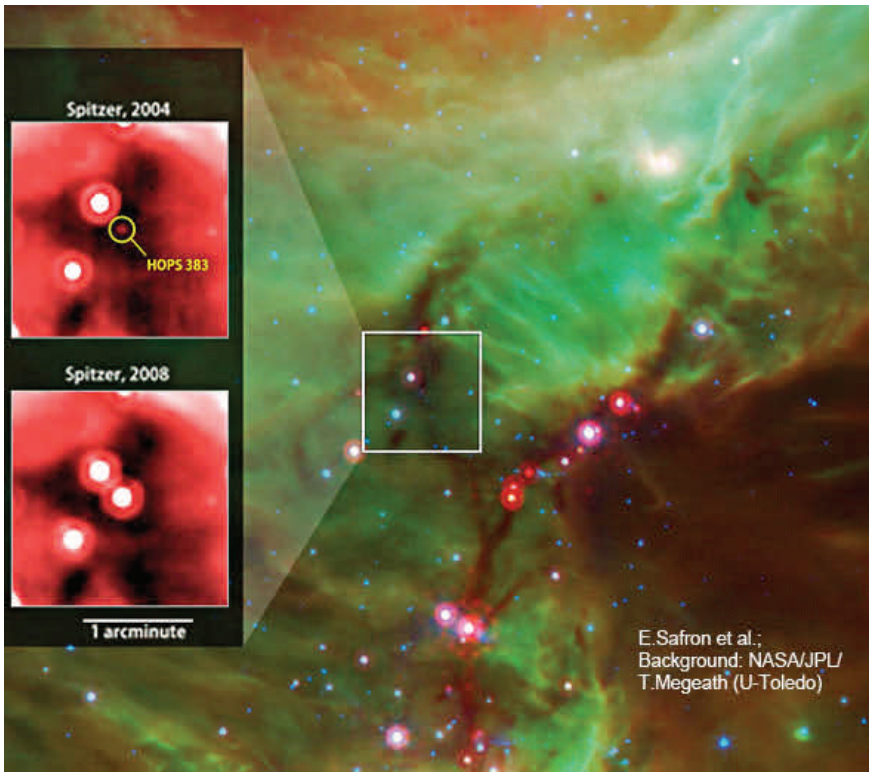
Supernova dust – Using SOFIA airborne infrared observatory, a science team discovered that supernovas are capable of producing a substantial amount of the material from which planets form. Observations showed that a cloud produced by a supernova explosion 10,000 years ago contains enough dust to make 7000 Earths. The investigation required observations at long infrared wavelengths in order to peer through interstellar clouds blocking the visual light view. Astronomers already knew that a supernova's outward-moving shock wave can produce significant amounts of dust. But it was predicted that the rebound shock wave after it bounces off surrounding interstellar gas and dust would destroy much of the dust created. But the new observations showed the dust survived the rebound shock and is flowing into the interstellar medium. This supports that vast amounts of dust that have been observed in distant young galaxies may have been made by supernova explosions of early massive stars.

Supernova cause – A study of 3C 397, a supernova remnant, indicates the blast arose from a single white dwarf that accumulated matter from a normal companion star. Much data recently has indicated Type Ia supernovas occur with the collision of 2 white dwarfs. This new study gives firm evidence that the accumulating matter scenario also happens. 3C 397 is located about 33,000 light-years away in Aquila. Astronomers estimate this cloud of stellar debris has been expanding for 1-2 thousand years, making it a middle aged remnant. The team made detections of elements crucial to determining the mass of the object that exploded. An explosion of an accumulating white dwarf produces significantly different amounts of nickel and manganese in its expanding cloud than a merger of 2 white dwarfs.

