SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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REMINDER: SEPTEMBER MEETING ON 9/17!!!!!

Rob Roberson captured this image of the Bubble Nebula (NGC 7635) from the Anza site on August 7-8, 2010. The image consists of 150 minutes total expsosure using a Meade LX90 8-inch SCT with an SBIG ST-6800C imager.

OCA CLUB MEETING

The free and open club meeting will be held September 17th (note new date) at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Dennis Mammana will present 'One People, One Sky'.

NEXT MEETING: October 8th

STAR PARTIES

The Black Star Canyon site will be open on September 4th. The Anza site will be open on September 11th. 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, September 3rd at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.
GOTO SIG: TBA
Astro-Imagers SIG: Sep. 21st, Oct. 19th
Remote Telescopes: Sep. 27th, Oct. 25th
Astrophysics SIG: Sep. 17th, Oct. 15th
Dark Sky Group: TBA

September 2010 President's message

By Craig Bobchin

Greetings all; well September is here and that means back to school. Along with that are a bunch of annual traditions, Buying school supplies, buying new clothes, End of summer BBQs, Hot temperatures (since we seem to get the hottest temps in mid August thru September). And of course the influx of students to the Chapman University campus. Some of whom will wind up attending our general meetings throughout the school year. Another time honored tradition what I like to call the September shuffle. This is when we traditionally swap weeks for our general meeting. So instead of occurring on the 2nd Friday of the month as is usual this month we take over the 3rd Friday. So if you go to the meeting on September 10th, you will be very surprised to be included in a Chapman University event rather than the OCA general meeting. So remember to mark your calendar and come to the OCA general meeting on the third Friday September 17th.

If you are looking for something to do on the 2nd Friday then you can check out the monthly Astrophysics meeting which has taken over the general meeting's slot for the month. So on September 10th, instead of going to Chapman University, head down to the Centennial Heritage Museum and join the regulars as they learn about the details of cosmology and the universe.

Another annual fall tradition is the Pacific Astronomy and Telescope Show, or as it is known, PATS. PATS is the West coast what NEAF is the East coast. It is a gathering place for vendors, manufacturers, Amateur Astronomers, astronomy stores and of course clubs to come together and check out the latest wares and hear some wonderful speakers. There are also the various raffles where you can win some cool prizes. Like NEAF this takes place during the day and there is no observing, save for some solar scopes outside the venue.

This year PATS is being held on September 18-19 (Sat. and Sun. after the general meeting). Tickets are $20.00 a day, through Ticketmaster or at the door. The club has a few discount tickets left ($10.00 per ticket). If you would like to get a discount ticket contact our secretary Bob Buchheim before the Sept. Meeting.

Some of the other highlights of PATS include:

1 Presentations related to observing, imaging, and astronomy by leading figures in the field.
2 Unlike RTMC, PATS is held in a pleasant, comfortable indoor venue, clean and dust-free.
3 Special tour of Mount Wilson. If you haven't been there before then you really should go. It is an enjoyable experience.

Southern California's fire season is in full swing and as I write this there are very high temperatures, and a number of wildfires burning already throughout the Southern California region. If you have not already done so, please help protect Anza by trimming weeds and other flora around your pads and observatories. If you see an area other than yours that needs trimming be a good neighbor and take care of it.

Until next month, here's wishing you clear dark skies. ■

M8 and M20 are seen in this image created by Jeff Malmrose on 8/24/10. Jeff used an AstroTec 66mm telescope with a Canon XT imager.

NASA's Space Place

The Turbulent Tale of a Tiny Galaxy

by Trudy Bell and Dr. Tony Phillips

Next time you hike in the woods, pause at a babbling stream. Watch carefully how the water flows around rocks. After piling up in curved waves on the upstream side, like the bow wave in front of a motorboat, the water speeds around the rock, spilling into a riotous, turbulent wake downstream. Lightweight leaves or grass blades can get trapped in the wake, swirling round and round in little eddy currents that collect debris.

Astronomers have found something similar happening in the turbulent wake of a tiny galaxy that is plunging into a cluster of 1,500 galaxies in the constellation Virgo. In this case, however, instead of collecting grass and leaves, eddy currents in the little galaxy's tail seem to be gathering gaseous material to make new stars. "It's a fascinating case of turbulence [rather than gravity] trapping the gas, allowing it to become dense enough to form stars," says Janice A. Hester of the California Institute of Technology in Pasadena.

In the ultraviolet image on the left, from the Galaxy Evolution Explorer, galaxy IC 3418 leaves a turbulent star forming region in its wake. In the visible light image on the right (from the Sloan Digital Sky Survey), the wake with its new stars is not apparent.

The tell-tale galaxy, designated IC 3418, is only a hundredth the size of the Milky Way and hardly stands out in visible light images of the busy Virgo Cluster. Astronomers realized it was interesting, however, when they looked at it using NASA's Galaxy Evolution Explorer satellite. "Ultraviolet images from the Galaxy Evolution Explorer revealed a long tail filled with clusters of massive, young stars," explains Hester.

