# SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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## DON'T FORGET TO VOTE! BOARD ELECTIONS THIS MONTH!

An oldie but goodie: OCA Member John Thomas took this picture of Comet Hyakutake from the Anza site on March 25, 1996, when the comet was only 0.9 AU from Earth. Hyakutake was one of the brightest comets in recent times. John took the picture with a Pentax 6x7 with a 90mm lens at f/2.8 piggybacked on his Celestron C8, using Konica 3200 film and an 8 minute exposure. For more on naked-eye comets, read Helen Mahoney's article on page 3.

## OCA CLUB MEETING

The free and open club meeting will be held January 14th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Dr. Linda Morabito will present 'One Astronomer's Journey Through Space And Time'.

NEXT MEETING: February 11th

## STAR PARTIES

The Black Star Canyon site will be open on January 8th. The Anza site will be open on January 1st and January 29th. Members are encouraged to check the website calendar, for the latest updates on star parties and other events.

Please check the website calendar for the outreach events this month! Volunteers are always welcome!

*You are also reminded to check the web site frequently for updates to the calendar of events and other club news.*

## COMING UP

The next session of the Beginners Class will be held on Friday, January 7th at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana. Next month the class will be offered on February 4th.

GOTO SIG: TBA
Astro-Imagers SIG: TBA
Remote Telescopes: TBA
Astrophysics SIG: TBA
Dark Sky Group: TBA

*(NOTE: the website calendar has not yet been updated as of press time. Please check the website for further updates)*

# Avoiding Amateur Astronomy Disasters

## January, 2011

By Tom Koonce

The weather is turning cold and all of us want to maximize our observing time and minimize how long we're exposed to the bitter cold. In circumstances like this, we amateur astronomers tend to get in a hurry, or perhaps not think things through before doing something… and disaster can strike. Disasters come in many forms, among them, dropping an eyepiece to the ground because it wasn't held securely. Hearing the thud/crunch/tinkle sound is sickening, even for those observers around you. Having your secondary mirror come loose and drop onto your primary mirror is pretty bad, but what about dropping an expensive precision filter into the dirt? And then there are the truly dangerous mistakes such as not making sure a stepstool or ladder is on firm ground or loading your dobsonian telescope lengthwise into the car with the secondary at the front and the primary at the back of the car. I'll explain each of these and how to reduce the risk of these happening to you.

The cold affects each of us to a differing extent. I'm assuming you already know to dress for weather 20 degrees cooler than weather reports predict. After all, you're going to be standing still in freezing weather, not chopping a cord of wood. I also assume that you know to remain hydrated since this can affect your thought processes and reaction times. Some people get cold just thinking about going out at night, some must have a furnace built inside of them because they seem to remain warm with little notice of the thermometer. Most of us are in between these extremes. Fingers and toes get cold first, and then grasping objects becomes difficult, thought processes slow down, and our logic becomes blurry. The trick is to recognize how **you** respond and take steps to counteract it before you damage equipment.

**Disaster: Dropping eyepieces.** Think ahead about which eyepieces you will need for the next hour. Keep a fanny pack on over your jacket that makes storing and switching eyepieces convenient and minimizes how long your fingers have to grasp them. Stick your hands inside of your jacket and under your armpits for a couple of minutes before you do the eyepiece switch. Another trick is to place a packing quilt or old rug under your entire telescope setup so that if something is dropped even after taking precautions it might survive the plunge.

**Disaster: Secondary Mirror Drop.** Always check your equipment. Before you start your evening's observing, do a "walk-around" of your telescope. Are there any frayed wires? Are there any loose bolts? If you have a Newtonian, is the secondary secured to its mount? Have you placed a small safety wire between the spider and the secondary… just in case? This is a disaster that can be avoided. I have seen/heard this happen to my buddy's 6 week-old 14" Dob at a public outreach event. It destroyed his primary mirror. During your walk-around, be conscious of any tools that you need to setup your telescope. Wrenches and screwdrivers can be devastating when applied to any optical surface. Tools tend to slip when brains and fingers are cold. Consider drilling a hole through the handle and affixing a cord loop to each tool to wrap around your wrist to eliminate the possibility of despair.

*A filter slide provides safe and easy access to your filters. Photo used with permission.* [*www.Astrocrumb.com*](http://www.Astrocrumb.com)

**Disaster: Filter Drop.** Think ahead about the dexterity you're going to need to take the small filter out of its case and screw it onto the eyepiece. It's possible that filters can be only partially screwed onto the eyepiece and may drop off onto the primary mirror during observing. In my dobsonian, I can vouch for the fact that a two inch O-III makes a heart-stopping sound when it bounces off of the primary mirror. Not good. To remedy this situation, take the time to make sure that your fingers are warmed up and the filters are fully screwed on. Alternatively, consider installing a filter slide on Newtonian or Dobsonian telescopes. I have made this modification on my Dob and it makes using filters simple, convenient and safe. If you have this type of telescope, check out http://www.astrocrumb.com/ for the best filter slides I've found.

**Disaster: Stepstool and Ladder Tilt.** Anyone who is showing the night sky to the general public or who has a larger Dobsonian knows the pitfalls of using stepstools or ladders. They need to be sturdy and lightweight, but rarely are they made to be placed upon bare earth. Sometimes ground can be frozen hard on the surface, but mushy just an inch or two below. Take the time to be sure of the placement of their feet

*(continued on page 9)*

# TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE

## #9 A Naked Eye Comet

By Helen Mahoney

Comets are such fascinating objects. They are at the same time sparkling streaks in the sky, and oddly shaped icy rocks. They appear, decorate the sky for a few days or months, and then leave. Roughly once every two years, a comet comes by that is bright enough to see naked eye.

