

SIRIUS ASTRONOMER

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Although technically a Southern Hemisphere object, NGC 1365, the Great Barred Spiral Galaxy, is visible in the extreme southern sky during fall and winter. Bill Hall obtained this image from our Anza site on October 22, 2011.

OCA CLUB MEETING

The free and open club meeting will be held January 10 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month is our annual Members' Night. Be sure to come out and hear presentations by Larry McDavid and Bob Buchheim!

NEXT MEETINGS: February 14, March 14

STAR PARTIES

The Black Star Canyon site will open on January 25. The Anza site will be open on January 4. 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 February 7. The following class will be held March 7.

GOTO SIG: TBA

Astro-Imagers SIG: Jan. 14, Feb. 11

Remote Telescopes: TBA

Astrophysics SIG: Jan. 17, Feb. 21

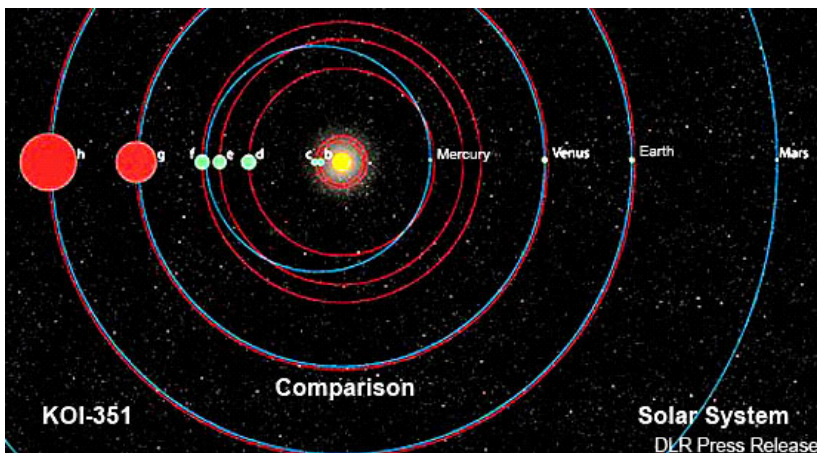
Dark Sky Group: TBA

AstroSpace Update

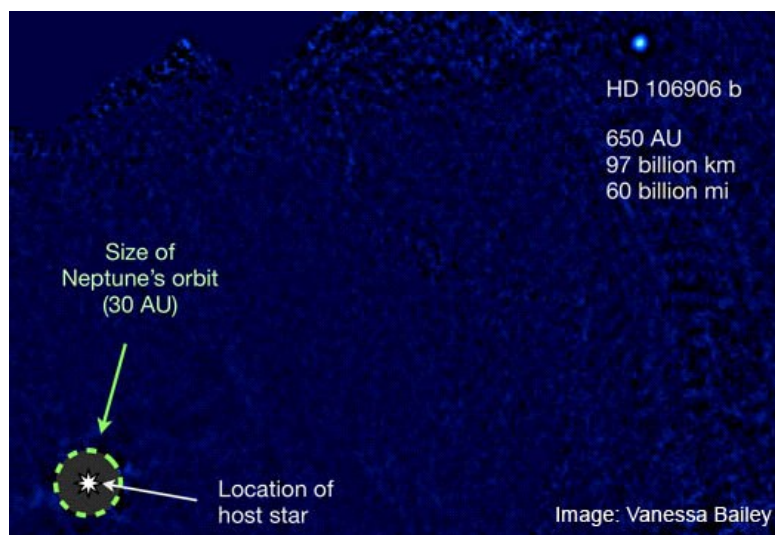
January 2014

Gathered by Don Lynn from NASA and other sources

Solar-System-like planets – A team of astronomers has discovered a planetary system, designated KOI-351, with some strong resemblances to our Solar System. It has 7 planets, with the small rocky planets grouped closer to their star, and gas giants farther. However the whole system orbits so close to its star that the system would just about fit within the Earth's orbit. 3 of the planets were found in Kepler (planet-finding space telescope) data, and the other 4 were found by analyzing changes in the orbital timing of the 3, due to perturbations from the others. The orbital periods ("years") of the planets are 7, 9, 59, 92, 125, 210, and 331 Earth days. It is not known how the planets formed in this way, but the astronomers involved feel knowing this system is key to understanding planetary formation.



Exoplanet water – Using the Hubble Space Telescope, 2 teams of scientists have found faint signatures of water in the atmospheres of 5 exoplanets (planets outside our Solar System). The observations involve taking infrared spectra of a star when its planet is passing in front (transiting), and subtracting from this the spectra of just the star taken another time. The difference is due to light passing through the planet's atmosphere. The 5 planets orbit nearby stars. WASP-17b, a planet with an especially puffed-up atmosphere, and HD209458b had stronger water signals, while the planets WASP-12b, WASP-19b and XO-1b were weaker. The water signals were all less pronounced than expected, and the scientists suspect this is because a layer of haze or dust blankets each of the planets, reducing the intensity of the signals. The 5 are all hot Jupiters, that is, gas giants that orbit very close to their stars. Finding all 5 hazy was a surprise, but recent work by other astronomers has found hints of haze on exoplanet gas giants also, so maybe this is common.