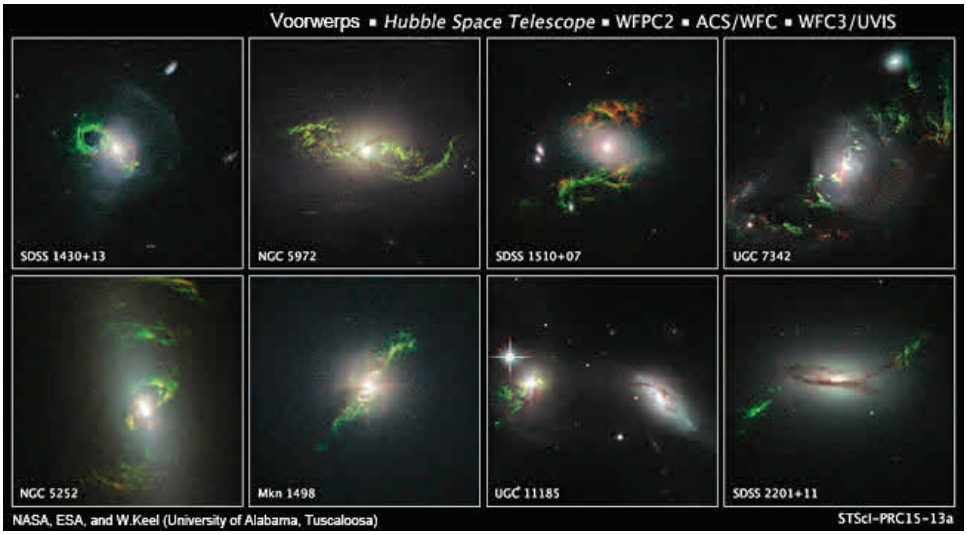
Expansion of the Universe – Type Ia supernovas allow astronomers to measure distances to galaxies. Combined with Doppler measurements of the galaxies' and supernovas' speeds, the expansion rate of the Universe can be measured. But the Type Ias exhibit a little variation, so the expansion rate still has several % of uncertainty. A new study showed that supernovas near populations of hot young stars show only about ½ as much variation. The hot young star populations were found in archived data from GALEX (ultraviolet space telescope). So using only those Type Ias near hot young stars halves the uncertainty of our measurements of the expansion rate of the Universe.

Star formation – A pair of images of a young star, made 18 years apart, has revealed a dramatic difference that is providing astronomers with a unique look at how massive stars develop in the earliest stages of their formation. The astronomers used the Jansky Very Large Array (VLA) radiotelescope to study a massive young star called W75N(B)-VLA 2, 4200 light-years from us. The earlier image shows a compact region of a hot ionized wind ejected from the young star. The new image shows that ejected wind deformed into a distinctly elongated outflow. The scientists believe the young star is forming in a dense gaseous environment and is surrounded by a dusty torus. The star has episodes in which it ejects a hot ionized wind for several years. At 1st hat wind can expand in all directions to form a spherical shell, but then it hits the dusty torus. The wind expands along the poles of the torus, where there is less resistance.

Lonely variable stars – Many, perhaps most, stars in the Universe live with companion stars. But RR Lyrae type variable stars appeared to be loners. Only 1 binary RR Lyrae was known out of about 100,000 of them. Since measuring the orbit of a binary is the best way to determine a star's mass, the mass of RR Lyrae stars was poorly known. A new study found 20 RR Lyraes that are good candidates to be binary. This study used deviations in the timing of the stars' variability to show that they were orbiting another mass. 12 of these have been verified binary. The systems newly identified have orbital periods of several years, which indicate that the companions are not very close to one another. RR Lyrae binaries with even longer periods may also exist, but might not yet be detectable. Follow-up observations of these binary candidates are planned with spectroscopy and astrometry for further verification. Determination of masses and possibly diameters will also be pursued.



