SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

SEPTEMBER 2013 *Free to members, subscriptions $12 for 12* **Volume 40, Number 9**

RTMC RECAP—PAGES 8-9

NGC 6357, a diffuse nebula in the constellation Scorpius, was imaged by Bill Hall from Yorba Linda on August 4. Bill used an 8-inch f/4 Newtonian with MPCC, an ST-8300 imager with an H-alpha filter and 55 minutes total exposure to create the image.

OCA CLUB MEETING

The free and open club meeting will be held September 13 at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Dr. Richard Ellis of Caltech will present "Let There Be Light: Finding the Earliest Galaxies"

NEXT MEETINGS: October 11, November 8

STAR PARTIES

The Black Star Canyon site will open on September 28. The Anza site will be open on September 7. 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 September 6. The following class will be held October 4.

GOTO SIG: TBA
Astro-Imagers SIG: Sep. 17, Oct. 15
Remote Telescopes: TBA
Astrophysics SIG: Sep. 20, Oct. 18
Dark Sky Group: TBA

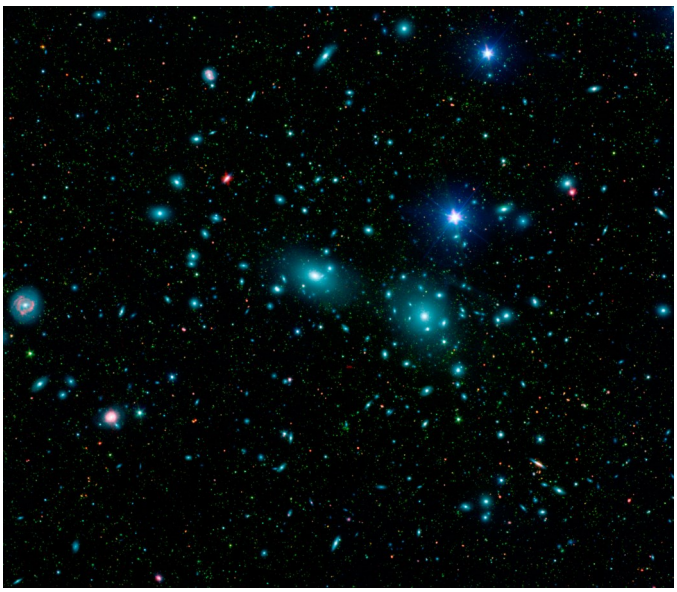
Size Does Matter, But So Does Dark Energy

By Dr. Ethan Siegel

Here in our own galactic backyard, the Milky Way contains some 200-400 billion stars, and that's not even the biggest galaxy in our own local group. Andromeda (M31) is even bigger and more massive than we are, made up of around a *trillion* stars! When you throw in the Triangulum Galaxy (M33), the Large and Small Magellanic Clouds, and the dozens of dwarf galaxies and hundreds of globular clusters gravitationally bound to us and our nearest neighbors, our local group sure does seem impressive.

Yet that's just chicken feed compared to the largest structures in the universe. Giant clusters and superclusters of galaxies, containing thousands of times the mass of our entire local group, can be found omnidirectionally with telescope surveys. Perhaps the two most famous examples are the nearby Virgo Cluster and the somewhat more distant Coma Supercluster, the latter containing more than 3,000 galaxies. There are millions of giant clusters like this in our observable universe, and the gravitational forces at play are absolutely tremendous: there are literally *quadrillions* of times the mass of our Sun in these systems.

The largest superclusters line up along filaments, forming a great cosmic web of structure with huge intergalactic voids in between the galaxy-rich regions. These galaxy filaments span anywhere from hundreds of millions of light-years all the way up to more than a *billion* light years in length. The CfA2 Great Wall, the Sloan Great Wall, and most recently, the Huge-LQG (Large Quasar Group) are the largest known ones, with the Huge-LQG -- a group of at least 73 quasars – apparently stretching nearly 4 billion light years in its longest direction: more than 5% of the observable universe! With more mass than a million Milky Way galaxies in there, this structure is a puzzle for cosmology.



Digital mosaic of infrared light (courtesy of Spitzer) and visible light (SDSS) of the Coma Cluster, the largest member of the Coma Supercluster. Image credit: NASA / JPL-Caltech / Goddard Space Flight Center / Sloan Digital Sky Survey.