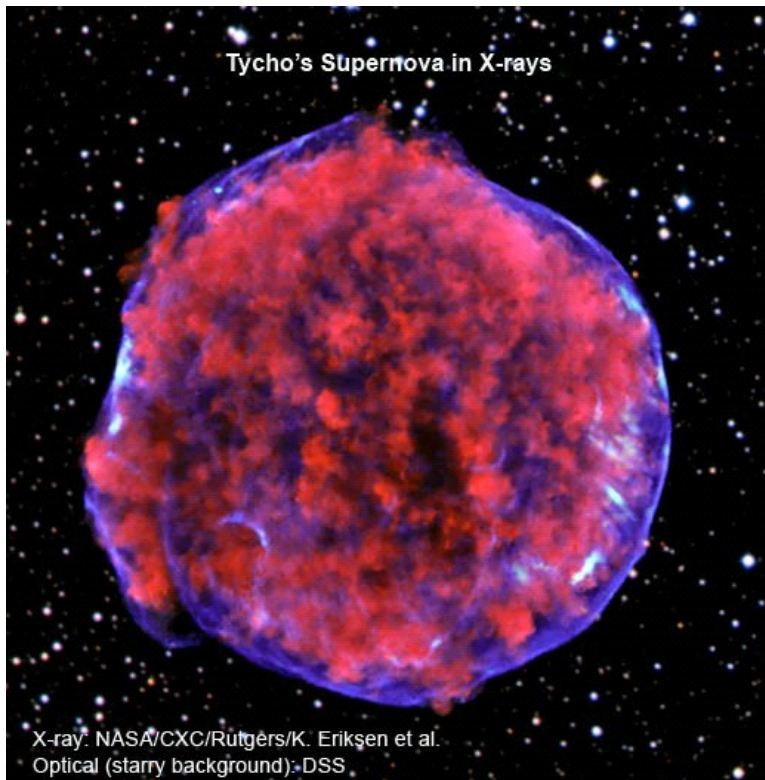
Baffling exoplanet – Last month I reported on an exoplanet (Kepler-78b) that was closer to its star than could be explained. Now astronomers have found an exoplanet, dubbed HD 106906b, that is too far from its star to be explained. It is 650 times as far from its star as the Earth is from the Sun. This is even 20 times the Neptune distance, the farthest one in our Solar System. It could not have formed there, because circumstellar disks are never that big (gravity pulls them in smaller), so there would be no material out there out of which to make a planet, particularly such a massive gas giant (11 times Jupiter's mass). The planet is still glowing (at 2700°F = 1500°C) from the heat created when it formed, so is known to be young for a planet, about 13 million years old. No one can figure how a planet could form reasonably close to its star and migrate out to this huge distance so quickly. Another possible explanation is

that the planet formed like a binary star, since such are known to form a pair of stars separated by this great a distance. But there is no explanation why it didn't form into a (much more massive) star rather than a planet. The mass ratio of the components of a binary star is almost always less than 10 to 1, but this new planet is more than 100 times less massive than its star. The observations of this

planet were made with adaptive optics on the Magellan Telescope in Chile. Such optics are necessary to see a dim object in the glare of its star.

Brown dwarfs – A team of astronomers has discovered 2 of the oldest brown dwarfs in the Milky Way. Brown dwarfs are star-like objects without sufficient mass to sustain nuclear fusion. These 2 ancient objects are moving at 60-120 mps (100-200 km/s), much faster than normal stars and other brown dwarfs. Due to their chemical composition, they are believed to have formed when the Galaxy was very young, more than 10 billion years ago. They appear to be halo objects, orbiting outside the plane of the Galaxy, but were found while briefly (astronomically speaking) passing through our neighborhood. Assuming the halo is permeated with such ancient brown dwarfs, this would represent a huge population of them. But we have found extremely few of them because of the difficulty of detecting them at any distance. They were found in data from WISE (infrared space telescope). Their nature was confirmed by large ground-based telescopes. Confirmation is necessary because the sky is littered with other types of objects that appear similar in infrared.

Gamma-ray burst (GRB) – One of the brightest GRBs ever seen occurred last April. Long GRBs are thought to be triggered when the core of a massive star runs out of nuclear fuel and collapses to form a black hole, which is one type of supernova. Fermi and Swift (gamma-ray space telescopes) detected the GRB, and immediate follow-up observations by ground-based telescopes detected an optical flash that reached magnitude 7, the 2nd apparently brightest GRB afterglow ever seen. As the optical flash peaked, Fermi detected a spike in high-frequency gamma rays. This spike at the time of the optical peak was unexpected. It had been theorized that the visible GRB light came from shocks internal to the collapsing star, and that the gamma rays peaked from processes outside, so they should not have occurred at the same time. The gamma rays were detected for about 20 hours, far longer than any previous GRB. For a GRB, this one was relatively nearby, only 3.8 billion light-years away. NuSTAR (high-frequency X-ray space telescope) was able to make the 1st ever measurements of high frequency X-rays during a GRB.



Supernova remnants – When a star explodes as a supernova, it shines brightly for a few weeks or months, but leaves behind material blasted outward that glows hundreds or thousands of years, in what we call a supernova remnant. What powers the glow in the remnant? That question has been answered with new observations, at least in the case of Tycho's supernova remnant. Astronomer Tycho Brahe observed what we now term a Type Ia supernova in 1572. It has long been known that a supernova throws material outward that collides with surrounding material, creating a shock wave that moves out at 300 times the speed of sound (Mach 300). New observations of Tycho's remnant in X-rays show that there is also a backlash, a reverse shock wave that speeds inward at Mach 1000. It is this reverse shock wave that causes the remnant to glow. The astronomers plan to look for evidence of similar reverse shock waves in other young supernova remnants.