The first naked eye comet that I clearly remember seeing is Comet Bennett in 1970. I saw it in the pre-dawn twilight sky rising above Los Angeles from my dorm window at UCLA.

Comets originate in the Oort Cloud or the Kuiper Belt, and their long elliptical orbits around the sun can last tens of thousands of years. As they go through the inner solar system, the gravitational forces of Jupiter can change their orbit to a longer or shorter period. You usually can't plan too far ahead to see a comet, because most comets are discovered shortly before they pass close to the earth. So we have to wait for one to be discovered and make quick plans to get to a dark enough sky to see it well.

The exception is Halley's Comet, the only consistently naked eye comet we know of whose orbital period is short enough (75 years) for it to have been seen several times in recorded history. That one we can plan for, and in 1986 I was lucky enough to see it. I saw it best in this hemisphere from Mount Wilson, but with my children and friends we traveled to New Zealand and Australia where we saw it each night high in the sky.

*Dave Kodama produced this photo of naked-eye comet McNaught (C/2006 P1) using a Nikon D70s camera at f/5.6 (1/15 sec. exposure , ISO 2000). This image was taken from Fullerton, CA on January 12, 2007.*

As beautiful as Halley was, it was not the best naked eye comet I have ever seen. For that, there is a tie between Hale-Bopp and Hyakutake. Hyakutake passed within 0.1 astronomical unit (AU) from the earth in March of 1996. From Long Beach, it was a naked eye fuzz ball. When I went in to do a late night baby delivery, I would drag nurses and other doctors out into the parking lot to see it. But when I went out to Anza to see it, I was astonished. In a dark sky, its tail stretched a good 60 degrees across the sky. At first I thought it was a jet contrail, until someone identified it for me.

Hale-Bopp was discovered before Hyakutake, in 1995, but at that time it was out past Jupiter. It took until April of 1997 for it to make its closest approach to the sun. It was naked eye visible for 18 months, the longest ever for a comet. It was so bright that it was easily visible from town, and had a double tail—one of ionized gas, and the other of dust.

I've seen many other naked eye comets, including Kohoutek in 1973, West in 1976, Bradfield in 1980, Levy in 1990, Linear, Neat, and Ikeya-Zhang in 2002, Machholtz in 2004, Lulin in 2009, and Holmes in 2007 (the one that exploded and grew larger each day until it was the size of the moon).

I even got to see Comet McNaught in daylight, shortly before sunset, in January 2007. A few days after that, it went behind the sun. When it emerged, it could only be seen in the Southern Hemisphere—where it went on to be the most spectacular comet of the century. My New Zealand friends (who I had met when we went down to view Halley) sent me spectacular pictures of its tail fanning across most of the sky. (They always get the best stuff!)

So, I am waiting for the next bright comet to come by, and hope I can get to a dark sky to get the best view of it in its entire splendor. Who knows—I might even make it to Halley's return in 2061.

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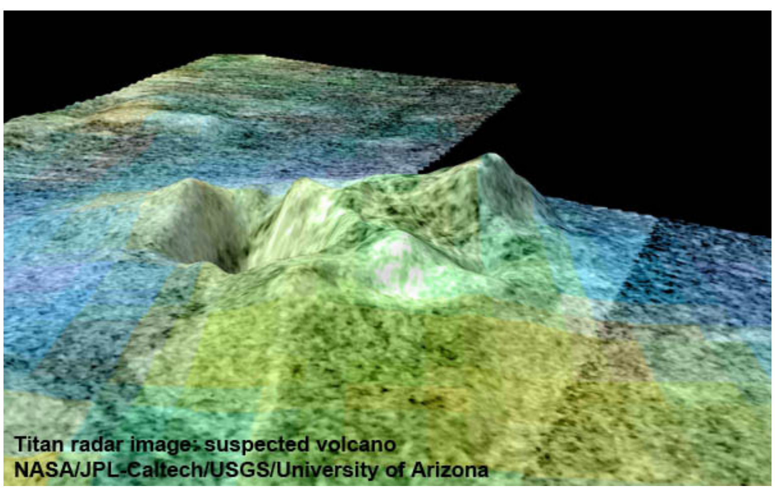
# AstroSpace Update

January 2011
Gathered by Don Lynn from NASA and other sources


**Deep Impact** (comet mission) – Further analysis of data from the November flyby of Comet Hartley 2 has shown that the jets visible at both ends (but surprisingly not the middle) of the comet's nucleus are spewing out water-ice particles with sizes ranging from that of a snowflake to a basketball. None of the other 4 comets seen close-up was throwing off ice particles. Spectrometer data shows that transparent water vapor is being emitted from all parts of the comet. Carbon dioxide (also transparent) is being emitted at the ends. Likely the escaping carbon dioxide is carrying the ice particles along. The storm of ice particles extended at least for several miles, farther than the area which was imaged. Eventually sunlight will turn the particles into vapor. There may have still been a trace of the particles at the distance of the flyby, 435 miles, as spacecraft instruments recorded 9 collisions with particles roughly the mass of snowflakes. No damage to the spacecraft occurred, even though the particles hit at 27,000 mph. The behavior of the mid section of the nucleus resembled that seen over the entire surface of Tempel 1, the previous comet visited by Deep Impact.