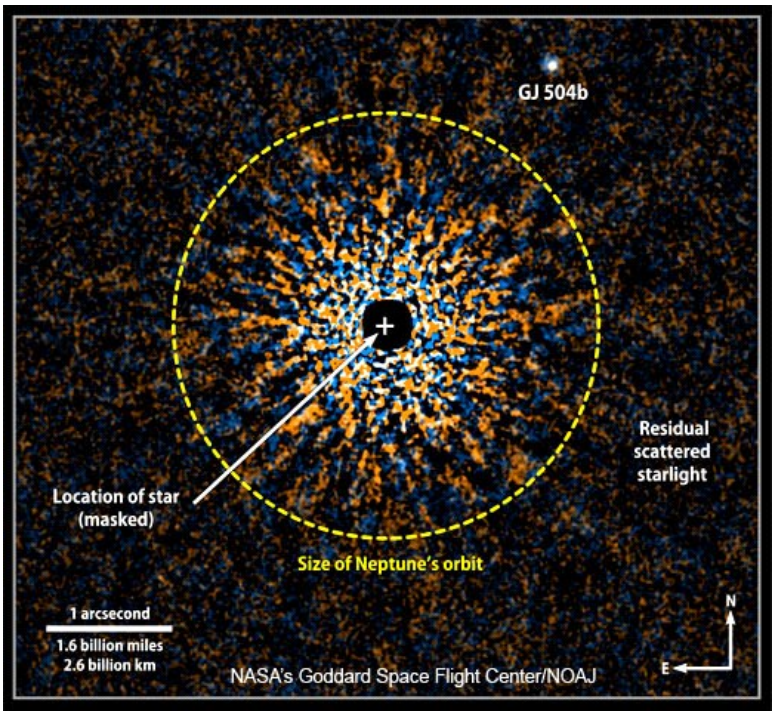
You see, with the normal matter, dark matter, and dark energy in our universe, there's an upper limit to the size of gravitationally bound filaments that should form. The Huge-LQG, if real, is more than *double* the size of that largest predicted structure, and this could cast doubts on the core principle of cosmology: that on the largest scales, the universe is roughly uniform everywhere. But this might not pose a problem at all, thanks to an unlikely culprit: **dark energy**. Just as the local group is part of the Virgo Supercluster but recedes from it, and the Leo Cluster -- a large member of the Coma Supercluster -- is accelerating away from Coma, it's conceivable that the Huge-LQG isn't a single, bound structure at all, but will eventually be driven apart by dark energy. Either way, we're just a tiny drop in the vast cosmic ocean, on the outskirts of its rich, yet barely fathomable depths.

Learn about the many ways in which NASA strives to uncover the mysteries of the universe: http://science.nasa.gov/astrophysics/. Kids can make their own clusters of galaxies by checking out The Space Place's fun galactic mobile activity: http://spaceplace.nasa.gov/galactic-mobile/

AstroSpace Update

September 2013

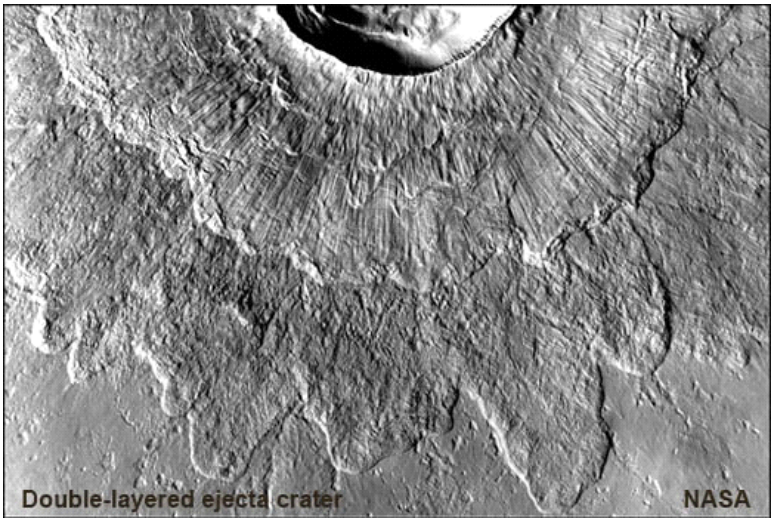
Gathered by Don Lynn from NASA and other sources



Exoplanet imaged – Using infrared data from the Subaru Telescope in Hawaii, a team of astronomers has imaged a giant planet around the bright star 59 Virginis (aka GJ 504). About 4 times the mass of Jupiter and about the same diameter, the planet, dubbed GJ 504b, is the lowest-mass planet directly imaged around a Sun-like star. The world is still glowing from the heat of its formation and has a dull magenta color. Because it is so difficult to image a planet close to a star that is typically millions of times brighter, only about 1% of known exoplanets have been imaged. The use of infrared light and adaptive optics, and the facts that the planet is glowing in infrared and is far from its star, have allowed this planet to be imaged. GJ 504b orbits its star nearly 9 times as far as Jupiter orbits the Sun, which poses a problem to the theory of how giant planets form. Either they can form much farther from their star than theorized, or else they can migrate farther from their star more quickly than thought. This planet has a temperature of about 460° F (237° C), is 57 light-years away, and orbits a G0 star, which is slightly hotter than the Sun. The star is estimated to be about 160 million years old, based on its color and rotation period.