Galaxies with spectacular tails have been seen before. Usually they are behemoths—large spiral galaxies colliding with one another in the crowded environment of a busy cluster. Tidal forces during the collision pull gas and stars of all ages out of these massive galaxies to form long tails. But in IC 3418, the tail has just young stars. No old stars. "The lack of older stars was one tip-off that IC 3418's tail isn't tidal," says Hester. "Something else must be responsible for these stars"

Hester and eight coauthors published their findings in the June 10, 2010, issue of *The Astrophysical Journal Letters.* The team described the following scenario: IC 3418 is speeding toward the center of the Virgo cluster at 1,000 kilometers per second. The space between cluster galaxies is not empty; it is filled with a gaseous atmosphere of diffuse, hot hydrogen. Thus, like a bicyclist coasting downhill feels wind even on a calm day, IC 3418 experiences "a stiff wind" that sweeps interstellar gas right out of the little galaxy, said Hester—gas that trails far behind its galaxy in a choppy, twisting wake akin to the wake downstream of the rock in the babbling brook. Eddy currents swirling in the turbulent wake trap the gas, allowing it to become dense enough to form stars. "Astronomers have long debated the importance of gravity vs. turbulence in star formation," Hester noted. "In IC 3418's tail, it's ALL turbulence." To many astronomers, that's a surprising tale indeed.

See other surprising UV images from the Galaxy Evolution Explorer at http://www.galex.caltech.edu. Kids (and grownups) can play the challenging new Photon Pileup game at http://spaceplace.nasa.gov/en/kids/galex/photon/ .

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

TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE

#13 Any Object Through a Large Telescope

By Helen Mahoney

Once you are hooked on astronomy, it's easy to get aperture fever. You start with binoculars and small telescopes (like my first Tasco scope), and it's not long before you want to see more. While you can see the Moon, planets, and Messier objects with binoculars or small telescopes, when you put a larger scope on them, the detail comes out and they are quite beautiful. And, of course, the bigger the better.

Pat Knoll created this image of M87 with its characteristic jet of material using the 22-inch Kuhn telescope at OCA's Anza site on 5/19/09

It is not just a matter of magnification, because the faint objects will fade out when magnified if the aperture (the diameter of the opening through which light passes) of the telescope is not large enough. By "large," I believe that it takes an aperture of eight inches or more to have the light gathering capacity to see the detail in the faint fuzzies.

In 2010, it is easier to have this experience, because the mass production of larger telescopes by Meade, Celestron, Odyssey, and others has made them more available to amateur astronomers. Back in the 70's, if you wanted a big telescope, you had to build it yourself.

Growing up, I had a handful of friends who were mildly interested in astronomy, but none as avid as I. When I started college at UCLA, I met friends in my dorm who were astronomy majors. I had no idea there was a *major* in astronomy! They actually had a body of knowledge in my personal passion of astronomy big enough for a degree? It's as though they told me you could major in ice cream sundaes.

I joined the newly formed UCLA Astronomical Society (UCLAAS, pronounced "useless"), and met a wonderful group of people (including OCA member Bill Hall), many of whom are still my observing pals. They invited me to a "star party". I had never heard the term before, let alone gone on a star party, and it sounded like an exciting thing to do. I had no idea.

When we arrived at the chosen dark site, they began to pull things out of their cars and vans and set up the biggest telescopes I had ever seen. I was treated that night to views of star clusters, galaxies, and nebulae that I thought could only be viewed in encyclopedia photos of the Palomar Sky Survey.

Over the years, I have seen hundreds of objects through dozens of telescopes. Among my favorite large telescope deep-sky objects are the Veil Nebula, the Horsehead Nebula, the Whirlpool Galaxy (M-51), and smaller and fainter, but also gorgeous, Stephan's Quintet and the Deer Lick Group of galaxies. I mentioned in an earlier article that we saw Saturn through the 60 inch Mount Wilson scope, and the detail in the rings and bands on the planet were incredible.

Looking through a large telescope affords you experiences you can't otherwise encounter. When I was at CSULB, I worked on a paleontology project. One day I was helping to analyze the leg bone of a small dinosaur that was over 200 million years old. At a star party the next day, I asked Bill if he could put his 16 inch telescope on an object 200 million light years away. He found a suitable galaxy for me. As I stared at the small spiral structure, I imagined that the light from that galaxy had been traveling since that little dinosaur walked on the earth. And the final destination of those photons was my retina.