**Cassini** (Saturn orbiter) made the most detailed observations of the hot spots of the Saturnian moon Enceladus during a recent flyby. The hot spots were already known to surround the deep fractures, known as tiger stripes, from which geysers spew material into space. Temperatures as high as minus 120° F were recorded, 30° warmer than seen previously. It is not known whether the temperature was really warmer than before, or the increased resolution simply allowed picking out a small hot spot. One warm spot was seen that is isolated from the fractures. Other warm areas branch off like split ends from the main tiger stripes. These findings probably indicate places where fracture activity is getting started or is winding down. The flyby also went close to the moon Tethys, collecting images that help to fill in gaps in the global map of that moon.

Cassini has detected a very tenuous **atmosphere** (called an exosphere) containing oxygen and carbon dioxide surrounding the moon **Rhea**. The detection was made by flying through the exosphere and actually sampling the gas with Cassini instruments. The oxygen appears to arise when Saturn's magnetic field rotates over Rhea. Particles trapped in the magnetic field pepper the moon's water-ice surface, causing reactions that decompose the ice into oxygen. The source of the carbon dioxide is less certain. Oxygen at Rhea's surface is about 5 trillion times less dense that on Earth. But this is about 100 times denser than the exospheres on Mercury or our Moon. Scientists had suspected Rhea could have an exosphere with oxygen and carbon dioxide, based on observations of Jupiter's icy moons.




Cassini radar images of the surface of the Saturnian moon **Titan** has shown features that appear to be **ice volcanoes**. Some ice volcanoes, such as the tiger stripes on Enceladus, bear little resemblance to volcanoes on Earth. But the Titan ones do resemble Earth's. They have build ups forming volcanic peaks with craters atop, and finger-like flows on them. But they must be icy material, not melted rock, because of the low temperatures on Titan. Cassini's infrared spectrometer showed that the flows have a composition different from the surrounding surface. No evidence of current activity has been seen, but Cassini will continue to monitor the areas to look for changes. Current icy volcano activity would explain how Titan maintains the methane in its atmosphere in spite of methane being constantly broken down by sunlight. Methane would be a likely constituent of icy volcanic material.

The discordant measurements of **Saturn's rotation** speed have now been explained, but the true speed has still not been established. The rotation speed of the planet was determined by timing the radio signals made by the magnetic field. It is believed that the field turns with the core of the planet. All parts of the visible surface are clouds that drift about in relation to the core rotation. Unfortunately the radio method kept coming up with slightly different results. Such a massive body as Saturn could not be changing rotation speed that much. Similar measurements of Jupiter's rotation show no variation. A new analysis of Cassini data shows that enormous clouds of plasma (charged particles) periodically bloom within the planet's magnetic field and move around the planet like an unbalanced load in a clothes washer. This makes the magnetic field move around, affecting the rotation measurements. The force of the solar wind stretches the magnetic field out away from the Sun into what is called the magnetotail. Occasionally the magnetotail collapses, kicking off a process that causes the plasma clouds to bloom. The cause of the magnetotail collapse is not yet known, but it may be related to centrifugal forces on the plasma ejected by Saturn's moon Enceladus.

**Voyager 1** (outer planet mission) has reached a point at the edge of our solar system where the outward motion of solar wind has slowed to a stop. The slowing is caused by the wind coming up against interstellar material. It is 116 times the distance from the Sun that the Earth is. The wind stopping point was reached last June, but scientists kept monitoring the spacecraft instruments to assure that it was not just a local hole in the wind. Theory had predicted a sharp edge to the solar wind, but it actually just diminished steadily over a period of months of Voyager's travels. The spacecraft already crossed the termination shock some time ago, the point where solar wind slows below supersonic speeds. Voyager has not yet reached truly interstellar space, which is expected to occur in about 4 years. That will be indicated by a drop in the density of hot particles (from the solar wind) and an increase in the density of cold interstellar particles. Voyager 2 is traveling more slowly than Voyager 1, and so is expected to reach the stoppage of the solar wind in a few more years.

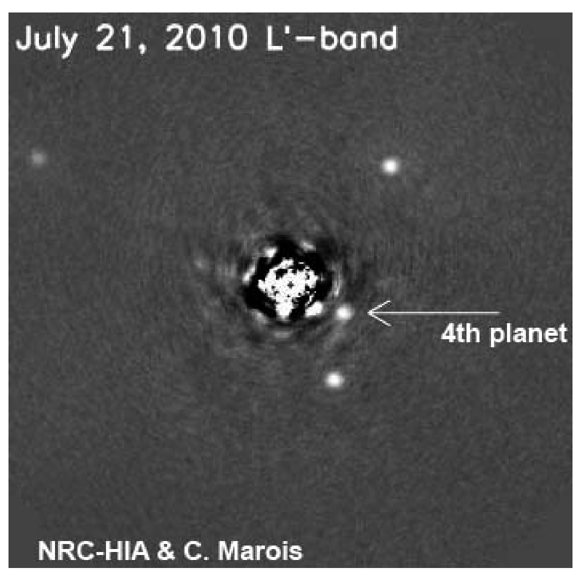
**Coronal mass ejections** (CMEs) – Scientists have learned that CMEs, eruptions from the Sun that blast billions of tons of charged particles into space at more than a million mph, are preceded by flares, coronal dimmings, or filament eruptions. These signs are used to predict CMEs, to allow warning before they hit Earth and do damage to satellites and power grids. A new study has found that about 1/3 of CMEs are not preceded by any of these signs. Astronomers will need to find other warning signs in order to more thoroughly predict CMEs.