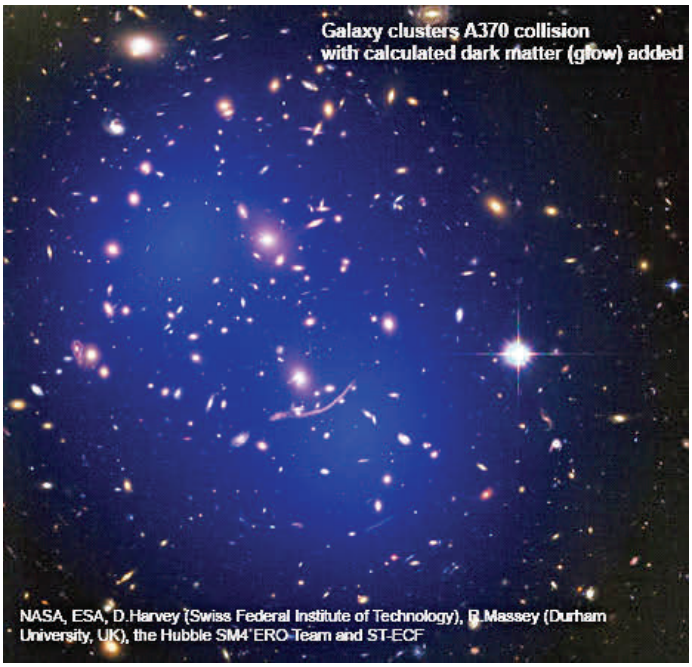
Protostar eruption – Using data from orbiting observatories and ground-based facilities, a team of astronomers has discovered an outburst from a star thought to be in the earliest phase of its development. The eruption reveals a sudden accumulation of gas and dust by an exceptionally young protostar known as HOPS 383. Stars form within collapsing fragments of cold gas clouds. As the cloud contracts under its own gravity, its central region becomes denser and hotter. By the end of this process, the collapsing fragment has transformed into a hot central protostar surrounded by a dusty disk roughly equal in mass, embedded in a dense envelope of gas and dust. Astronomers call this a "Class 0" protostar. This is the 1st outburst observed from a Class 0 object. The Class 0 phase is short-lived, lasting roughly 150,000 years. A protostar has not yet developed the energy-generating capabilities of a Sun-like star, fusing hydrogen. Instead, a protostar shines from the heat energy released by its contraction. Because these infant suns are thick in gas and dust, their visible light cannot escape. But the light warms dust around the protostar, which reradiates the energy in infrared. HOPS 383 is near NGC 1977, a nebula in Orion, about 1400 light-years away. The eruption was 1st noticed by comparing decade-old Spitzer observations with 2010 ones from WISE (both are infrared space telescopes). The 1st hint of brightening appears in Spitzer data from 2006. By 2008, the brightness in 24 micron wavelength had increased by 35 times. In the most recent data (2012), the eruption shows no sign of abating. An outburst lasting this long rules out many possible causes. The discoverers believe it is best explained by a sudden increase in the amount of gas the protostar is accreting from the disk around it.



More Voorwerps – Hubble Space Telescope has photographed a set of wispy green objects that are the ghosts of quasars the flickered to life and then faded. The glowing structures have looping, helical, and braided shapes, not fitting a single pattern. The wisps are outside their host galaxies, believed to have been illuminated by powerful ultraviolet radiation from supermassive black holes at the cores of host galaxies. The quasars are not bright enough now, so must have faded in astronomically recent times. One possible explanation for the sudden fading is they may be binary black holes in the quasars. The green filaments are believed to be long tails of gas pulled apart under gravitational forces resulting from a merger of 2 galaxies. These immense structures, tens of thousands of light-years long, are slowly orbiting their host galaxy long after the merger. They are far enough outside their galaxies that light from the quasar takes tens of thousands of years to reach the filaments and cause them to glow. About 20 of these green filaments were

found in the new study, and 8 of them clearly had insufficient quasar light now to make them glow. So each quasar had to have faded in the past few tens of thousands of years. The 1st discovered such green wispy glowing object near a galaxy was found by Hanny van Arkel, a Dutch school teacher who found it while a volunteer in the Galaxy Zoo project. It was termed "Hanny's Voorwerp", where voorwerp means object in Dutch.