Chandra (X-ray space telescope) has imaged faint remnants of a supernova around Circinus X-1, an X-ray binary star, and this helped researchers determine that it is the youngest known X-ray binary. This class of star consists of a

neutron star or black hole orbiting a normal star, which loses gas that is pulled into its companion. The gas falling in heats to millions of degrees, producing intense X-rays. Circinus X-1 was found from the supernova remnant to be less than 4600 years old. This is a great opportunity to study a newly made X-ray binary, before it ages and changes. There are hundreds of X-ray binaries known in the Milky Way, and typical ages that have been measured are in the millions of years. The observations of the supernova remnant were made during a fortuitous lull in emission from the neutron star, which glaringly hid the remnant. The youth of Circinus X-1 helps explain its wild swings in brightness and the highly unusual orbit (very eccentric = highly non-circular) of its 2 stars. The orbital period

was found to be decreasing by several minutes every year. Previous observations indicated the magnetic field of the neutron star in Circinus X-1 is weak. With its ages established, this implies either a neutron star can be born with a weak magnetic field, or it can quickly become demagnetized, neither of which was expected. In our galaxy, the only other established X-ray binary within a supernova remnant is SS433, which is between 10 and 100 thousand years.

Neutrinos – Results were released of the 1st 2 years of observations made by the IceCube neutrino detector, which is located near the South Pole. IceCube consists of over 5000 optical detectors that catch the light emitted when a neutrino collides with an atom anywhere in a cubic kilometer (0.6 mile on a side) of ice. Among the many neutrinos detected were 29 with very high energies (over 30 trillion electron volts), including 3 with extremely high energy (over 1 quadrillion electron volts). These are millions of times higher energy than the neutrinos detected from the supernova 1987A, so were probably generated by a different process. They are also far higher energy than is possible to create with our particle accelerators. Neutrinos can come from the Sun, from deep space, from collisions of cosmic rays with our atmosphere, or from nuclear power or particle accelerators. These high energy ones are believed to be from deep space. They did not show any statistical correlation in time or direction, though such may show up with much more observation. That could lead to identification of what deep space objects emit these. The leading theoretical contender is active galactic nuclei, that is, material falling into supermassive black holes at the centers of galaxies.

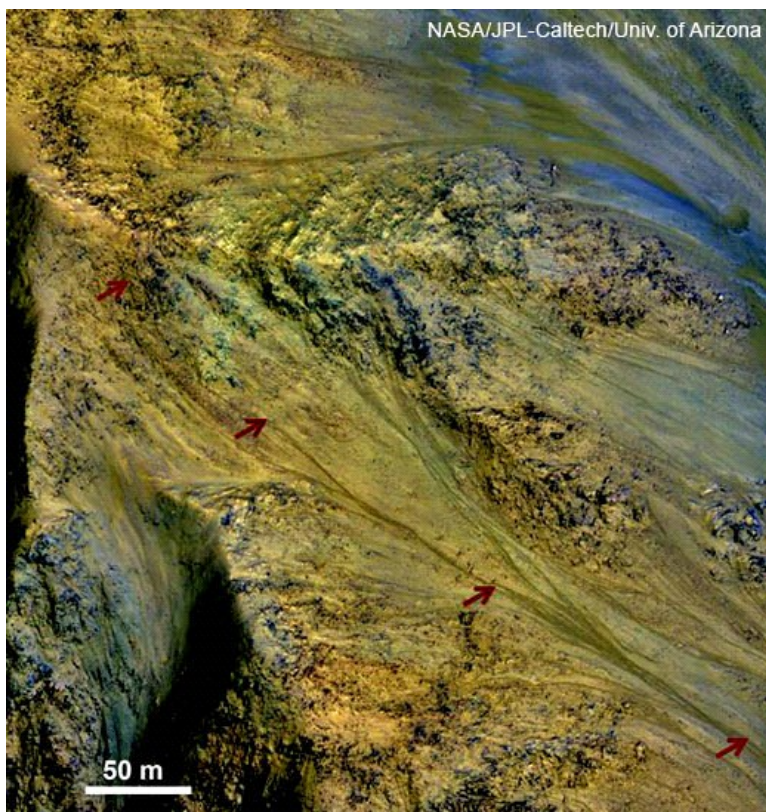
Hubble Space Telescope has observed water vapor clouds near the south pole of Jupiter's moon Europa, likely caused by geysers similar to those at Saturn's Enceladus. Europa has long been thought to have an ocean a few miles below its frozen surface. The clouds exist only at one part of Europa's orbit, so it is thought that tidal forces are opening cracks down to the ocean that allow water to geyser up. If this is confirmed, it means that a future mission to determine the ocean content need only sample the geysers, without needing to drill down to the ocean. Because gravity is much stronger at Europa than Enceladus, the clouds at the former fall back down after reaching an altitude of about 125 miles (200 km), while much water at the latter escapes to space.

More Europa – A new analysis of data from Galileo (Jupiter mission) has revealed clay-type minerals (phyllosilicates) in a patch on the surface of Europa that appear to have been delivered by a collision with an asteroid or comet. The minerals appear in a broken ring about 25 miles (40 km) wide, which lies about 75 miles (120 km) from the center of a 20-mile wide (30 km) crater. The leading explanation for this pattern is the splash back of material ejected when the body hit the surface at an angle of 45° or more from vertical. Such a shallow angle would allow some of the space rock's material to fall back to the surface. A more head-on collision would not do this. It is hard to see how phyllosilicates from Europa's interior could make it through the icy crust and create this pattern. It would take an asteroid about 3600 ft (1100 m) across, or a comet 5600 ft (1700 m) across to create this splash.