Exoplanet in X-rays – For the 1st time an exoplanet has been observed transiting (passing in front of) its star as seen in X-rays. Both Chandra and XMM Newton (X-ray space telescopes) saw this. The planet, HD 189733b, is the closest known hot Jupiter, that is, a gas giant orbiting very close to its star. This is the same planet that the Hubble Space Telescope recently determined is blue, probably due to molten glass droplets in its atmosphere. Chandra discovered that the orbited star has a faint red companion star. The 2 stars do not appear to be the same age, which is a puzzle. The atmosphere of the planet is seen in X-rays to be much larger than can be detected in visible light. This explains previous measurements of atmospheric mass loss (into space), which were faster than could be explained by the size of atmosphere seen, but the X-ray measurements explain the mass loss.

Snow line is the distance from a star where it becomes cool enough for snow to form. There are separate snow lines for water, carbon dioxide, and other materials that can freeze. The snow lines affect what kind of planets can form at various distances from a star. A snow line has been imaged for the 1st time by ALMA (radiotelescope array) in Chile. Snow lines have been detected spectroscopically, but without the resolution to image them. The new observation is of TW Hydrae, a young star 175 light-years away, and the snow line is for carbon monoxide (CO). It was not imaged directly, as ALMA cannot see CO snow, but it can see diazenylium, which is destroyed by CO gas, but not CO snow. The CO snow line is about 30 AU from TW, about the distance Neptune is from the Sun.



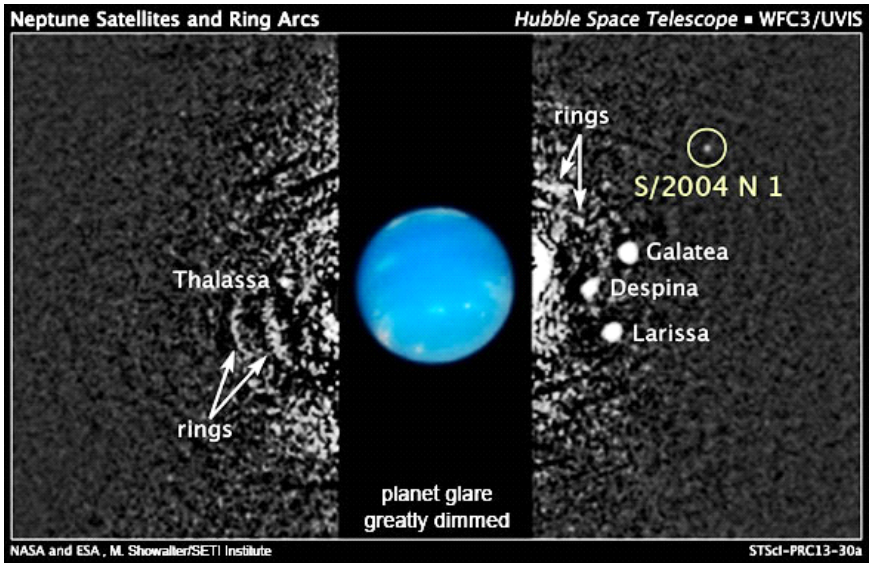
Double-Layered Ejecta craters (DLEs), like other craters, are surrounded by debris excavated by an impactor, but differ from other craters in having 2 distinct layers of debris – a large outer layer with a smaller inner layer sitting on top. DLEs were 1st documented in Viking images of Mars in the 1970s, and scientists have been trying ever since to figure out how the layers form. A new study suggests the DLEs are the result of impacts onto a surface that was covered by a layer of glacial ice tens of yards (meters) thick. The impact blasts through the ice layer, spitting rock and other ejecta out onto the surrounding ice. But because that ejected material sits on slipper ice, the material near the top of an upraised crater rim slides down the slipper ice and overtops material on the lower slopes. This scenario explains several of the distinct features of DLEs. Radial striations (grooves radiating out from the crater rim) are explained. The scenario requires a steep slope on the outside of a crater rim. That slope depends on crater size, with larger craters generally having less uplifted rims. The new study calculated that craters larger than about 16 miles (25 km) probably would not have steep enough rims to cause the icy landslide. About 600 known Martian DLEs were surveyed and nearly all of them are between 0.6 and 16 miles (1-25 km) in diameter. DLEs tend not to have secondary craters surrounding them. Secondary craters are where big chunks of ejecta leave gouges in the surrounding surface. The new theory has the secondary craters occurring in ice that later melts. DLEs are typically found at middle or high latitudes of Mars – areas where scientists believe there may have been much glacial ice in the past.