**Solar eruption** – Last August 1, an entire hemisphere of the Sun erupted. Filaments of magnetism snapped and exploded, shock waves raced across the surface and billion-ton clouds of hot gas billowed into space. Before this, explosions on the Sun had been viewed as isolated events. But these explosions appear to have been all connected by magnetism. The lesson to be learned is that solar activity has to be studied as a whole.

**WASP 12b** (exoplanet), discovered in 2008, lies so close to its star that gas is being stripped from its atmosphere. A new study has found that it is rich in carbon. Unlike other recent studies of planetary atmospheres, this study did not use spectroscopy during transit, but instead examined the reflective properties of the planet at 4 wavelengths of light. Typical hot Jupiters have a ratio of carbon to oxygen of about 0.5, but WASP 12b has a ratio of over 1. This abundance is probably due to formation from accreting more rocky carbon-rich material, as opposed to accreting icy bodies like comets (richer in oxygen contained in the abundant water).

**WASP 17b** (exoplanet) has had its atmosphere examined spectroscopically, and sodium was found there. The amount of sodium measured is less than expected for such a planet, and so it is being classified as sodium depleted. At least one other exoplanet is also known to be sodium depleted. The astronomers involved theorized that the depletion was caused by sodium freezing out on the night side. The planet is known to be so close to its star that it should be tidally locked, that is, it keeps one side always toward its star. Thus the night side will never face the star and become warm enough to evaporate the sodium back into the atmosphere. The observations also implied that there are clouds in the upper layers of the atmosphere. The observations were made with the Very Large Telescope in Chile.

**Another exoplanet** – One of the very few exoplanets systems imaged (rather than detected indirectly) are the 3 planets orbiting the star HR 8799. Follow up observations with the Keck 2 Telescope picked up a 4th planet, closer to the star than the others. It orbits about 14 AU (an AU is the Earth's distance from the Sun) from its star, somewhat farther than Saturn orbits our Sun. The images were taken in infrared because young planets such as these are hot and so emit large amounts of infrared, making them easier to image than in visible light. There are 2 leading theories about how large planets form, and neither one can produce 4 large planets with the orbital sizes of these. The system also has several belts of dust, and these will be studied to see if they shed light on how such a system can form.




**Exoplanet atmosphere** – A few exoplanets that happen to pass in front of their stars as seen from Earth have allowed astronomers to measure the constituents of their atmospheres, using spectrographs. This was done recently for the first time on a super-Earth (designated GJ 1214b), that is, a planet larger than Earth, but smaller than a gas giant (like Jupiter or Saturn). All previous instances have been on hot Jupiters, that is, gas giant planets that orbit so close to their stars that they are hot. The previously known density of GJ 1214b (1.87 times that of water) rules out the possibility of it being a rocky planet with little atmosphere. What fits the density is a rocky planet with a very large atmosphere, which brings the average density down far below that of rocky material, or else an icy planet with a thinner atmosphere. There were no strong lines seen in the new spectrum. The only types of atmosphere that fit this observation are: 1) steam, or 2) thick clouds or haze. Other types

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would have shown strong spectral lines of the gasses present. Longer wavelength infrared observations would confirm or reject the steam possibility, so such observations are planned.

**Extragalactic exoplanet** – A planet has been discovered orbiting a star that formed in another galaxy, though the star and planet have since become part of our Milky Way when their parent dwarf galaxy was captured. The planet orbits the star HIP 13044 at a distance 8 times closer than the Earth orbits the Sun. It is 2200 light-years away in the constellation Fornax. The star had previously been identified as part of the Helmi Stream, which was billions of years ago captured by the Milky Way during a collision involving a dwarf galaxy. Since stars in other galaxies are too distant for current technology to detect planets, this is the only way to learn about planet formation in other galaxies. The star has already passed through the red giant phase, providing insight into how planets survive this event. The planet was detected with the radial velocity method. It has at least 1.3 times the mass of Jupiter and it orbits its star every 16.2 Earth days.

**Comet formation** – Computer simulation of stars forming in clusters shows that the comets forming around those stars often end up orbiting a different star than where they formed. The Sun is thought to have formed in a cluster of stars that has since dissipated. This implies that many of the comets we see in the solar system that came from the Oort Cloud actually formed about some other star. Simulations of the Oort Cloud forming just about the Sun fail to produce the numbers of comets that statistically match frequencies of comets falling into the solar system from the Cloud. But the new simulation can produce the numbers, but most of the comets then formed about other stars. This means that study of comets will often tell us about the conditions about other stars at the time of their forming, not necessarily about the Sun.

**Masquerading comet** – On December 12 it was announced that asteroid 596 Scheila has sprouted a tail. Apparently it is really a comet that had been posing as an asteroid. It orbits in the main asteroid belt. It will probably be renamed as a comet: given a P (Periodic comet) number and the name of the discoverer (in this case the discoverer of the tail). This has happened just a few times before, to other main belt asteroids, leading astronomers back in 2002 to propose a new class of objects: main belt comets. The few examples known do not appear to have formed in the same way as either Oort Cloud comets or Kuiper Belt comets.