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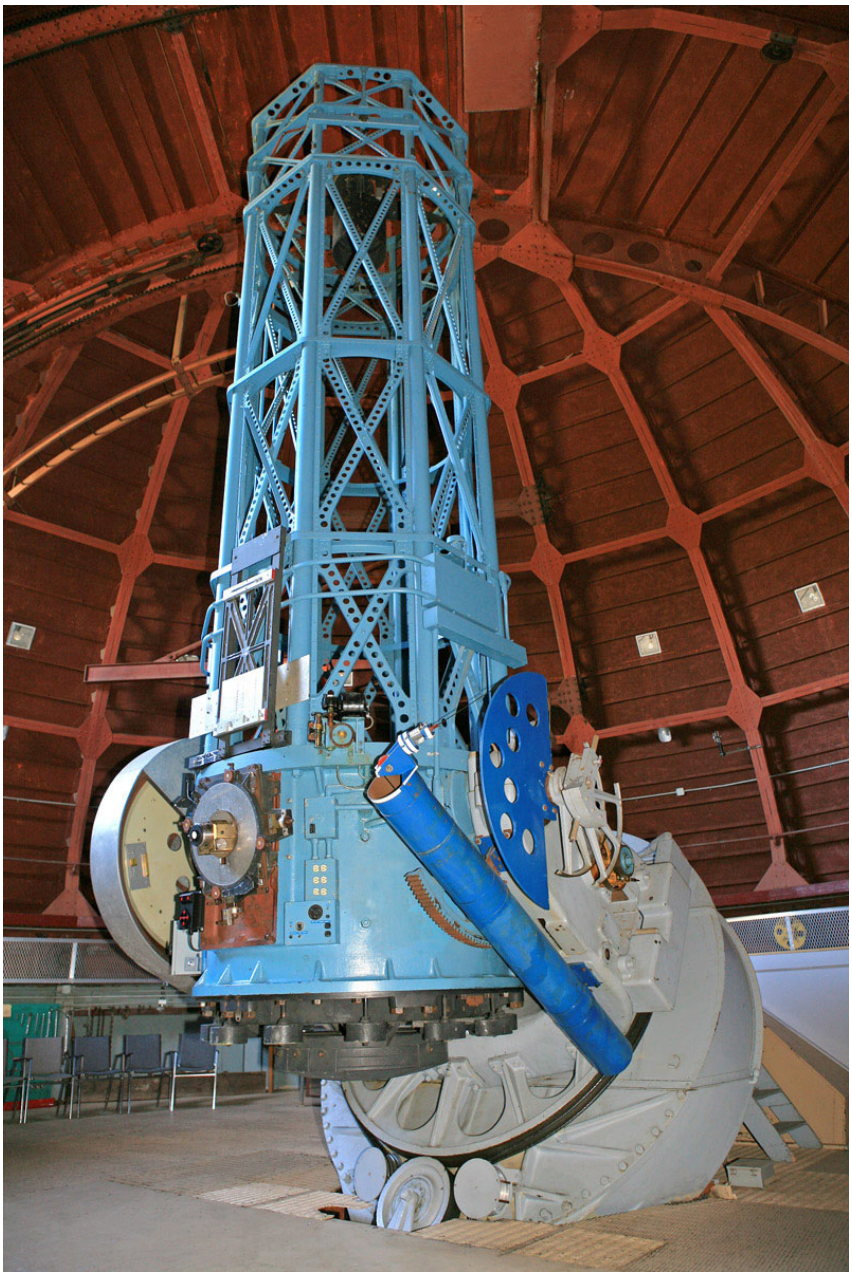
PATS Weekend Shaping Up
September 18-19



Spend the afternoon touring Mt. Wilson, personally hosted by Dave Jurasevich, and then explore the heavens on the historic 60 inch, the largest telescope in the world when it was first built. This is one of the special events at PATS, September 18-19 in Pasadena.

The organizers of the Pacific Astronomy and Telescope Show have announced the tentative schedule for the big weekend. In its third year, this has proven to be one of the largest gatherings of amateur astronomers, vendors, and presenters on the West Coast. An all day ticket goes for $15 for club members at the meeting, ($21 at the door!). This gets you in to the large exhibit hall where more than four dozen vendors and exhibitors will be showing off their latest equipment, software, and other products. It also gets you in to see presentations from some of the most respected names in astronomy.

Cosmologist Alex Filippenko highlights Saturday, and extra-solar planet finder Geoff Marcy will close out Sunday. Also on Saturday will be Sky and Tel Editor Bob Naeye, German AstroImager Wolfgang Promper, and Solar imager Gary Palmer.

Marcy is preceded on Sunday by JPL mission scientist Dave Doody, Mt. Wilson Superintendent Dave Jurasevich, and IDA's David Crawford. Both days will have door prizes and plenty of time to interact with the vendors and friends. On Friday and Saturday special events (see box next page) allow amateurs to learn more about their astroimaging, to become serious contributors to science, and to tour and observe through the historic telescopes on Mt. Wilson. In addition to the formal activities during the day, both Friday and Saturday nights will feature an urban star party outreach at the beautiful Paseo Colorado. Bring your scope and/or your enthusiasm as you show off the moon, planets, and stars (alongside some of the same people who made your telescope!). The Pasadena Convention Center is a beautiful facility, with plenty of room, a snack bar, and an ideal location, in central Old-Town Pasadena. For details on the Show, see telescopeshow.com

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AstroSpace Update

September 2010
Gathered by Don Lynn from NASA and other sources

[* File contains invalid data | In-line.JPG *]**Opportunity** (Mars rover) captured an image of a dust devil, the first for this rover. Spirit and various orbiting spacecraft have seen plenty of dust devils, but the conditions in the Meridiani area, where Opportunity is, do not seem to produce them often. Controllers gave up 3 years ago taking images from this rover to catch dust devils, but will now resume them. The day before taking the image, wind cleaned off Opportunity's solar panels, boosting the power level. The cleaning event may possibly be related to the dust devil.[* File contains invalid data | In-line.JPG *]

Spirit (Mars rover) has not yet wakened up from its winter hibernation, forced by insufficient power from its solar panels. Controllers are listening at every opportunity for the signal the rover is to transmit after a normal wakeup, and are also sending commands to respond in case its clock has stopped during hibernation, which would prevent a normal wakeup. Simulations showed that best case wakeup was late July, but most likely wakeup is around October. Spirit dropped into hibernation mode March 22. Peak energy generated by the solar panels will occur next March. So unless permanent damage occurred during winter, we should hear from Spirit before then.

Curiosity (the next Mars rover) has a landing camera that will take high-definition slow-frame video during the final 2 minutes of landing. This will be the first sky-crane landing, in which a rocket hovers and lowers the rover to the surface on a cable. Curiosity is too heavy for an air-bag landing, like the previous 3 rovers have used. The video will be stored for later transmission to Earth, so we won't get to see the entire video until weeks after the landing, which is scheduled for spring 2012. The video will be used to establish the exact landing spot, to measure wind speeds during landing, to locate interesting rocks for the rover to visit, and to assess the landing operation: heat shield, parachute and sky crane. The camera may be used again after the landing to image what is under the rover.