Cassini (Saturn mission) has been observing Titan's northern regions during recent close flybys, an area that contains almost all of the moon's seas and lakes. Scientists using the radar instrument have put together the most detailed yet mosaic image of that region. 97% of the liquid on Titan is included in one area about 600 by 1100 miles (900 x 1800 km). Some of the flybys tracked over areas previously seen at a different angle, yielding stereo 3-D views. The new images show Kraken Mare, the largest sea, is more extensive and complex than previously thought. Scientists have been wondering why Titan's lakes are where they are. These images show that the bedrock and geology of the area may explain this. It may be a deformation of the crust that created fissures that fill up with liquid. Analysis of the radar signals revealed that Ligeia Mare, the 2nd largest sea, is about 560 feet (170 m) deep. This is the 1st measurement of the depth of a Titan lake or sea. Scientists have now estimated the total volume of the liquids on Titan at about 2000 cubic miles (9000 km³). The new observations show that the liquid in the lakes and seas is mostly methane. It was established some time ago that it was likely some mixture of methane and ethane with perhaps other hydrocarbons in small amounts.

Phaethon (asteroid) was observed while close to the Sun in its orbit by using the STEREO solar space telescopes. It has long been known that Phaethon shares the orbit of the Geminid meteor shower, and so is presumed to be the source of the meteoroids. But comets, not asteroids, appear to be the source of all other meteor showers. The STEREO observations caught Phaethon in the act of throwing off a cloud of material while close to the Sun, even forming a short comet-like tail. It is being termed a "rock comet". It is believed that the heat of the Sun is fracturing the crust to throw off material, or possibly desiccation (like mud cracking in the Sun) is doing so. However the amount of dust measured is not enough to sustain the number of meteors produced by the Geminid shower. So it is believed that sometimes, or perhaps once in the past, Phaethon throws off much more material than seen now. Observations will continue.

Martian water – Radar and other measurements have previously shown that the equatorial regions of Mars are apparently lacking in water, either frozen or liquid, while temperate and polar regions have much ice, sometimes just below the surface. New observations by Mars Reconnaissance Orbiter (MRO) have found slender dark markings that appear seasonally (spring-summer) near the equator that appear to be salty liquid water running down slopes. Similar markings had previously been seen in temperate zones, where ice is known to be just under the surface, and liquid water could theoretically exist with underground pressures. 5 well-monitored equatorial sites with these markings are in Valles Marineris, the largest canyon system in the Solar System. The markings appear on both north- and south-facing walls. Dissolved salts could make the water last long enough to flow some distance before freezing or evaporating in the cold dry Martian conditions. Some of the newly found markings stretch as long as 4000 ft (1200 m).



Curiosity (Mars rover) has determined the age of a Martian rock, taken the 1st readings of radiation on the surface, and shown how natural erosion could reveal traces of past life, if they exist. The 2nd rock that Curiosity drilled and analyzed yielded results showing the rock was between 3.86 and 4.56 billion years old. This is within the crater-count age estimates of the area, confirming that the crater-count method seems to be right. The age of Curiosity's rock was determined from the decay of radioactive potassium into argon. The rock was found to have been exposed on or very near the surface for 60-100 million years. This was measured by looking for products made by cosmic rays striking the surface. This suggests that the layers of rock above were stripped by (probably wind) erosion geologically recently. Looking for organic materials that may have been left by ancient microscopic life should be done at the most recent exposures, since surface conditions, including ultraviolet light, will break down organic materials. Previous work has established that neutral liquid water existed on the surface of Mars perhaps 4 billion years ago, and that later it underwent drying that left any remaining liquid water acidic and briny. Chemical analysis showed that the clay materials formed where they were found, ruling out the other theory that the clay washed there from higher ground. The new work showed that the neutral liquid water phase extended until somewhat less than 4 billion years ago, interestingly close to when life on Earth is believed to have formed. Those water conditions were found to exist for at least millions to tens of millions of years. This would oppose theories that water ran on Mars' surface only during brief floods. Even after the surface finally dried, the subsurface likely was wet, as indicated by mineral veins found that were deposited by underground water into fractures in the rocks. New results from the rover's radiation instrument are providing the 1st readings of radiation hazards at the planet's surface, which will aid in planning of human missions to Mars. Most (95%) of the radiation came from cosmic rays, but by chance, the period of measurement did not include any major solar storms that hit Mars, which could also contribute. Exposure to radiation from the trip and surface exposure of a human mission to Mars is now estimated at about 1 sievert. This is more than astronaut rules allow in a lifetime, and would be enough to raise the chances of contracting cancer by 5%. Clearly radiation shielding will be needed on a human Mars mission. The measurements from Curiosity are telling scientists how much shielding.

Curiosity was commanded to stop operations when a voltage changed radically in late November. A thorough check showed that it was due to intermittent electrical leakage in the radioisotope generator (power supply). The rover was designed to operate fully with such problems, and in fact several other spacecraft have suffered a similar problem without any effect on the mission. So after 6 days, Curiosity was commanded to resume operations.