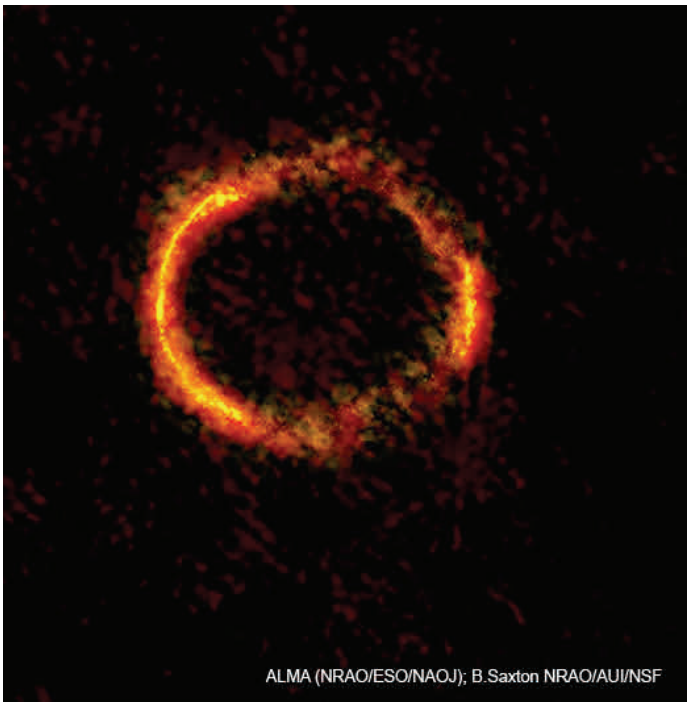
New neighbors – 2 teams of astronomers have discovered 9 possible dwarf galaxies near the Milky Way. These need to be confirmed as dwarf galaxies, not globular clusters, or something else that resembles a dwarf. The candidates range is size from 120-1300 light-years across. The nearest, Reticulum 2, at a distance of almost 100,000 light-years, is the strongest candidate. Even though it is small (200 light-years across) it is elongated, so is unlikely to be a globular. The 2nd most likely candidate, Eridanus 2, is also stretched out and lies the farthest away, at 1.2 million light-years. Follow-up observations are planned to determine the candidates' masses (including dark matter), since dwarf galaxies have higher amounts of dark matter than globulars.



Dark matter – Study of the Bullet Cluster, a pair of clusters of galaxies that recently (in astronomical times) collided, has shown that dark matter likely has very little interaction with ordinary matter or itself. The dark matter of each of the 2 clusters was shown to have passed through each other with little or no inhibition, while the gas of the clusters showed its expected slowing due to friction. A new study was made to see if the conclusions reached from the one sample (the Bullet Cluster) held in general. So they studied dozens of collisions of galaxy clusters. These happened at different times in the past and were viewed from all angles. Dark matter was measured by the gravitational lensing it caused on light passing through it. Conclusion: dark matter definitely interacts very little, if at all, with ordinary matter or itself. The team will now study collisions of individual galaxies to see if they also support this conclusion.

Milky Way structure – New studies of stars in the Milky Way have found 4 structures. The stars' distances were calculated from their apparent brightness, how bright each star should be from its type, and the amount of dust obscuring them. These yielded the 4 places where stars bunched up. The closest is about 6000 light-years outward from us, and each subsequent structure lies roughly 6000 light-years beyond the previous. They alternate above and below the plane of the galaxy. They are believed to be ripples in the galaxy structure caused by a dwarf galaxy that passed through the Milky Way's disk.