Neptune – Data taken by the Herschel infrared space telescope found an unusual distribution of carbon monoxide in the atmosphere of Neptune. The concentration of the carbon monoxide was greater in the stratosphere layer of the atmosphere than lower layers. Astronomers in the study concluded that this is the result of a collision of a comet with the planet about 200 years ago. Theories that increased the carbon monoxide concentration from any source within Neptune did not agree with the data. The distribution of the carbon monoxide agreed with calculations for about 200 years of diffusion since its introduction from the collision. The Herschel data also found more methane in the stratosphere than expected, but this can be explained by methane sources within the planet.

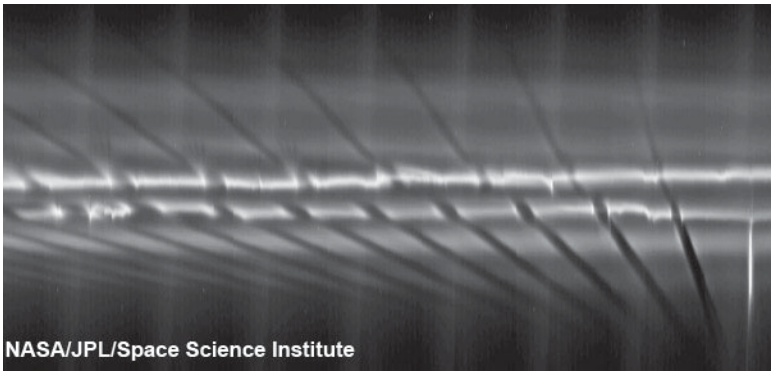
Neptune Trojan – The first Trojan asteroid in Neptune's L5 region has been discovered using the 8-meter Subaru Telescope in Hawaii. It is named 2008 LC18 until the discoverers think of something better. It is estimated from its brightness that it is about 60 miles across. There are already 6 known in that planet's L4 region. L4 and L5 are regions of a planet's orbit found at a 60° angle ahead and behind the planet respectively, where small bodies can orbit stably. The "L" stands for Lagrange, who first calculated where stable orbit points lie. It has been difficult to find asteroids in Neptune's L5 because it has for years been in front of the Milky Way, so stars drown out the weak light of the asteroids. The new search was made by looking at the dark nebulas in that area of the Milky Way, where an asteroid would stand out more easily. Jupiter has over 4000 known Trojan asteroids in its L4 and L5 regions, and Mars has 4. No other planets are known to have Trojans, though 2 of Saturn's moons have Trojan moons. They are called Trojans because the early discoveries in Jupiter's orbit were named after the heroes of the Trojan War (Achilles, Hektor, Odysseus, etc). All but one of those at L4 are named for those who fought on the Greek side, while L5 fought for Troy. It is believed that the Neptune Trojans are about as numerous as the Jupiter Trojans, but are more difficult to discover because they are farther from us and dimmer in the weaker sunlight there, not to mention the Milky Way issue. For those readers who are UCLA fans, and may be offended by discussing Trojans, I need to point out that a technical paper on asteroids, written by UCLA astronomers, has proposed that asteroids to be found at Saturn's L4 and L5 regions should be called Bruin asteroids (I am not making this up). I don't know whether this will catch on if and when such are discovered.

Mercury – New results have been announced from observations made by the Messenger spacecraft during its latest flyby of Mercury in September of last year. The distribution of chemical elements sodium, calcium and magnesium in the planet's exosphere (extremely thin atmosphere) varied around the planet. Detailed altitude profiles of elements over the north and south poles were measured for the first time. Calcium was found concentrated over a relatively small region, with most emission occurring close to the equator. A basin named Rachmaninoff was found to have a floor that flooded with lava after the impact formation of the basin. The count of small craters within showed that it was geologically the youngest volcanic deposit yet seen on Mercury. Substorms were observed in the planet's magnetic tail, similar to those seen in Earth's tail, but quicker (2-3 minutes) and about 10 times more powerful.

Titan dunes – Sand dunes are plentiful in the equatorial regions of Saturn's moon Titan, some stretching hundreds of miles and standing 300 feet high. The curves of dunes (there or on Earth) indicate the direction that the winds blow. Unfortunately, all measurements and simulations of the winds on Titan showed that the wind nearly always blows in the wrong direction (east to west) for the curve of the dunes (indicating west to east). The mystery has been solved. A computer simulation of Titan atmosphere found that the winds blow gently east to west all Titan year, except for a brief period at equinoxes, when the winds blow strongly west to east. Only the strong winds are able to move the sand and shape the dunes. A similar brief reversal of the winds here on

Earth is known to occur with overhead (equinox) Sun in the Indian Ocean. Although the equinox winds are strong in Titan terms, they reach only about 4 mph.

Titan mountains – Titan ripples with mountains, and scientists have been trying to figure out the process by which they formed. A new simulation of conditions on Titan shows that the surface is wrinkling because the interior of the moon is shrinking. The shrinkage is caused by continued cooling from the heat generated when it formed through accretion of material and the heat of radioactive decay of material out of which it formed. The computer model matched Titan's behavior only when it included a core that only partially separated (rock and ice), surrounded by dense water ice, and then an ocean of water and ammonia, covered by a water-ice shell. Titan is the only icy body in the solar system known to be shrinking and wrinkling. This probably means that the interior of other icy moons, such as those at Jupiter, differ in their structure from Titan. However there are mountains on Earth formed by similar shrinkage and wrinkling.