Curiosity (Mars rover) has analyzed, with 2 instruments, the abundances of different isotopes of gases in the Martian atmosphere. Lighter isotopes of carbon and oxygen were found to be lacking compared to heavier ones, just as expected by the theory that Mars has lost much of its atmosphere to space. Lighter isotopes escape to space faster. The measurements did not match another theory that much of the atmosphere was lost to the planet itself, like much of Earth's carbon dioxide is thought to be tied up chemically in rocks. Hydrogen isotope measurements by the rover also supported loss to space. The current loss rate of atmospheric gases to space will be measured by the MAVEN spacecraft, NASA's next mission to Mars.

Opportunity (Mars rover) has reached Solander Point, the area it will study during the coming Martian southern hemisphere winter. It has a north-facing slope that will allow the rover to tilt toward the low winter Sun and increase the power generated by its solar panels. This tilt will become necessary about December, so until then the rover will explore other sides of Solander Point. All the regions that the rover has explored so far are in what is called the Burns Formation, which shows evidence of highly acidic water flowing when that layer was formed. Solander Point has a contact with an older formation that may have existed when less acidic water flowed on the planet billions of years ago.

Cassini (Saturn orbiter) – The intensity of jets of water ice and other particles that shoot out from Saturn's moon Enceladus has been found to depend on the moon's proximity to the planet. Cassini data show the jets most active when Enceladus is farthest from Saturn. Apparently tidal pulls from the planet force the slots closed from which the jets emanate. This reaction of the jets suggests that they come from a large body of liquid water under the surface.

Cassini has yet to detect **waves** on the ethane lakes and seas of Saturn's moon Titan, though they have been predicted to exist. A new study has determined that it will take 1-2 mph wind to create waves, and possibly winds are calmer than that at the surface. However the change in seasons on Titan should boost the winds, so Cassini will keep looking during future pass by the moon. Winds have to exist on Titan, since numerous sand dunes there show that wind has sculpted them.



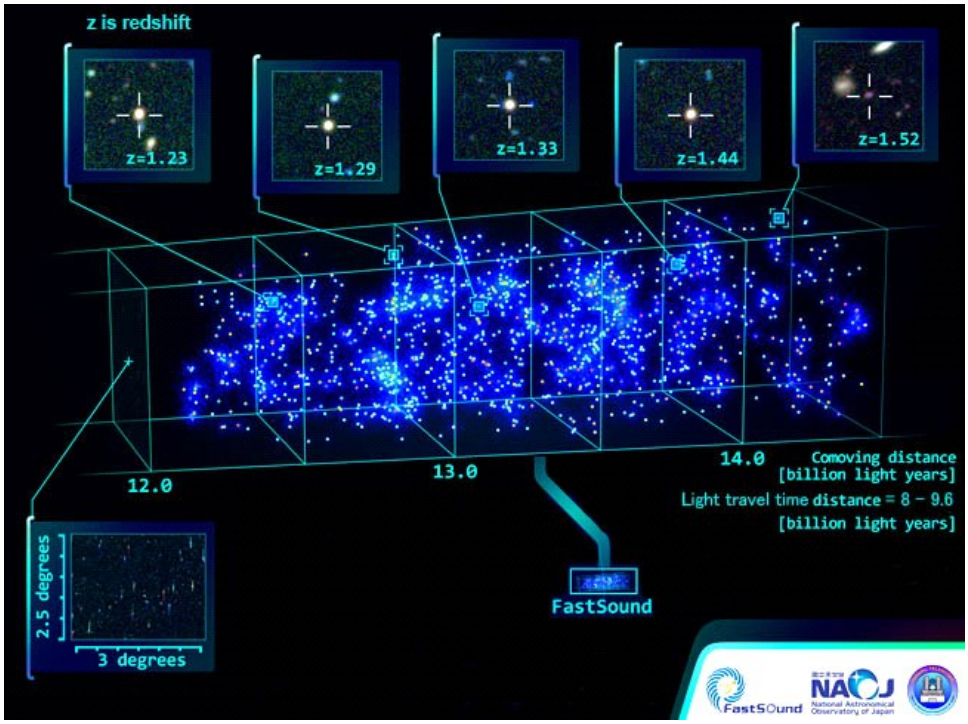
Neptune moon – Hubble Space Telescope has discovered a new moon orbiting Neptune, the 14th known there. It is designated S/2004 N1, since it was found on archived images back to 2004. It is estimated to be no more than 12 miles (20 km) across, making it the smallest moon known at Neptune. It was found while studying the faint arcs, or segments of rings, around the planet.