Radio ring – Several Einstein Rings are known in visible light. The gravity of a massive object very well aligned in front of a more distant one focuses the distant light into a ring by gravity's bending of light, as theorized by Einstein in his General Relativity. Now an Einstein Ring has been found in radio light. ALMA (radiotelescope array) was being tested at its highest resolution, achieved when its antenna dishes are moved to their widest separation (over 9 miles = 15 km), observed SDP.81, a star-forming galaxy nearly 12 billion light-years away, which happens to sit behind a galaxy at about 4 billion light-years. The resolution achieved was 23 milliarcseconds, about twice as good as the Hubble Space Telescope achieves.



ARM – NASA announced more details of its Asteroid Redirect Mission (ARM). The second of the 2 options was chosen: 1) capture a whole very small asteroid, or 2) pluck a large boulder (up to 4 yards [m] across) off the surface of a somewhat larger asteroid. This option costs slightly more, but it's also the safer choice, with more time to assess the target, and more suitable targets. The specific asteroid to be visited will be selected no sooner than 2019, approximately a year before launching the robotic spacecraft to capture the sample and move it to a parking orbit about our Moon. Solar electric propulsion, used on the Dawn mission to Vesta and Ceres, will be used to move the boulder. In roughly 2025 a crew of astronauts will go visit, study, and take part of the sample to Earth. 3 suitable asteroids are known from which to pick a boulder, and it is expected that more will be found in the next few years. The known 3 are Bennu, Hayabusa and 2008 EV5.

HAWC (gamma-ray and cosmic-ray observatory) was dedicated, after 4 years of construction high in the mountains of Mexico. It consists of 300 tanks of 50,000 gallons each of ultrapure water with light sensors inside. High energy gamma rays are emitted by the most extreme environments in the Universe: supernova explosions, active galactic nuclei, and gamma-ray bursts. Also gamma rays are thought to be correlated with the sources of cosmic rays (high energy particles). The detections system looks at 15% of the sky at all times, and will cover 2/3 of the sky during every rotation of the Earth (day).

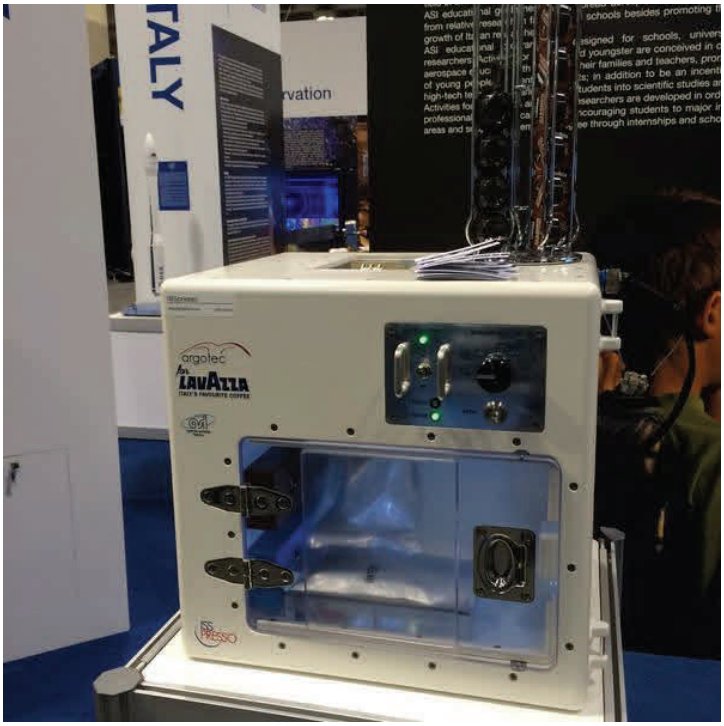
Instant AstroSpace Updates

After 2 years in high-inclination orbits that limited its ability to encounter Saturn's moons, **Cassini** returned to the planet's equatorial plane, where it will remain the rest of the year. It will have 4 encounters with Titan, 2 with Dione, and 3 with Enceladus and its geysers.