Saturn's F-ring has intriguing dark blades and bright streamers because ring material is disturbed by the gravity of the moon Prometheus, whose orbit is just smaller than the ring, but a little eccentric. This causes the moon to approach, and then recede from the ring on every orbit. Each approach is a little farther around the ring, relative to ring particles, since the moon's orbit is slightly faster than the ring particles' orbits. The moon gains a full lap on the ring particles every 68 days. Prometheus is potato shaped and is 92 miles across in the long direction. Cassini has taken a series of images of the F-ring, which were then merged into one long image, showing the ring as a straight line with the blades and streamers. It was found that Prometheus's disturbances tend to clump up ring material and can form temporary moonlets within the ring of up to 12 miles across. These moonlets can be detected by their shadows. This is the first time that scientists have been able to watch as moonlets are built. The F-ring lies right at the balance point where tidal forces that try to break apart objects match self-gravity forces that tend to build up objects. So the activity we are seeing in the F-ring may not occur elsewhere.

Moon ring (or not) – Charged particle anomalies found in 2005 and 2008 near Saturn's moon Rhea suggested that there might be a ring of dust or debris around it. There are no known rings about any moon. Visible light images failed to find anything near Rhea, but hope was held out that there was a very diffuse ring. New observations made with the best possible lighting failed to find any ring of dust or debris. The charged particles remain to be explained.

[* File contains invalid data | In-line.JPG *]**Galaxy rings** – Astronomers have found giant loops of ultraviolet light in aged, massive galaxies. Somehow these old galaxies have been infused with fresh gas to form new stars that power these rings, some of which are large enough to encircle several of our Milky Way galaxies. The findings are from combining observations by Galex (orbiting ultraviolet telescope) and the Hubble Space Telescope. The latter observations were done to follow up on Galex work that showed some old galaxies were giving off unusually high levels of ultraviolet light. ¾ of these galaxies were found to possess these huge rings, some of which stretched out 250,000 light-years. A few of the galaxies had spiral-shaped structures in ultraviolet, though none were spiral galaxies. Where gas for star formation came from and how it created the rings remains unexplained. Merging with a smaller galaxy has been proposed, but some of the observations do not fit this theory. The best remaining theory is that the galaxies somehow collected intergalactic gas. More observations are needed to unravel this mystery.

Lunar water – A new analysis of 11 lunar rocks brought back by Apollo missions indicates that the interior of the Moon formed essentially dry of water. This contradicts another recent study that found a significant amount of water in Apollo rocks that were thought to be representative of the interior. The new study implies significant water is a surface property of the Moon, and that the water arrived after the Moon's formation. The new study looked at chlorine isotopes in the rocks and determined that any substantial amounts of hydrogen, including that in water, which might have been present at the formation of the Moon would have resulted in different abundances of chlorine isotopes.

More lunar water – Lunar Reconnaissance Orbiter (LRO) is continuing its radar mapping of our Moon's polar areas, with the greatest resolution ever. The data is confirming the findings of the recent LCROSS impact and the Indian lunar orbiter Chandrayaan-1 in finding large quantities of (frozen) water just beneath the surface in many areas, particularly within shadowed craters. The new data implies there are at least 800 million tons of water in the north polar area, somewhat less in the south. The ice is at least several yards thick in many locations.

Close brown dwarf – A very young brown dwarf star (a star without enough mass to sustain nuclear fusion) has been discovered in orbit around a nearby star (PZ Tel) that is much like the Sun, except only 12 million years old. The brown dwarf is separated from its star by only about the distance that Uranus is from our Sun, which quite close compared to other known brown dwarfs. PZ Tel has been extensively studied in the past, but no evidence of its brown dwarf companion had been seen until now. The discovery image was taken with adaptive optics, and blocking the star's light, using the Gemini South Telescope in Chile. An old image taken

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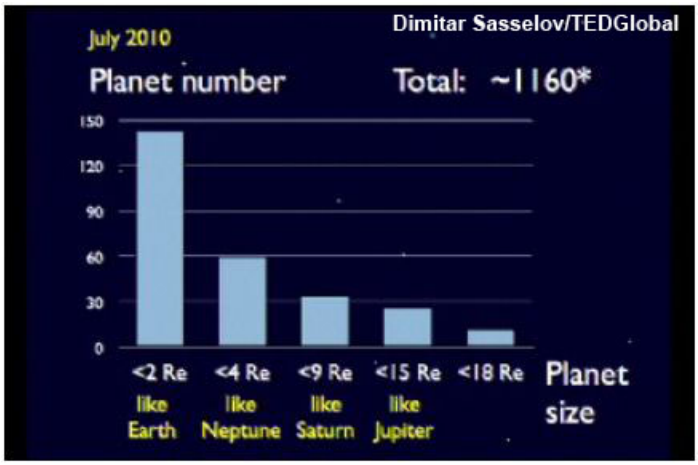
in 2003 that should have showed the brown dwarf did not. This implies that its orbit is quite eccentric, and when the old image was taken, the brown dwarf happened to be too close to its star and was lost in the glare.