Zombie comets – A team of astronomers has discovered a graveyard of comets within the asteroid belt. Some of these objects, inactive for millions of years, have returned to life by small changes in their distance to the Sun, and therefore temperature. In the last decade, 12 active comets have been found in the main asteroid belt. The new study investigated their origin. Their conclusion is that millions of years ago the main asteroid belt was populated by thousands of active comets. This population aged and became dormant. Slight changes in orbits bring a few of these closer to the Sun and they come back to life.

More comets – A new study of dozens of the Centaurs (small bodies orbiting between Jupiter and Neptune) using WISE (infrared space telescope) found that most, about 2/3, appear to be comets rather than asteroids. It has long been debated which the Centaurs are. Because the Centaurs are very far from the Sun, they almost never develop a comet-like gas cloud head, which would confirm their identity. The study also looked at some scattered disk objects (the more eccentric portion of those small bodies orbiting beyond Neptune) and found they are mostly comets. The WISE observations measured reflectivity (albedo) and was combined with previously known color data. Reddish objects were judged to be asteroids, while blue-gray objects were classified as comets if very low albedo or asteroids if higher albedo. Comets are known to have a dark, soot-like coating, making them dark.

Quenched galaxies – Some galaxies hit a point in their lives when their star formation is snuffed out, and this is called quenched. Observations of quenched galaxies show that billions of years ago such galaxies were smaller than today. It became a puzzle as to how quenched galaxies could grow over billions of years without forming new stars. Some theorists proposed the growth was due to galaxies merging. But observations did not support that galaxy collisions happened often enough to support the growth rate. New observations answered the puzzle. They don't grow. The average size of quenched galaxies rises because as time goes on, larger galaxies become quenched, raising the average size. The new observations were taken from the Hubble Space Telescope COSMOS survey. They showed that over billions of years, the small quenched galaxies remained small, but were joined by larger ones becoming quenched. Galaxy merging may still cause some growth of quenched galaxies, but it is a small contribution.

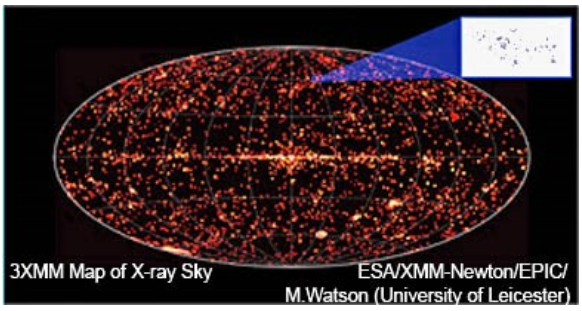
Galaxies losing appetites – Our Universe is filled with galaxies bound into clusters. Lying at the heart of most such clusters is a monster galaxy, thought to have grown to such size by merging with neighboring galaxies. New research from Spitzer and WISE (infrared space telescopes) is showing that, contrary to previous theories, these giant galaxies appear to slow their growth over time. They apparently started a diet in the last 5 billion years, feeding less on neighboring galaxies. Astronomers surveyed nearly 300 galaxy clusters spanning 9 billion years of cosmic time. Growth rates of the largest galaxy in each cluster matched theory until about 5 billion years ago, when growth slowed. Further research is needed to determine the cause of the slowing.



Map of the Universe – A team of astronomers has released its 1st version of a 3D map of the Universe from the FastSound project, which is surveying galaxies so distant that it took their light up to 9.6 billion years to reach us. This is the farthest any survey has shown the 3D structure of the Universe. The new map includes 1100 galaxies in an area of sky 3 degrees long. The observations were made with a multi-object near-infrared spectrograph on the Subaru Telescope. The team will eventually survey about 30 square degrees of sky, measure precise distances to about 5000 galaxies. Then the rate of growth of galaxy cluster structure will be measured as it changed over billions of years in order to measure the effects of dark energy.

X-ray catalog – Scientists have set a new record for cosmic X-ray sources by releasing a new X-ray catalog of all sources seen by the XMM-Newton X-ray space telescope. Typically each target observed is near about 70 other sources within the field of view. All of these were included in the catalog, which totaled over 370,000 objects.

Blinking stars – Astronomers using Spitzer have spotted a young stellar system the blinks every 93 days. The system likely consists of 2 developing star, 2 of which orbit each other within a disk of material. They periodically peek out from the disk causing the blinking. The disk appears to be misaligned from the star pair, probably due to the disrupting gravitational presence of the 3rd star. This is the 4th known star system to blink like this. It is designated YLW 16A and is located in Ophiuchus.