Mars and asteroids – Some time ago I reported here the 2010 discovery that asteroids that happen to have relatively unweathered (by solar wind) surfaces correlated with close passes by Earth in the recent past. Apparently tidal forces disrupt the loose surface material, exposing fresh unweathered material. A new finding is that passes by Mars can also clean up asteroidal surfaces, even though

Mars is much less massive and therefore creates much weaker tidal forces. This is apparently offset by the fact that Mars is closer to the asteroid belt, and so has many more chances to disrupt asteroids. Possible causes of this clean up other than tidal disruption were ruled out by probability calculations done on 60 known cleaned-up asteroids. These possible causes included spin up and collisions.

Cloud map – A multi-year study of nearby galaxy M51 using millimeter radiotelescopes has mapped the locations of 1500 giant clouds of molecular hydrogen. Most of a galaxy's stars are born with such giant molecular clouds. Analysis of the map included comparison with ionized and atomic gas and newly-formed stars from previous data. This analysis yielded surprises. The 1st was that so much of the molecular hydrogen (about half) is not in the clouds, but in a diffuse disk or fog pervading the galaxy. Pressure from this fog turns out to be important in where new stars form, where such pressure had been thought to be negligible before. So stars do not necessarily form in the densest giant clouds, which fill the galaxy arms, but form where density and pressure are high. The pressure from the fog is low (by Bernoulli's principle) where the fog is moving. This explains why large regions within the galaxy arms do not have star formation. Further observations will include other galaxies to see if the surprises found in M51 generalize.



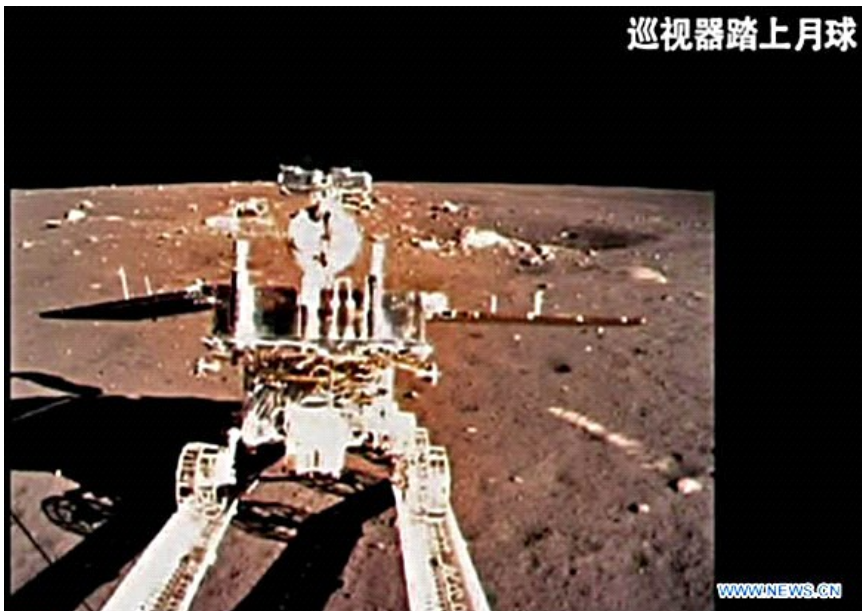
Black hole pair – Astronomers have spotted what appear to be 2 supermassive black holes at the heart of a remote galaxy, circling each other. The rare sighting was made using WISE (infrared space telescope) and confirmed with ground-based optical and radio telescopes. This revealed unusual features, including a lumpy jet thought to be the result of 1 black hole causing the jet of the other to sway. The finding could tell astronomers more about how supermassive black holes merge. WISE scanned the entire sky twice in infrared before being put into hibernation in 2011. Only a handful of supermassive black holes have been identified in the early phase of merging. This discovery appears to be in a late phase of merging, and such pairs are very rare. It is located relatively far away at 3.8 billion light-years. Visible-light spectra showed signs of abnormalities, thought to be the result of 1 black hole causing disk material surrounding the other black hole to clump. This and other signs point to the black holes being fairly close, and therefore closer to merging.

Bright black hole – An ultraluminous X-ray (ULX) source in nearby galaxy M101 has been a puzzle for many years. Usually ULXs are binaries consisting of a stellar mass black hole and a normal star losing material into the black hole. But the M101 ULX is too bright in X-rays for that. It would violate the Eddington limit. That limit says that at a certain brightness, the pressure of light will overcome gravity and blow away the surface or surrounding material of any object. In other words, the M101 ULX should have blown away the material before it falls toward the black hole, and should extinguish itself ... unless the black hole is much more massive than stellar size (which is defined as up to a few tens of times the mass of the Sun). Finally astronomers have been able to measure the mass of this black hole, to try to settle this, and it is somewhere in the range of 20-30 times the Sun's mass. The measurement was made by timing the orbital period (about 8 days), and determining the type and mass of the companion, and so use orbital equations to determine the black hole mass. So it is stellar mass. But why is it so bright? The astronomers involved surmised that it could be because the companion star has such a strong stellar wind that it overcomes the light pressure, or that the X-ray radiation is concentrated in bubbles and the material falls in between them.