Exoplanets – A graph has been released showing the sizes (diameters) of a couple hundred exoplanet candidates found by the Kepler spacecraft. It showed that there are far more small planets than large. Theorists had expected this. However the sensitivity of methods used to find planets before Kepler tended to find only the large planets. The Kepler data is the first planet search that is thorough down to roughly the size of the Earth, so this trend (the smaller, the more numerous) could be demonstrated. They are referred to as "candidates" because other phenomena, including companion stars and brown dwarfs, can masquerade as planets to Kepler. So the candidates must be followed up by other types of observations, such as radial velocity measurements, before being considered confirmed planets. It is expected that roughly half of the candidates will be weeded out by this process, but that the trend of more smaller planets will remain. Kepler is most sensitive to finding planets close to their stars, although sensitivity to planets with larger orbits increases with time as more data is taken. So although the candidates include dozens of planets near the size of the Earth, it likely includes none with orbits as large as the Earth's, and therefore likely none with temperatures comparable to Earth. In summary, Kepler is finding Earth-sized planets, but not yet Earth-like planets.



Chandra (orbiting X-ray telescope) has found in a distant galaxy 2 pairs of cavities carved out by the opposing pair of jets at the supermassive black hole at the galaxy's center. Neither pair lines up with the current position of the jets. This means that the black hole's spin direction has changed twice, moving the jets with it. The best theory on what could move a black hole's spin direction is a collision with another galaxy. If enough matter from the colliding galaxy falls into the black hole at a different angle than the black hole's spin, the new material will, as it falls in, establish a new spin direction. Changing the central black hole's spin direction may also explain the phenomenon known as X-shaped radio galaxies. The X-shape could be the result of seeing (in radio light) both the old and the new jet directions of such a galaxy.

Hypervelocity star – Less than a score of hypervelocity stars are known, ones that are moving so fast that they are escaping from our Milky Way. One of them was reported here in March 2008 because its chemical makeup and age were different from all the others, leading astronomers to propose that it was escaping from the Large Magellanic Cloud (LMC, a small neighboring galaxy), not from the Milky Way. Forget that theory. Astronomers have now measured its motion across the sky in Hubble Space Telescope images taken more than 3 years apart, and the motion leads right back to the center of the Milky Way. So maybe it formed in an area with exceptionally low metal content, and that's how its chemical makeup looked more like that found in the LMC than the Milky Way. But that still leaves the problem of its age. It appears to be 20 million years old, but its path from the center of the Milky Way had to have taken 100 million years. The solution is that the star must be a blue straggler, which is a star that looks like a young hot massive blue star, but is actually a collision product of 2 less massive and older stars. The most common way for a star to acquire hypervelocity is for a binary pair of stars to come too close to a massive object (black hole or massive star), at which point gravity deflects one star toward the massive object and flings the other away. So this was probably a triple star originally, that got too close to the supermassive black hole in the center of the Milky Way, at which point one star was grabbed by the black hole, and the other 2 were flung away, much later merging (likely when one aged to the point of becoming a red giant) to form a blue straggler. The team of astronomers is now measuring the motion of 4 more hypervelocity stars to see if more surprises arise.

Most massive star – Astronomers using the Very Large Telescope in Chile and archived data from the Hubble Space Telescope have found a star in the Tarantula Nebula with 265 times the Sun's mass, much larger than the previous record holders, Eta Carinae and the Pistol Star. Projecting back from its current mass loss, the star must have been born with 320 Sun's masses. This exceeds what some theorists claimed was the limit to how large a star can form, sending them back to the drawing board. The star was found in a search of 2 star-forming regions that seem to produce very large stars, RMC 136a in the Tarantula Nebula and NGC 3603.

Cosmic rays – Though still under construction, the IceCube Neutrino Observatory at the South Pole is already taking data. Cosmic rays cause noise that has to be filtered out to see the neutrinos. So of course, cosmic ray scientists are studying what gets filtered out. What they found is a cold direction and a hot direction for the arrival of cosmic rays from southern directions. This confirms a similar finding from cosmic ray detectors in the northern parts of the Earth. It is not known what is causing more cosmic rays to arrive from certain directions; possibilities are magnetic effects or a supernova remnant in the Sun's neighborhood. The Vela supernova remnant is suspiciously near a hot spot. The southern data have at least ruled out some theories proposed for the northern hot spot.

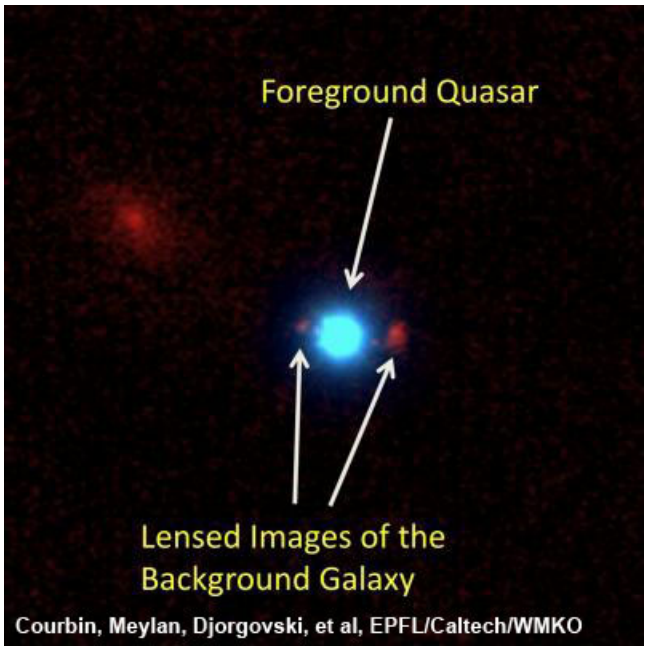
Mapping the Universe – A new observational technique called intensity mapping was used on the Byrd radiotelescope at Green Bank West Virginia, and gives astronomers a new method to map in 3 dimensions the large-scale structure of the Universe. The observations mapped hydrogen gas to 10 times the distance ever achieved before. To test the technique, an area of the sky was