**Lunar mini magnetosphere** – It has been known for some time that our Moon has a few locations with weak magnetic fields, though the body as a whole lacks a magnetic field. A new study shows that mini magnetospheres form over the magnetic locations. The study was based on observations of hydrogen atoms scattered from the Moon's surface by particles from the solar wind. For higher energy particles, the solar wind appears to be deflected somewhat around these magnetic locations, resulting in a mini magnetosphere. The area did not have a sharp boundary, so it probably does not have a bow shock like planetary magnetospheres. The phenomenon seems to disappear for lower energy particles. The authors of the new study suggest looking for similar features on Mercury and asteroids.

**Cepheid mass** – Astronomers have discovered the first double (binary) star in which one is a pulsating Cepheid variable and the stars orbit such that one passes in front of the other (transits) as seen from Earth. Transiting binaries allow calculating accurate masses of the stars. So this discovery allowed the most accurate (to 1%) measurement yet of the mass of a Cepheid. This had long been hoped for, since the theories of how Cepheids pulsate and of how stars evolve had produced mass estimates for Cepheids that differed by 20-30%. The newly measured mass agreed with pulsation theory and disagreed with stellar evolution theory. This implies that as stars evolve they lose 20-30% more mass at some point than was believed. Cepheids are unstable stars that are larger and much brighter than the Sun. They expand and contract in a regular way, taking somewhere between a few days to months to complete the cycle. The time taken by the cycle is longer for stars that are more luminous and shorter for the dimmer ones. This precise relationship makes Cepheids one of the most effective ways to measure the distances to nearby galaxies, and from there to map distances of the whole Universe. No eclipsing Cepheid binary stars are known in the Milky Way. This newly discovered one is in the Large Magellanic Cloud (LMC), a neighboring galaxy. This new observations will be used to refine the distance to the LMC and possibly the whole cosmic distance scale.

**T-dwarf mass** – Astronomers have discovered the first T-dwarf (the cooler class of brown dwarf) that is part of a binary star. This allowed calculation of the T-dwarf's mass. Its age is assumed to be the same as its companion, a white dwarf star. Brown dwarfs are stars that are not massive enough to sustain nuclear reactions that power ordinary stars.

**Zirconium star** – A team of scientists have discovered a star that is enveloped by clouds of zirconium. They were looking for clues to the lack of hydrogen on helium-rich hot subdwarf stars, and found the zirconium instead. The type of zirconium is one that forms only in temperatures in excess of 20,000 degrees. It has never been found on any star before. It appears that the star has cloud layers of various metals, including zirconium, at various heights. The star seems to be shrinking from a bright cool giant star to a faint hot subdwarf, and apparently these metal-cloud layers form during the process.

**Epsilon Eridani** – Many stars are known to have discs of warm dust around them. Over long timescales, the stellar wind should clear these out, so we know that such discs have been recently formed. Usually the cause is thought to be collisions in an asteroid belt or Kuiper belt (composed of icy asteroids). Epsilon Eridani has such a disc, and it has known planets that do not leave space for a stable asteroid belt. So the usual explanations do not apply. There is also a second disc, much farther out from the star, for which a Kuiper belt to generate the dust is possible. A new study of the system concluded that the inner disc must have formed much farther out, near the outer ring, but has migrated inward due to the Poynting-Robertson effect. That effect is where stellar winds drag on small particles, causing them to slowly spiral inward. Epsilon Eridani is known to have strong stellar wind, adding support to this new theory. Computer simulations showed this disc migration could occur, given the conditions known to exist about the star.

**Red dwarf numbers** – The estimates of how many stars exist in galaxies is based on the ratio of small dim stars (red dwarfs) to bright stars. This is necessary because the dim stars cannot be imaged at any great distance (with current technology), even in the remoter parts of our own galaxy, much less in other galaxies. The ratio has been measured only in the Sun's neighborhood of our Milky Way, and it has been assumed the ratio is the same elsewhere. A new study of the cores of 8 relatively nearby elliptical galaxies using the Keck Telescopes in Hawaii has measured the faint red glow of red dwarfs, though not individual stars. The study concluded that elliptical galaxies have higher ratios of red dwarfs to bright stars, resulting in total numbers of stars in elliptical galaxies that are 5-10 times as large as previously thought. The red dwarf ratio measured in the Milky Way is still assumed to hold for spiral galaxies. The new measurement of the elliptical galaxies means that the Universe probably has 3 times the number of stars previously estimated.

**Underluminous supernovas** are rare explosions that are 10-100 times less bright than a normal Type Ia supernova and eject only about 20% as much matter. A team studying extremely low mass white dwarf stars has found that the rate at which white dwarf binary stars merge is about the same as the rate of underluminous supernovas. They say that this suggests that underluminous supernovas occur when white dwarf binary stars merge.

**Cosmic filaments** – Astronomers have discovered an unusual galaxy that gives us new information regarding the filaments of denser matter that connect the clusters of galaxies. The galaxy lies within the filament connecting the galaxy clusters Abell 1763 and Abell 1770. It possesses twin jets of material spewing in opposite directions from a supermassive black hole at its center. The jets, as is common, end in giant lobes of material that emit a large amount of radio waves. But what is unusual is that the lobes are bent back away from the galaxy's motion through the filament. This is caused by material in the filament dragging the lobes back. Measuring the bend in the lobes allows calculation of the pressure being exerted on the lobes and the density of material in the filament. The density was found to be about 100 times the average density of the Universe. Filament density has previously been calculated from X-ray data, and the new measurement agrees nicely with that.