Globular star orbits – Astronomers using the Hubble Space Telescope have determined the orbital motion of 2 distinct populations of stars in the ancient globular cluster 47 Tucanae, offering proof that they formed at different times. The 2 populations differ in age by less than 100 million years. The cluster is about 10.5 billion years old. Previous spectroscopic studies revealed that many globular clusters contain stars of varying chemical compositions, suggesting multiple episodes of star birth. But the new study is the 1st to factor in orbital motions. The new study also measured the stars' brightnesses and temperatures. The 1st population consists of redder stars, which are older, less chemically enriched, and orbiting in random circles. The 2nd population consists of bluer stars, which are younger, more chemically enhanced, and moving in more elliptical orbits.

Very distant GRB – Just a billion years after the Big Bang a star exploded, blasting its remains outward in twin jets at nearly the speed of light. It glowed so brightly that it outshone its entire galaxy by a million times. This flash traveled across space for 12.7 billion years before reaching Earth (which had not formed when the light began its journey). The flash was a gamma-ray burst (GRB), and was classified as a long GRB, lasting over 4 minutes. It was detected by the Swift spacecraft in early June. Follow-up observations found the afterglow, which is caused by the jets slamming into surrounding gas. Spectra were taken, and spectral lines were found that were caused by passing through interstellar gas in the distant galaxy where the GRB occurred. The GRB galaxy contained only about 1/10 the heavy elements that are found in our solar system. This tells us that the galaxy had not yet undergone enough supernova explosions to create much heavy elements and spread them about. This is one of the most distant GRBs observed. It allowed astronomers to learn about the content of its galaxy, even though that galaxy is too faint to produce a spectrum without the help of the GRB.

Short GRB – Hubble Space Telescope provided the strongest evidence yet that short GRBs (less than a couple of seconds) are produced by the merger of 2 small dense objects, probably neutron stars. It had been predicted that such a merger would produce a kilonova, or stellar explosion 1000 times as bright as a nova, but 100 times dimmer than a supernova. It would be in near-infrared light, though visible light should be blocked by hot plasma. Hubble observed such a kilonova following the detection of a short GRB by Swift (gamma-ray space telescope), found to be about 4 billion light-years away. The GRB, though it lasted only about 1/10 second, was about 100 billion times as bright as the kilonova, which lasted days. It has been believed that short GRBs were caused by such mergers, but this is the best evidence yet supporting that. Observations of the kilonova showed that substantial amounts of heavy elements, including gold and radioactive elements, were created. About 1% of a solar mass of material was ejected. From the rate of short GRBs occurring and the amount of gold produced in this one, it was estimated that this method is sufficient to explain all the known gold in the Universe.

Gas loss – New observations from ALMA have given astronomers the best view yet of how vigorous star formation can blast gas out of a galaxy and starve future generations of stars of the fuel they need to form and grow. The observations were made of the nearby Sculptor Galaxy (NGC 253), which is about 11.5 million light-years away. The researchers measured vast quantities of molecular gas – 10 times or more the mass of our Sun each year – were being ejected from the galaxy at speeds between 90,000 and 600,000 mph (150,000-1,000,000 km/h). At this rate, the galaxy could run out of gas in as little as 60 million years.

Black hole spin – Astronomers have found a new way to measure the spin in a supermassive black hole. Using visible, ultraviolet and soft X-rays, scientists were able to measure how far the accretion disk was from the black hole at the center of a galaxy 500 million light-years away. The faster a black hole spins, the more it deforms space according to Relativity, pulling space and therefore the accretion disk in closer.

Gas cloud ripped apart – New observations from the Very Large Telescope in Chile show for the 1st time a gas cloud being ripped apart by the supermassive black hole at the center of our Milky Way galaxy. The cloud is now so stretched that its front part has passed the closest point and is travelling away from the black hole at more than 6 million mph (10 million km/h) while the tail is still falling inward. The gas cloud was discovered in 2011 and astronomers have been watching it approach the black hole. The gas is now stretched over more than 100 billion miles (160 billion km). The closest approach is 15 billion miles (25 billion km) from the black hole, only about 5 times Neptune's distance from the Sun. As the gas cloud is getting stretched, it is getting harder to see. The new observations consisted of 20 hours of exposure with a spectrometer to measure different velocities within the cloud.

Missing lead – Earth is believed to have formed from the collision of asteroids, so its composition should resemble meteorites, the chips off asteroids. A lingering mystery is that Earth's mantle – the layer between the crust and core – is missing an amount of lead found in meteorites. The lead is measured as a ratio to uranium, since uranium eventually decays to lead. The lead ratio of Earth's mantle is too low compared to that of meteorites. Researchers studying the only place on Earth where a chunk of mantle is exposed, the Kohistan arc where the India and Asia plates collide, found denser rocks with a lead ratio like that of meteorites. They theorize that such denser rocks normally get subducted (pushed down into the mantle), but never return to the surface (as lava) for some reason. So the answer to the mystery is that Earth isn't missing the lead, it is just hiding it deep in the mantle. Now scientists have a new mystery: why the denser rocks never return to the surface.