examined that had previously been mapped in 3-dimensions using visible light spectroscopy to determine redshifts, and therefore the 3rd dimension (distance). The Byrd telescope looked for hydrogen gas in large volumes of space that included many galaxies, which was detectable at much greater distances than individual galaxies. Astronomers hope to use this technique to map larger parts of the sky in order to show how the structure of the Universe has changed over time (the more distant objects are seen earlier in the history of the Universe because the radio light took longer to get here). This should provide clues about how dark energy has affected the structure over time. Dark energy is the name given to the cause of the observed speeding up of the expansion of the Universe. The farthest hydrogen detected in these observations was seen as it appeared 6.5 billion years ago.

Sunspot cycles – The Sun has a pair of conveyor belts that move material toward the poles, then return material beneath the surface. The conveyors were measured for the immediately previous sunspot cycle (numbered 23), and the moving material extended all the way to the poles. During cycle 22, the material reached only about 60° latitude. So the scientists went back through old solar observations and established that cycles 21 and 20 also reached only about 60°. Cycle 23 also differed from the previous 3 cycles in another way: It lasted 12.5 years, longer than the average sunspot cycle of 11 years, while the previous 3 cycles have been shorter than average, about 10.5 years. So the new theory is that the farther the conveyor moves material, the farther it drags magnetic field along with it, and the longer it takes for the Sun to reverse its magnetic field. This magnetic reversal always occurs as a new sunspot cycle begins. So maybe measuring the length of the conveyor will better allow scientists to predict how long a sunspot cycle will last. In case there are any readers living on the Sun, please make sure that you have purchased your cycle 24 compass. ☺ Otherwise you may be lost, as your cycle 23 compass is now pointing the wrong way.

Thermosphere, a rarefied layer high in the Earth's atmosphere that is heated by the Sun's extreme ultraviolet, has collapsed. It always cools and shrinks somewhat between sunspot cycles, as the Sun's ultraviolet output drops then. However this is the biggest contraction since the space age began. The most accurate way to measure the thermosphere size and temperature is to calculate them from measurements of atmospheric drag on low orbiting satellites, so the thermosphere wasn't measured before the space age. The contraction was 3 times as large as computer predictions said it would be even after taking into account the unusually long period of little solar activity that has occurred. Attempts to explain the size of the contraction due to other causes, such as changes in the constituent gases of the thermosphere, have also failed. Scientists will be watching the thermosphere rebound as the new sunspot cycle begins and the Sun's ultraviolet output increases.

Gravitational lenses have often been seen that consist of a quasar directly behind a galaxy. The other direction (a galaxy behind a quasar) had not been discovered until now. It was found by searching the Sloan Digital Sky Survey for quasars with colors that did not match what was expected. This indicated that more highly redshifted light was mixing in with the quasar's light from an object behind it. 22,000 quasars were examined, and 14 were found with anomalous color. Only the announced discovery (of the 14 candidates) has yet been followed up with high resolution observations to show that indeed an object behind the quasar is being lensed by gravity.



Buckyballs – Astronomers using the Spitzer infrared space telescope have found in a planetary nebula (named Tc 1) the spectrum of C_{60}, molecules of 60 carbon atoms in soccer ball shapes, commonly known as buckyballs (after Buckminster Fuller, the architect famous for his domes). Previous hints of this spectrum have been seen, but this find was strong and unambiguous. A related molecule C_{70} was also found. The molecules are at approximately room temperature, the ideal temperature for a strong infrared spectrum. A century from now, the nebula could cool enough to make detection of the spectrum difficult.

THEMIS (5 orbiting spaceweather spacecraft) have discovered a new phenomenon that is being called a spacequake. It has about the energy of a magnitude 5 or 6 earthquake, but takes place in the magnetic field and particles in near-Earth space. It occurs when the Earth's magnetic tail becomes stretched out and then releases its tension by snapping back. Charged particles trapped in the field hurtle toward the Earth, then bounce and spin on the stronger magnetic field there. The spin may funnel particles into Earth's atmosphere, sparking auroras and setting up waves of ionization.

Scout program – A few years ago, NASA split off the Mars Scout program of low-cost missions to Mars from the Discovery program of low-cost missions to anywhere. Mars Scout has produced the Phoenix polar lander, and has the MAVEN mission on the way to a 2013 launch. After that, the Scout program will be discontinued, and low-cost Mars missions will be once again a part of the Discovery program. However, it is expected that few low-cost Mars missions will be proposed, since we will have accomplished most of the goals of Mars orbiters, and the landers tend to be too expensive for the Discovery program. The only difference should be that the few low-cost Mars missions that may be proposed will have to compete for funding with all low-cost missions, not just with Mars missions.

(continued next page)

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Instant AstroSpace Updates

NASA and its European counterpart ESA have agreed on 5 science instruments for the joint project called **ExoMars Trace Gas Orbiter**, scheduled to launch in 2016: a sensitive atmospheric spectrometer, a spectrometer to measure sunlight shining through the atmosphere, an infrared radiometer/sounder, a high-resolution 4-color stereo camera, and a multispectral camera. The goal is to study Mars's atmosphere in great detail, particularly the methane of unknown origin.