Milky Way jet – Astronomers have long sought strong evidence that Sagittarius A*, the supermassive black hole at the center of the Milky Way, is producing particle jets. Previous studies have shown only suggestions of a jet. New observations with Chandra (X-ray

space telescope) and VLA (radiotelescope array in New Mexico) have definitively found a jet and the shock wave it produced when it struck surrounding gas. The jet's axis is parallel to the rotation axis of our galaxy. This is expected if large amounts of material have fallen into the black hole from the disk of the galaxy, as opposed to material or black holes falling in from colliding with other galaxies (which would change the axis of the jet). It is not surprising that the jet is weak and was therefore hard to detect, since the black hole is known to be presently consuming very little material. Jets usually appear in oppositely-pointing pairs, but a 2nd jet was not seen, possibly because gas or dust is blocking our line of sight or because it is even weaker than the one seen.

Chang'e 3 (Chinese lunar mission) landed on the Moon's Sea of Rainbows December 14, becoming the 1st soft lunar landing since the Soviet Union's Luna-24 in 1976. It carried a 6-wheeled rover named Yutu, which is scheduled to explore the area for at least 3 months. The stationary portion of the lander is designed to operate for a year. The name Yutu refers to a jade rabbit in myth, which belonged to the goddess of the Moon. The mission includes an astronomical telescope, spectrometers, and a ground-penetrating radar.



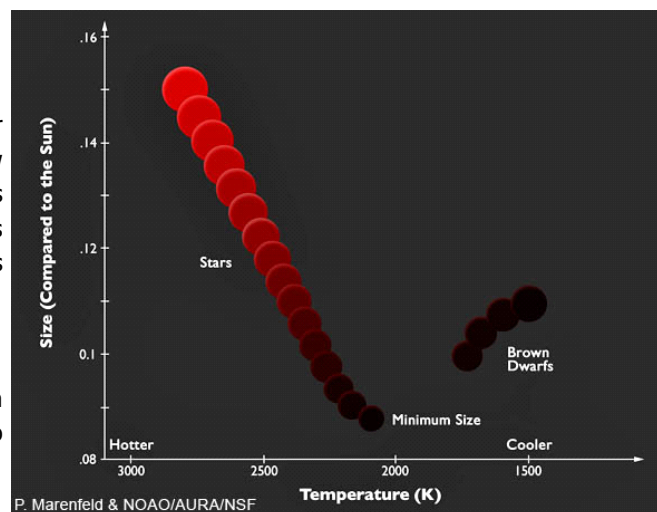
Radio bursts – I reported here last August that radio bursts from space, of which only 6 have ever been detected, appeared to be coming from billions of light-years away. This conclusion was reached because the various frequencies of radio waves were spread out in arrival time, an effect that is known to happen from the effects of the very sparse charged particles in deep space. A new theory has been presented: that the bursts originate much closer, from the extreme magnetic activity around flaring stars within our Milky Way. In this case the dispersion of frequencies would be caused by dense material around the source, not the thin matter in intergalactic space. To support the theory, the astronomers were able to find a flaring star at the location of 1 of the known radio bursts; however they failed to find flaring stars at 2 other locations that they studied.

International Space Station (ISS) – A pump in a cooling system aboard the ISS automatically shut down December 11 when it reached too low a temperature. Troubleshooting has determined that a control valve inside the pump is malfunctioning. There is no danger to the astronauts, but many experiments are being delayed, and non-essential systems have been shut down to reduce the cooling necessary. As I write this, NASA is deciding whether to schedule a space walk to make a repair. Spare pumps are aboard the station. However, no space walks have been performed in NASA spacesuits as a precaution since the serious water leak inside a suit occurred last July, though space walks have been made in Russian suits.

Instant AstroSpace Updates

Stars in the main sequence with smaller masses are known to be smaller in diameter, while **brown dwarfs** grow with smaller masses. A new study determined exactly the size (8.7% the Sun's diameter), brightness (1/8000 the Sun's brightness), and temperature (2100 K) at which this behavior reverses, which should help in distinguishing brown dwarfs from small cool stars.

MESSENGER (Mercury orbiter) took images in early November of both Comet Encke and Comet ISON as they flew by Mercury on their ways to close passes by the Sun.



Remember when your chemistry teacher told you that noble gases (like argon) do not join chemically to form molecules? Well, astronomers using the Herschel space telescope took far infrared spectra of the Crab Nebula, a supernova remnant, and found **argon hydride**, in this case only containing argon-36 isotope, the 1st noble gas molecules ever found in space.

In case you missed it in the news, **ISON**, touted by some as the comet of the century, did not get quite as bright as most predictions, was bright only very near the Sun where it could not be seen except by some solar telescopes, and disappeared in a puff of smoke when it got too hot really near the Sun.

NASA has launched its 2nd nanosatellite (4 inches [10 cm] on a side) made from a modified Samsung Nexus S **smart phone**, this one with 2-way radio and ground-command capabilities, and designed to last up to a year. There were 11 nanosatellites piggy-backed on a major satellite launch, but only this one made from a phone.

The European Space Agency has announced its **next 2** big (expensive) **missions**: A massive X-ray space telescope provisionally named Athena+, as successor to the US Chandra and European XMM-Newton, to launch in 2018; and a gravitational wave space observatory named eLISA for 2034 launch, to fill in for the LISA mission dropped by NASA budget cuts in recent years.

The Mars rover teams have given informal names to Martian features in honor of **Bruce Murray**, recently deceased former head of JPL and co-founder of the Planetary Society. Murray Ridge is where the Opportunity rover is now, and Murray Buttes are ahead of the rover Curiosity, at the base of Mount Sharp.

An object in Draco found by **Nathan Gray**, age 10, was confirmed to be a Type IIpec supernova, and he became the youngest person to discover a supernova, taking the record from his sister Kathryn. They are both part of a family project to compare images of galaxies to search for changes such as supernovas.