**Chemistry of life** – Researchers have discovered the first known microorganism on Earth able to thrive and reproduce using the chemical arsenic, which is toxic to most life. The microorganism was found in Mono Lake, California. It uses arsenic in some places that other life uses phosphorus. All previously known life uses carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur. This result means that other chemistry than those 6 elements must be looked for in the search for extraterrestrial life. Other scientists have criticized the techniques of this experiment and are demanding further proof of arsenic inclusion before these findings are accepted. Extraordinary claims require extraordinary proof.

**Oscillating Universe** – Roger Penrose, one of the great cosmologists, has published a paper claiming that circular patterns seen in the Cosmic Microwave Background could be explained if the Universe oscillates, rather than starting with the Big Bang, and that black hole collisions before that last expansion began would have caused the patterns. This pattern could not survive inflation (rapid expansion immediately following the Big Bang), so this theory would refute inflation. This is all very speculative, and is not being accepted by most cosmologists.

**Dragon** (privately developed space capsule) was tested for the first time in early December during a completely successful flight into space, 2 orbits, a reentry into the atmosphere, and an ocean landing. Dragon has a number of redundancies (thrusters, parachutes, thermal protection, etc.) in order to tolerate failures, but no failures occurred on this flight. Landing occurred only about ½ mile from the planned point. Launch was aboard the 2nd successful flight of the Falcon 9 rocket, also built by the SpaceX company. Dragon was designed to accommodate people, but until it is person-rated, it will be used to take cargo into space and back to Earth. The next test flight may take supplies to the International Space Station. Dragon and Falcon 9 are planned to eventually be reusable, though in this flight they were not.

**X-37B** – After 225 days in space, the U.S. Air Force's X-37B space plane reentered the atmosphere and landed completely automatically at Vandenberg Air Force Base in California. The runway used was built for Space Shuttles to use, but no shuttle has ever used it. The precise purposes of the X-37B have not been revealed, but obviously it can return items from space, and it was observed to change its orbit. It was launched last April by an Atlas 5 rocket. Another X-37B has been built, and is planned to launch during 2011.


X-37B after landing
30th Wing, Vandenberg Air Force Base

**Hayabusa** (asteroid sample return mission) – The Japanese space agency (JAXA) has confirmed that the dust found in the 1st of the 2 sample return containers from the Hayabusa spacecraft included particles from the asteroid visited, Itokawa. The sample mechanism failed to fire, but some dust apparently splashed into the container anyway. About 1500 particles were found, most of them rocky pieces of the asteroid. Most of the particles are extremely small, about 10 microns (1/2500 inch), which will make analyzing them difficult, but not impossible.

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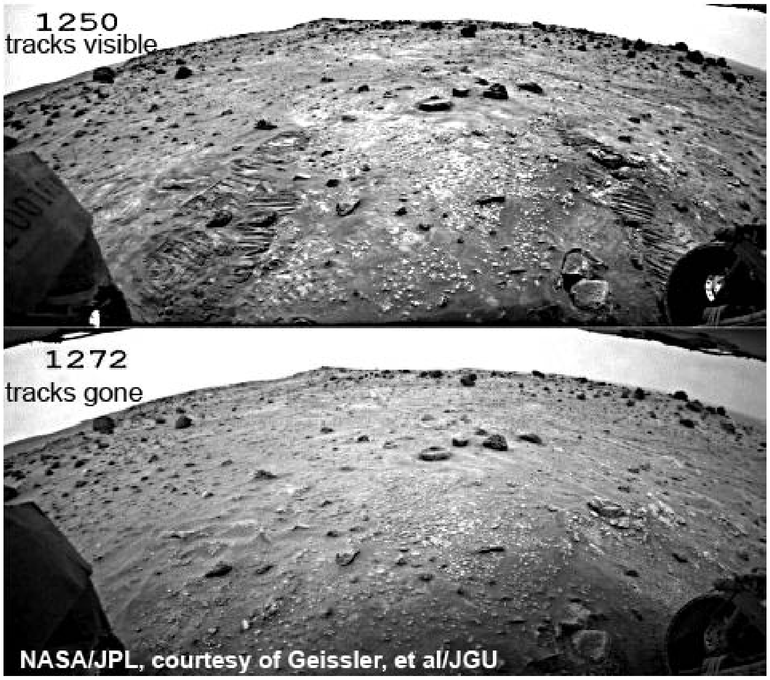
**Akatsuki** (Japanese Venus mission) failed to enter orbit about Venus in early December. Apparently the fuel tank pressurization system failed during the rocket burn to accomplish entering orbit, and the rocket shut off early. The spacecraft went into safe mode. It is possible that the rocket nozzle was damaged during the incident. The spacecraft will continue orbiting the Sun, and will first pass near Venus again in 6 years. There is sufficient fuel remaining that another attempt could be made to orbit then, if the rocket engine can be made to work.

**NanoSail-D** (solar sail) appears to have failed to unfurl its sail. It was on a timer to unfurl 3 days after it was released from FASTSAT, on which it was piggybacked. But no communications from NanoSail have been received since the release. NanoSail was contained in a package about the size of a loaf of bread. It was to test solar sailing (maneuvering by means of sunlight pressure on the sail), and eventually (2-4 months) to plunge into Earth's atmosphere. This was supposed to develop into a method to take expended satellites out of orbit, in order to reduce the space junk hazard glut.