The Smithsonian National Air and Space Museum awarded its highest group honor to the **Kepler** (planet-finding space telescope) mission team for finding the 1st Earth-sized planet in the habitable zone (where temperatures could allow liquid water) of another star.

Millions of images of celestial objects, including asteroids, stars, galaxies and quasars, observed by **NEOWISE** (wide-field infrared space telescope) have been placed online for used by any astronomers or the general public. This will continue as more data are gathered.

By the time you read this, a SpaceX Dragon spacecraft should have arrived at the International Space Station with tons of supplies, including an **espresso** coffee maker built to operate in weightlessness. It was requested by Italian astronaut Samantha Cristoforetti.



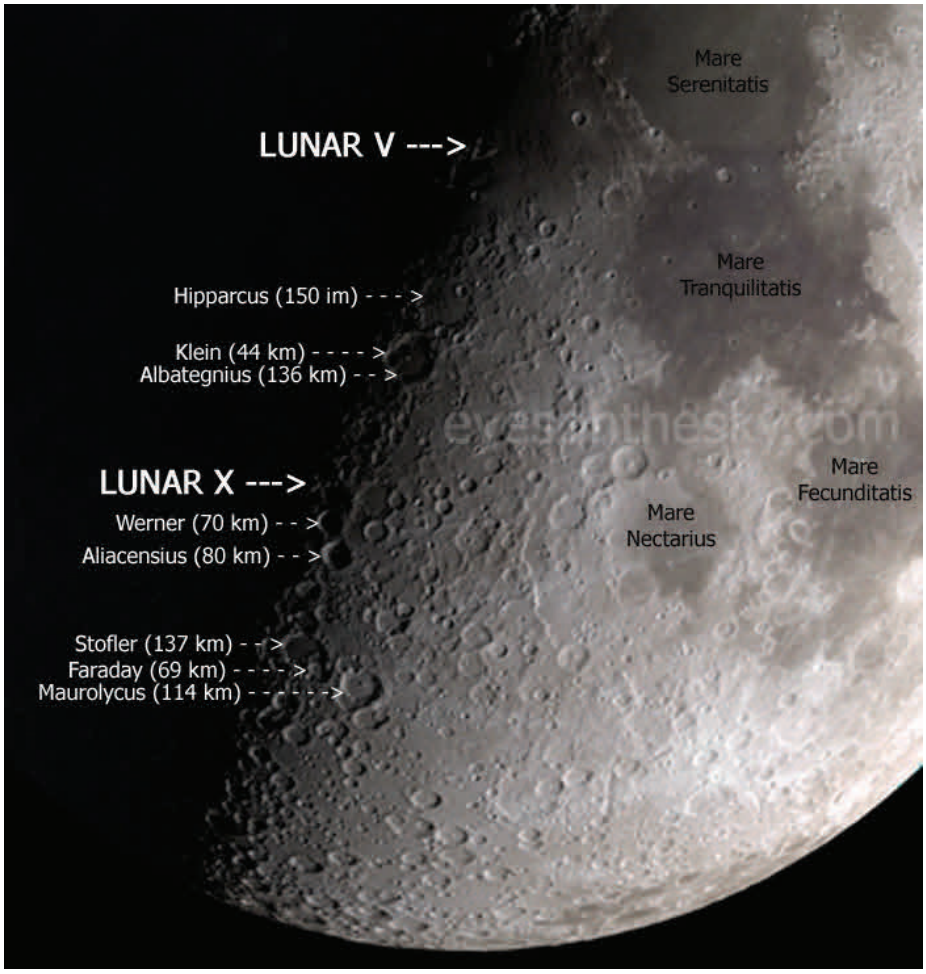
Right: The espresso machine that will be heading to the ISS in 2015. Brought to you by the Italian space agency, of course. (credit: Nicole Mortillaro/Global News (Canada))

LUNAR X AND LUNAR V

LUNAR X: The Lunar "X" is a transient optical feature of the Moon that occurs for about 4 hours near First Quarter phase of the Moon. Because the Earth is not always in the same place when the Moon is in this ideal sunlight location, not everywhere on Earth will always see the Lunar "X" phenomenon every month. However, it occurs frequently enough for most areas that it can be seen, on average, every few months. And it's a bright enough feature that it can even be seen in daylight - if you know when and where to look.