WISE (orbiting infrared all-sky survey telescope) is beginning to run out of coolant, and has lost sensitivity in one wavelength. It has completed its primary mission of surveying the entire sky, which constituted over a million images, and will continue repeating images which will be used to find changes, until complete coolant loss, probably in 2-3 months.

152 scientific papers were published in July announcing results from the **Herschel** infrared space telescope, launched 15 months ago. Highlights included penetrating the dust for the first time in a stellar nursery in Aquila, and examining the GOODS zone, an area unobstructed by nearby objects, where all space telescopes have taken deep field images.

Volunteers at the **Einstein@Home** project, which searches LIGO (gravitational wave detector) and Arecibo (radiotelescope) data for scientifically interesting items, have discovered their first pulsar (in the radiotelescope data). It rotates 41 times per second, has an unusually low magnetic field, and likely had a companion star that exploded and kicked it free.

Boeing has announced that they are developing a crew-carrying space vehicle, named **CST-100**, that is intermediate in size between the old Apollo capsules and the under-development much larger Orion capsule, for delivering astronauts to ISS and space tourists to the planned Bigelow space hotel. If NASA immediately funds it, CST-100 could be ready by 2015.

Astronauts are performing 4 spacewalks to replace a cooling pump that failed in late July on the **International Space Station** (ISS). There are already spare pumps on board ISS, and astronauts were trained in this procedure before launch, but leaky and stuck parts have extended the replacement into a lengthy job.

On a spacewalk in July to outfit the new **ISS** Rassvet module for future dockings, astronauts lost 2 items, which floated away, and will be tracked to assure that they do not become a hazard. One was identified as a cable clamp, while the other had not been identified. This was in addition to an obsolete camera intentionally tossed.

Scientists have produced the first-ever map of the **heights of the world's forests**, by combining lidar and spectrometer data from Terra, Aqua and ICESat satellites. This map is expected to aid forestry, carbon, biomass and other studies. ■

(continued from page 5)

PATS Special Events:

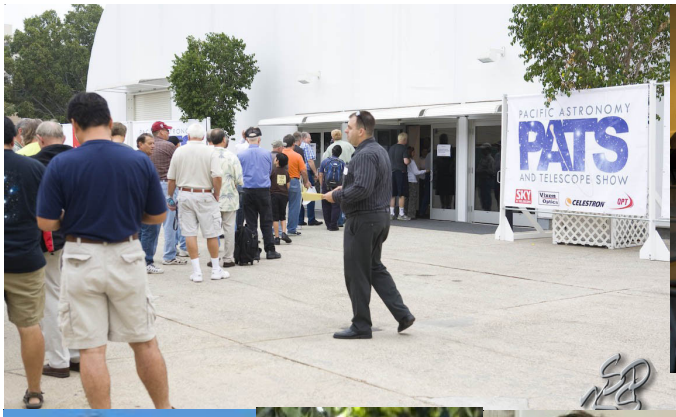
Several PATS events require registration

Tour/Observing at Mt. Wilson: You can walk where Einstein and Hubble walked, and then spend a half evening looking through the historic sixty inch telescope that helped establish our place in the universe. The tour includes places other tours never go. There were still spaces left as the newsletter went to press. See http://www.rtmcastronomyexpo.org/PATS/2010/Wilsontour/tourhome.htm

Brian Warner of the Society for Astronomical Sciences brings amateur scientists the **Measuring the Universe Workshop** on Saturday. The workshop is a hands-on tutorial on the Canopus software for photometry of asteroids and variable stars. Using it, amateurs can contribute to important scientific work with their telescopes and cameras. More information at http://www.socastrosci.org/files/PATS_2010.pdf

The **Riverside AstroImaging Workshop,** on Friday, September 17, brings together some of the best presenters in the field to share their imaging secrets. You will have plenty of opportunity to visit with the presenters and fellow imagers. Registration is required, and there is a discount for RAS members. See http://patsimage.org/ for details and registration.

There's plenty to do at the PATS. At right, top, is the line waiting to get in at opening. The event draws people from all over the country to Pasadena. The second picture shows one of the presentation halls where, for two days, well known speakers talk about the latest development in astronomy and the hobby. Three of those are





in the next set of pictures: Geoff Marcy is one of the leaders in finding exoplanets, Alex Filippenko worked with the team that discovered the acceleration of the expansion of the universe, and Bob Naeye is editor of Sky and Tel. At the bottom, David Nagler shows off some new Televue equipment.

Magazine Subscriptions

Subscriptions to the Astronomy magazines are now due for renewal, if you subscribed for one year or would like to subscribe at the club rate. You may also extend an existing subscription that does not end in December for one year at the club rate. Bring your check made out to the OCA to the meeting or mail it to:

Charlie Oostdyk, Orange County Astronomers, PO Box 1762, Costa Mesa, CA 92628. *Checks made out to the magazine publishers cannot be processed and will be returned to you*. If you already subscribe, please provide the mailing label or the billing invoice with your check. One-year rates are as follows:

	Club Rate	Regular Rate
Sky & Telescope*	**$33.00**	$42.95
ASTRONOMY	**$34.00**	$42.95

***Sky & Telescope subscribers please note: Due to a change by the publisher, renewals of current subscriptions should now be made directly through Sky and Telescope! New subscriptions at the club rate must still be made through Orange County Astronomers and then renewed through the publisher.**

The **DEADLINE** for subscribing at the club rates will be the **October monthly meeting, October 8th.** The publishers will send expiration notices to all current club subscribers about November 1st even if you renew through the club. It takes the publishers a few weeks to process renewals.

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