FOR SALE

Celestron super C-8, Meade heavy tripod with Celestron wedge, clock drives, 11 eyepieces, Parks filters, camera and ocular adaptors and other accessories, Burhams Celestial Handbook, Sky Atlas 2000, and books, all in five hard cases. \$1000 O/B/O. email carlberg@ix.netcom.com for complete inventory. Contact David Carlberg at 714-842-5619

Celestron NexStar 5, barely used. \$1400 o/b/o. Contact Carol at ccbopper@hotmail.com

Non-computerized C6 SGT including tube, mount (never used), Telrad finder, 25 mm eyepiece, focal reducer and case for the tube. Contact Michael Mirjahangir at 714-319-3103

Meade ETX-125C with accessories (tripod, carrying case, Autostar system, heat/dew cover, etc.) \$500 o/b/o. Email SRFROGN@aol.com with copy to startraveler68@yahoo.com for details.

Skywatcher 100ED f/9 refractor with Celestron CG-4 mount. Scope comes with a hard case, 8X50mm finder, 2-inch dielectric diagonal, 2 LET eyepieces, and 4-inch Baader solar filter. CG-4 mount has motors for both RA and DEC. Optical tube can be sold separate. \$600 o/b/o. Contact Val at 949-382-1869.

Celestron 90mm Maksutov Sky Prodigy with all attachments. \$300. Contact Val at 949-382-1869.

Meade LX90 10" ACF, f/10, with Autostar; GPS; Smartfinder; Telrad finder; 6.7 and 40 mm eyepieces and 8X50 ViewFinder. \$1700. Contact Don Rader at dgrconsult@roadrunner.com or 714-996-5138.

Remembering Alika Herring

Sheila Cassidy

Recently OCA was given a 12 1/2 inch Newtonian telescope that was the personal telescope of Alika Herring, by his son, Jack. Alika died in 1997 and was one of the early OCA members. He was a true renaissance man with many interests, all of which appeared to have been developed into expert status.

Alika Herring achieved fame in many pursuits. He was a well-known telescope maker, astronomer, archaeologist, and scientist. Alika was also a well-known musician who achieved early fame in Hawaii as a steel guitarist. In fact, he was considered one of the islands' best musicians. And yet, as with his telescopes later, he shared his instruments with his own children and their friends.

Herring was a true child of the great depression. He was born in July 1913 to missionary parents in Hawaii. His wife Trene also came from Hawaii. In spite of the hard times, Alika graduated from the University of Oklahoma at Norman in 1932; but jobs were scarce. So he worked as a mailman and a musician during the Great Depression.

December 7, 1941 would change Alika's life forever, as it did for so many Americans. His reaction to Pearl Harbor was to enlist in the Navy, where he served as a Sonar man during World War II. After the war he became a machinist and a musician, and also made several telescope mirrors around this time.

Like many other World War II veterans, he came in California in 1951. That's where Alika met Tom Cave and worked for the Cave Optical Company until 1961. He became such a master optician that Bill Gann claims Alika's mirrors were so flawless and perfect that they were used as part of the optics of the early space probes. One of the early space probes veered off course and Gann thinks that one of Alika's mirrors traveling in that probe might still be in deep space somewhere. His experience at the Cave Optical Company and his observational skills led to employment at the Lunar and Planetary Laboratory of the University of Arizona at Tucson. The director of the lunar and planetary laboratory at that time was Gerard T. Kuiper, who had the first airborne Observatory named after him, and also the Kuiper Belt. Alika observed and photographed the Moon, as part of a group that produced the Consolidated Lunar Atlas in 1967. This was during the heyday of the NASA missions that resulted in the first manned flight to the moon in 1969.

Seeking a large telescope site for Dr. Kuiper sent Alika on an odyssey that included Hawaii, Chile, Baja California, and elsewhere. He used his own 12 1/2 inch mirror, that he lovingly constructed through many hours of grinding and polishing, for these atmospheric tests. Alika was very serious about these tests and stated during an interview, "I shudder now when I think of the responsibility I had. Millions and millions of dollars hung in the balance, and it all was pretty much on my say-so. It scared me." The interviewer was O. Richard Norton of **Sky & Telescope** magazine, and the article was 'Master Optician, Master Observer'. The site testing trips were not without incident. When Alika was testing on a mountain in Baja California, he had to be rescued by helicopter because of an approaching storm. And in Hawaii he lived under sub Arctic conditions 10,000 feet or more above the lush tropical paradise that we know and love. These site testing trips led to the selection and development of Mauna Kea in Hawaii as a major center of astronomical research. Although Alika found slightly better seeing at Haleakala, Mauna Kea was chosen because it was above the top of the frequent cloudy inversion layers, where Haleakala was not. Herring found several periods of perfect seeing with intervals of many seconds between any visible atmospheric tremors on Mauna Kea. Today, Mauna Kea boasts not only the twin Keck telescopes, but many more besides, and is to be the future home of the 30 meter telescope. The very special 12 1/2 inch mirror found a later home in a box in his study.

Walter H. Haas, the A.L.P.O. Director Emeritus, considered Alika to be one of the best lunar artists of our times. Many of Alika's drawings appeared in **Sky & Telescope** magazine, the **Journal**, A.L.P.O. over a period of many years. Alika later came to regard the drawings from Earth-based telescopes to be of limited scientific value in our space-age. The accuracy of his drawings became clear only when space probe images produced views of the moon that confirmed the details in the drawings. Alika was a lunar recorder for A.L.P.O. from 1957 to 1961 while he was at Cave Optical Company and functioning as an amateur astronomer as well as an optician.