So WHERE is it? In the southern section of the Moon, there are a LOT of craters. The southern highlands are filled with them, whereas much of the northern region is dominated by the darker, lava-filled maria. Check out this labelled graphic below to see where the "Lunar X" is visible among some of the larger craters. This graphic shows the "X" as it would appear as it is just becoming visible.

Visible due to sunlight striking the tops of three craters – Purbach, LaCaille and Blanchinus – the "X" occurs when the sun is rising and striking the very top of each of them. This feature is easily visible even in very small telescopes, and tripod-mounted binoculars can show it to sharp-eyed observers. Despite its best apparitions occurring when the sky is dark, the "X" is prominent and visible during daylight hours.



Check the dates and times below for Lunar X visibility throughout 2014.

Lunar X visibility in 2015, with dates and times (24 hour format)

Jan 27 09:40 EST 06:40 PST

Feb 25 23:24 EST 20:24 PST

Mar 27 12:06 EST 09:06 PST

Apr 25 23:50 EST 20:50 PST

May 25 10:55 EST 07:55 PST

Jun 23 21:46 EST 18:46 PST

Jul 23 08:51 EST 05:51 PST

Aug 21 20:30 EST 17:30 PST

Sep 20 09:01 EST 06:01 PST

Oct 19 22:26 EST 19:26 PST

Nov 18 12:39 EST 09:39 PST

Dec 18 03:14 EST 00:14 PST

LUNAR V: Somewhat less well-known is the Lunar V. This sunlit feature is similar to the X in size, but is visible for quite a bit longer after the "X" has dissolved into the background craters. Created by sunlight striking the tops of the crater Ukert and ridges nearby, the "V" shape is slightly larger than the "X", though quite a bit further north, just south of the small Mare Vaporum. As the "X" becomes less prominent over time, the "V" still maintains a distinct shape and may also be viewed with most any small telescope or tripod-mounted binoculars.

(Editor's note: retrieved on 4/21/2015 from http://eyesonthesky.com/Moon/LunarX.aspx)

OWENS VALLEY RADIO OBSERVATORY TRIP

Doug Millar

I would like to announce our yearly trip to the Owens Valley Radio Observatory. It will be on June

19 and 20th. On Friday we will have night time astronomy by the main buildings. The next day we will have our tour of the 140ft dish and science experiments with Dr. Mark Hodges. That evening we will again have night time astronomy at the site.

The observatory is just outside of Big Pine, Ca on highway 395. You can find motel accommodations In Big Pine or Bishop. You can also camp at the site or at local camp grounds. We will go to Bishop on Saturday for pizza at the Pizza Factory.

It should be relatively warm, but plan on it being cold at night. Also plan on a few mosquitoes. The invitation is open to everyone and kids are especially welcome for both events. Please let your friends know. A map is below. If you have any questions, you can email me or call at 562 810 3989. Please RSVP so I know how many to plan on. Here is a link to the observatory for more information as well as a map. https://www.ovro.caltech.edu/

FOR SALE

Celestron Travel 70 Telescope $40; Celestron 114 'Cometron' telescope, $80

Vixen R130 f5 Newtonian OT, 6X30 finder; dovetail plate $100

Vixen mini Porta alt-azimuth mount $75

Celestron heavy duty alt-azimuth mount $50

Baader 'Q' turret (holds 4 eyepieces) $40

Orion 2" Crayford focuser for refractors with 10:1 fine adjustment $75

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