**Mars Odyssey** (orbiter) in mid December broke the record (of 9.14 years, set by Mars Global Surveyor) for the longest operating spacecraft at Mars. Odyssey completed all its prime mission objectives by 2004, and has since generated a high-resolution map of most of Mars, monitored Martian weather, and continued to relay to Earth most of the data from the Mars rovers. Odyssey detected the water ice just below the surface that Mars Phoenix then found when it landed and dug into the surface.

**Mars rovers** – Continued observation of the Mars rovers by orbiting spacecraft shows that over time the tracks left in the soil by the rovers are being obliterated. This was expected, but the speed with which it occurred surprised scientists. A single storm can completely eliminate the tracks. Some images taken by the rovers themselves have shown their tracks disappearing.



NASA/JPL, courtesy of Geissler, et al/JGU

**Instant AstroSpace Updates**

A team of astronomers has detected synchrotron radiation in the **jets** and measured the strength and direction of the **magnetic field** of a protostar for the first time. Synchrotron radiation and magnetic field measurements are commonly made for jets in supermassive black holes, but not for the jets on individual stars until now.

**SOFIA**, a 100-inch infrared telescope mounted in a jet plane to fly above most of our atmosphere, completed its first science flight, ending the test phase.

Scientists at Jet Propulsion Laboratory have tested the lasers proposed for use in the LISA fleet of 3 spacecraft, planned to detect **gravity waves**. The test showed that random fluctuations (noise) in the lasers could be removed to allow detection of signals as faint as those expected from gravity waves.

The Westerbork radiotelescope in the Netherlands has demonstrated a new wide-field radio camera, named **Apertif**, which allows 30 times the area of the sky to be observed. The demo observed 2 pulsars simultaneously, a first.

Russia has announced that it is designing a spacecraft that would sweep up satellite debris in space and bring it down into the ocean, reducing the **space junk** hazard. Launch would be about 2023.

**Cassini** (Saturn mission) resumed full operation November 24 after recovering from the safe mode caused by a computer glitch, reported here last month. ■

## FIRST ANNUAL VOICE OF THE CUSTOMER SURVEY

**In an effort to keep the newsletter fresh and relevant to the membership, I'm soliciting feedback from the membership as to what you would like to see in the newsletter. Please feel free to contact me by phone or e-mail (my contact information is on the back) and let me know what you think! How can the Sirius Astronomer be more useful to you as a member, an educator, or an observer? This is your newsletter, so let me know what you'd like to see! Please have your feedback to me by February 20, 2011 and I will attempt to address your suggestions in the March issue. Include the tag [VOC-SA] in your e-mail subject line to avoid the spam filter. All constructive comments will be considered. I look forward to hearing from you! -- Steve Condrey, Editor**

(continued from page 2)

to avoid a fall in the darkness. Test the stepstool with your full weight with someone standing in the safety position to catch you before trusting it to anyone else.

**Disaster: Mirror Missile.** Avoid this disaster by loading your Newtonian / Dobsonian telescope correctly into the back of your SUV. Think of what might happen during an emergency stop or front crash. If the tube is loaded so that the primary mirror and mirror cell are forward and the secondary mirror closest to the rear of the vehicle, an emergency stop will just press the primary mirror more securely into the mirror cell. However, if the secondary mirror is forward and the primary mirror is closest to the back of the vehicle, such a stop will likely rip the mirror from the three small protrusions that keep it centered on the mirror cell, sending it crashing forward, through the secondary mirror and likely into the back of the head of a person sitting in the front seat. Having your life saved in a crash by an airbag only to have your telescope's mirror kill you in a shower of glass shards milliseconds later is a serious disaster easily avoided.

OK… Take a deep breath… there is only a miniscule chance that any of these disasters will happen to you, and they are even less likely to happen if you take a few simple precautions involving just a bit of forethought and cost. Stay warm and keep safe out there.

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I'd like to draw your attention to the Astronomy Outreach Foundation which is trying to combat the "Graying" of our hobby by attracting Generations X and Y into the fun of amateur astronomy. This is a non-profit foundation started by a combination of amateur astronomical industry leaders "to stimulate greater public interest in astronomy and to assist everyone in becoming more engaged in activities that allow them to learn more about the universe." For more information, please visit http://www.astronomyoutreachfoundation.org

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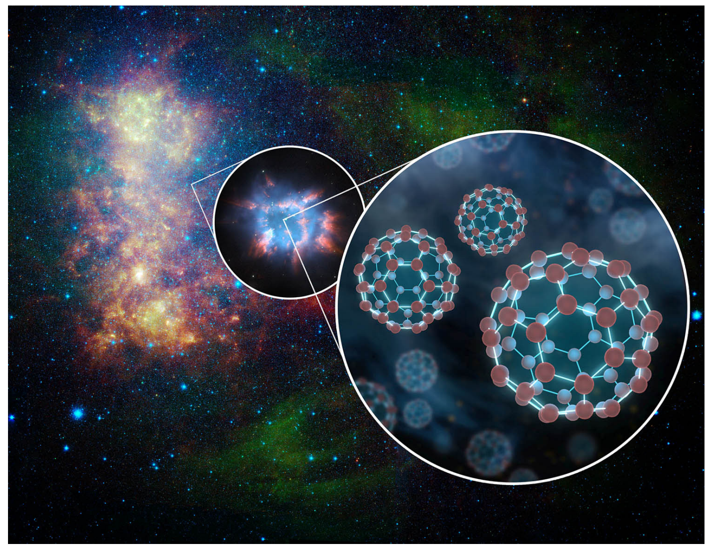
*Note from the author: I have no vested interest in the Astronomy Outreach Foundation or in Astrocrumb Filter Slides. But I have found that both are worthwhile entities. – Tom Koonce* ■