One time when Walter Haas was at Alika's home, they were observing Saturn. Alika identified several of the satellites that Walter was unable to see. But when Haas referenced the American Ephemeris and the Nautical Almanac, he found that Alika was spot-on. It was all the more heartbreaking in later years, when Alika developed macular degeneration in both eyes, and had to abandon making mirrors and observing the sky. But Alika didn't let the disability keep him from producing five albums or more of Hawaiian music, or from pursuing other hobbies or chess.

Alika Herring was not just a master astronomer and optician. He was also an archaeologist and became noted for his discoveries and writings about ancient cog stones that he found along California's coast. They look like stone gears from some ancient machine. He also recorded rock art and worked on digs in the Mojave and near Fossil Falls. Alika became an expert at flaking arrowheads, tools, and spear points. He enjoyed tricking fellow archaeologists by slyly tossing a flawless point on their shaker screen. He was an expert archer and sparked Bill Gann's early interest in the sport. Alika's son Jack, gave Bill Gann Herring's bows and arrows, including a wonderful set of hunting arrows tipped with Alika's faultless obsidian arrowheads. Later, Bill and Jack would take Alika on desert outings just as he had taken them when they were young boys. But they quickly found that he could hike for hours in summer heat and not show any signs of tiring, as he "led them up mountains and through valleys, naming every plant geological structure and ancient artifact along the way." Bill and Jack would drag themselves into camp in the evening, exhausted from having covered as much as 20 miles of wilderness.

Bill Gann remembers that Alika well into his 80s was pursuing new hobbies. He said that Alika painted with such precision when he decided to become a painter, that it was difficult to tell his paintings from photographs. Alika made model railroad displays that were geological and architectural wonders. Bill remembers one's railroad scene as a western town sitting in the desert resembling Knott's Berry Farm, where according to Bill, Alika worked for a number of years running the gold-mining display. Bill remembers the landscape as having such detail that you could find mineral deposits, earthquake faults, springs, and streambeds.

Both Bill Gann and Walter Haas agree that Alika never pursued fame or fortune, but lived a quiet, joyful life, doing only those things that sparked his endless curiosity. And although his cog stonework is still remembered, and telescopes with his garage-made mirrors become more valuable each year, it seemed like the former Oklahoma State chess champion "would rather spend his life playing chess by mail or over the ham radio with some friend in the outback than seeking recognition and wealth." Son Jack said he never beat his father at chess. The mind is truly a wonderful thing.

It only seemed most appropriate that the Hale-Bopp Comet signaled the exit of the STAR GAZER, as the ham radio community knew him, much as Halley's comet signaled the death of Mark Twain. Alika Herring was a man for all seasons, and like Mark Twain exited with a certain grace.



The Big Picture: GOES-R and the Advanced Baseline Imager

By Kieran Mulvaney

The ability to watch the development of storm systems – ideally in real time, or as close as possible – has been an invaluable benefit of the Geostationary Operational Environmental Satellites (GOES) system, now entering its fortieth year in service. But it has sometimes come with a trade-off: when the equipment on the satellite is focused on such storms, it isn't always able to monitor weather elsewhere.

"Right now, we have this kind of conflict," explains Tim Schmit of NOAA's National Environmental Satellite, Data, and Information Service (NESDIS). "Should we look at the broad scale, or look at the storm scale?" That should change with the upcoming launch of the first of the latest generation of GOES satellites, dubbed the GOES-R series, which will carry aloft a piece of equipment called the Advanced Baseline Imager (ABI).

According to Schmit, who has been working on its development since 1999, the ABI will provide images more frequently, at greater resolution and across more spectral bands (16, compared to five on existing GOES satellites). Perhaps most excitingly, it will also allow simultaneous scanning of both the broader view and not one but two concurrent storm systems or other small-scale patterns, such as wildfires, over areas of 1000km x 1000km.

Although the *spatial* resolution will not be any greater in the smaller areas than in the wider field of view, the significantly greater *temporal* resolution on the smaller scale (providing one image a minute) will allow meteorologists to see weather events unfold almost as if they were watching a movie.

So, for example, the ABI could be pointed at an area of Oklahoma where conditions seem primed for the formation of tornadoes. "And now you start getting one-minute data, so you can see small-scale clouds form, the convergence and growth," says Schmit.

In August, Schmit and colleagues enjoyed a brief taste of how that might look when they turned on the GOES-14 satellite, which serves as an orbiting backup for the existing generation of satellites.

"We were allowed to do some experimental imaging with this one-minute imagery," Schmit explains. "So we were able to simulate the temporal component of what we will get with ABI when it's launched."

The result was some imagery of cloud formation that, while not of the same resolution as the upcoming ABI images, unfolded on the same time scale. You can compare the difference between it and the existing GOES-13 imagery here: http://cimss.ssec.wisc.edu/goes/blog/wp-content/uploads/2013/08/GOES1314_VIS_21AUG2013loop.gif

Learn more about the GOES-R series of satellites here: <http://www.goes-r.gov>.

Kids should be sure to check out a new online game that's all about ABI! It's as exciting as it is educational. Check it out at <http://scijinks.gov/abi>



The Advanced Baseline Imager. Credit: NOAA/NASA.

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