Ancient calendar – A team recently announced the discovery in Scotland of a Mesolithic monument consisting of a series of pits estimated to be 10,000 years old. The major pits seem to correspond with 12 lunar months, and other features allow correcting this to the solar year, which is about 11 days longer. This would be the oldest solar/lunar calendar known, more than twice as old as Stonehenge, built shortly after the last ice age. The site was initially discovered during an aerial survey of the region.

Kepler (planet-finding space telescope) – As reported here, in May the 2nd of Kepler's 4 reaction wheels failed, and 3 of the wheels are needed to precisely point the spacecraft. Engineers have completed efforts to restore operations, but have been unsuccessful. NASA has asked for papers proposing what science the spacecraft can do without precise pointing. After receiving these the Kepler team will study these science opportunities by sometime this fall, and this study will be judged by NASA against other projects, and a

decision will be made then as to whether to attempt further observations with Kepler. Analysis of previously made observations will continue. Only about half of the 4 years of data have been processed, and analysis is expected to take about 2 more years. Scientists expect Kepler's most interesting discoveries are still to come from this continued analysis.

Instant AstroSpace Updates

A new study of stereo images of the Aeolis Dorsa area of **Mars** shows that the ridges there were formed as a delta, a river flowing into the northern lowlands, supporting the theory that those lowlands were an **ocean** in the distant past. Deltas previously found on Mars were flowing into smaller bodies, not an ocean.

Recent observations by the twin Van Allen Probes spacecraft show that charged particles within the **Van Allen belts** are accelerated by a force within the belts, supporting the "local acceleration" theory of how the particles reach high speeds. The energy for this must come from electromagnetic waves in the belts, but exactly which waves can by determined only by further observation.

A recent paper suggests that **exoplanets** in close orbits to red dwarf stars, which are thought to always face 1 side toward their star, will collect all their water as ice on the night side, and develop a **water cycle** in which ice approaches the hot side and is evaporated and condensed back on the night side.

Mars rover **Curiosity** made its longest drive yet in a day, 329 ft (100 m), as it moves toward the base of Mt. Sharp, where in several months it will start climbing to examine the geological layers there. New automatic navigation software installed in the rover should allow even longer drives.

New simulations of **exoplanet climates** shows that planets orbiting cool red stars may be warmer than thought because ice absorbs more of their infrared radiation than planets with ice would absorb from hot stars radiating in ultraviolet.

Planetary nebulae are formed when a star near the end of its life ejects its outer layers. M57, the famous Ring Nebula in Lyra, is a future portrait of the fate of our own sun some five billion years in the future. It is also an excellent object for casual viewing and star parties. Bruce Waddington captured this image on 8/26/05 from Laguna Beach using a 10-inch Meade LX200 and the Meade DSI color imager.

A NOTE FROM THE EDITOR

This issue marks 10 years since I took over editing the *Sirius Astronomer*. While I cannot and will not claim to have gotten everything exactly right over the years, it has been my pleasure and honor to serve the Orange County Astronomers in this capacity and I anticipate producing your newsletter for many years to come. If there is anything you wish to see in the newsletter, or that you would like done differently, please do not hesitate to let me know. Thank you for this opportunity!

Steve Condrey

RTMC Roundup

by Tim Hogle

Memorial Day weekend brought another very enjoyable RTMC (Riverside Telescope Makers' Conference and Astronomy Expo) to the Camp Oakes YMCA camp, 7000 ft above Southern California, near Big Bear Lake for the 500 plus attendees. This was the 45th annual RTMC, and WAA again was an active participant, as were several member organizations.

The event is regularly scheduled for Memorial Day weekend. This year they opened up the facility on Thursday, May 23 for those eager to get out of town early. The last events were Sunday night, allowing Monday for people to get home (in the intimate company of uncountable numbers of other intrepid weekend travelers). It included activities for everyone; a four-day star party, formal talks on astronomical subjects for beginners and advanced, a swap meet, astronomical vendors and door prizes (I ended a 35 plus-year record of not winning a single door prize of the hundreds given out each year, with the win of a tee shirt – whee!), and lots of time to meet and get reacquainted with like-minded folks from everywhere but there.

Family activities included swimming, canoeing, archery, horseback riding, hiking and whatever else one might think of doing in the mountains. A bonus was a tour of the nearby Big Bear Solar Observatory, a premier facility with the world's largest aperture and highest resolution solar telescope (and which rarely gives tours).