The Orion Nebula, M42, is one of the most popular and most easily-observed winter objects, visible throughout the night in December and January. Even binoculars and relatively small telescopes can display a wealth of detail in this nebula, roughly 1300 light-years from Earth. It is also one of the earliest-recognized stellar nurseries, with dozens of brown dwarfs, protoplanetary disks, and Evaporating Gas Globules (EGGs) related to star formation having been discovered by the Hubble Space Telescope since the mid-1990's. Bill Patterson captured this image using a Takahashi FSQ106 telescope with ST10XME (luminance) and ST8E (color) imagers from our Anza site. The two images were combined in Registrar to create this image.

# Astronomers Stumble onto Huge Space Molecules

By Trudy E. Bell and Tony Phillips

Deep in interstellar space, in a the swirling gaseous envelope of a planetary nebula, hosts of carbon atoms have joined together to form large three-dimensional molecules of a special type previously seen only on Earth. Astronomers discovered them almost accidentally using NASA's Spitzer Space Telescope. "They are the largest molecules known in space," declared Jan Cami of the University of Western Ontario, lead author of a paper with three colleagues published in *Science* online on July 22, 2010, and in print on September 3.



*Superimposed on a Spitzer infrared photo of the Small Magellanic Cloud is an artist's illustration depicting a magnified view of a planetary nebula and an even further magnified view of buckyballs, which consist of 60 carbon atoms arranged like soccer balls.*

Not only are the molecules big: they are of a special class of carbon molecules known as "fullerenes" because their structure resembles the geodesic domes popularized by architect Buckminster Fuller. Spitzer found evidence of two types of fullerenes. The smaller type, nicknamed the "buckyball," is chemical formula $C_{60}$, made of 60 carbon atoms joined in a series of hexagons and pentagons to form a spherical closed cage exactly like a black-and-white soccer ball. Spitzer also found a larger fullerene, chemical formula $C_{70}$, consisting of 70 carbon atoms in an elongated closed cage more resembling an oval rugby ball.

Neither type of fullerene is rigid; instead, their carbon atoms vibrate in and out, rather like the surface of a large soap bubble changes shape as it floats through the air. "Those vibrations correspond to wavelengths of infrared light emitted or absorbed—and that infrared emission is what Spitzer recorded," Cami explained.

Although fullerenes have been sought in space for the last 25 years, ever since they were first identified in the laboratory, the astronomers practically stumbled into the discovery. Co-author Jeronimo Bernard-Salas of Cornell University, an expert in gas and dust in planetary nebulae, was doing routine research with Spitzer's infrared observations of planetary nebulae with its spectroscopy instrument. When he studied the spectrum (infrared signature) of a dim planetary nebula called Tc 1 in the southern-hemisphere constellation of Ara, he noticed several clear peaks he had not seen before in the spectra of other planetary nebulae. "When he came to me," recounted Cami, an astrophysicist who specializes in molecular chemistry, "I immediately and intuitively knew it I was looking at buckyballs in space. I've never been that excited!" The authors confirmed his hunch by carefully comparing the Tc 1 spectrum to laboratory experiments described in the literature.

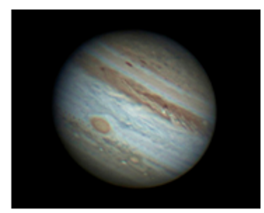
"This discovery shows that it is possible—even easy—for complex carbonaceous molecules to form spontaneously in space," Cami said. "Now that we know fullerenes are out there, we can figure out their roles in the physics and chemistry of deep space. Who knows what other complex chemical compounds exist—maybe even some relevant to the formation of life in the universe!" Stay tuned!

Learn more about this discovery at http://www.spitzer.caltech.edu. For kids, there are lots of beautiful Spitzer images to match up in the Spitzer Concentration game at http://spaceplace.nasa.gov/en/kids/spitzer/concentration.

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

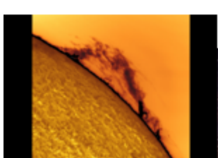
Leon Aslan took this image of star trails over the Racetrack Playa in Death Valley on December 28, 2010 using a 15mm fisheye lens with his EOS 5D MKII imager.

# 2011 OCA Astroimage SIG Desktop Calendar - Now Available!




With Images by Ray Stann, Jeff Malmrose, John Castillo, Craig Bobchin, Bruce Waddington, Pat Stoker, Don Lynn, Pat Knoll, Sam Saeed, Jim Windlinger, Dave Kodama, Alan Smallbone, Wally Pacholka, Doug Acrea, and Bill Warden!

## 14 **months** of images by OCA members to enjoy!



# ONLY $10!!!

See Charlie Oostdyk at the general meetings, or contact Barbara Toy or Alan Smallbone for information about ordering and picking up at other OCA meetings! Great Gift Idea!

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