I had no trouble claiming my usual campsite under a pine tree at the southeast corner of the camp. I didn't bring a telescope (my usual MO) because there are so many others to look through, each with the opportunity to meet new people and engage in some interesting discussion. Several other stalwart OCA members were in attendance, mostly set up at their usual enclave along "telescope alley".

Weather was cool but very pleasant this year; clear, calm days in the 60s to 70s; nights mostly clear but some high clouds and overcast with temps generally going to about freezing. One night did bring a low 20s temperature reading. The full moon this year dictated mostly observations of bright objects, and Saturn was a top favorite. A very popular activity was observing an early evening triple conjunction of Mercury, Venus and Jupiter from a newly man-made hill on the west side of the open telescope field.

Sunday night provided a couple of hours of real dark sky time, with the highlight of observing the (now faint) comet PanSTARRS as it passed nearby Polaris (well, actually it was much closer to Earth than to Polaris), but most significantly, Earth passed through the plane of the comet's orbit that night, affording a view of an impressively long anti-tail.

The first scheduled activity was a show-and-tell on Friday evening, with the regular frenzied swap meet starting early the next morning. A very interesting series of formal talks started after breakfast Saturday, beginning with Jack Eastman's presentation on the cleaning and optical characterization of the 20" Alvan Clark refractor of the U of Denver's Chamberlin Observatory – history being opened up before our eyes. Other highlights of the day included several beginners talks to arm newbies with some practical information to help them get started with telescope and accessory selection and use, and introductions to various aspects of astronomy. For those wanting more meaty material to chew on, there was no lack of content. Tim Thompson, a retired JPL scientist talked about the series of Hubble Deep Field photos taken over the last several years, compared them and showed just what was learned from each. He really put them all in perspective.

Saturday afternoon, Steven Flanders and Kin Searcy, both docents at Palomar Observatory, talked (respectively) about the history and current science work at Palomar. Richard Berry talked about the optical designs of eyepieces and astrographs, unfortunately concurrent with the WAA board meeting, so I missed it. Saturday evening was a highlight, with most awards presentations made.

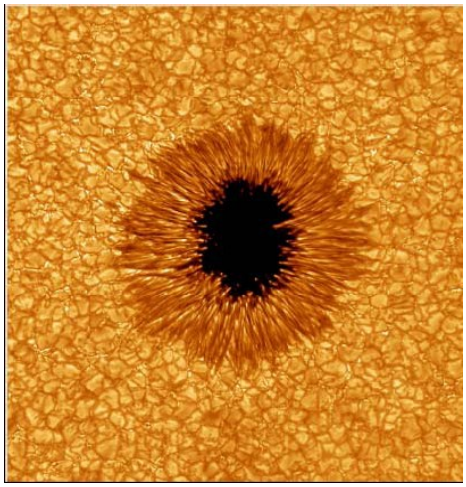
The usual Merit Awards for innovative telescope construction were rather sparse this year. There were only four entries, and one was not even a telescope (it was an astronomically-oriented camper). The keynote was by Trina Ray, from the Cassini mission team at JPL. She gave a great overview of the major discoveries of that highly successful mission to Saturn and a glimpse of what is in store for the future of Cassini.

Sunday was a continuation of a busy speaker schedule, including detailed talks on comets by Charles Morris and Steve Edberg and a historical look by Martin Carey at Lord Rosse's 72-inch telescope, the "Leviathon of Parsontown," which was the world's largest telescope during the 19th and early 20th centuries.

Unfortunately, I missed most of those talks because of opting for the highly worthwhile intimate tour of the Big Bear Solar Observatory, a half hour away from RTMC. BBSO is situated on a causeway in Big Bear Lake, affording a very stable ground temperature, which minimizes heat currents and maximizes seeing. It's new 1.6m (63-inch) telescope is heralded as the world's largest aperture and highest resolution solar scope. We did get up close and personal with the telescope and were truly amazed at the fine detail it produces.

In spite of the relatively low attendance, there were many interesting telescopes available for viewing and to admire the craftsmanship of both simple and sophisticated homemade designs. Dan Schechter and Jack Eastman both brought beautiful antique Clark refractors (3- and 6-inch apertures, respectively). Bob Pfaff brought up his superb and beautifully crafted Schmidt-Newtonian. Gerry Logan brought a 7-inch Schupmann Medial refractor.

A magnificent spectrohelioscope was open for business along telescope alley. It was fascinating to look through and scan spectral lines along the entire visible spectrum and to see how far my own eyesight could see into the UV and IR. With a few configuration changes, we could do the same with an image of the sun, looking for changing details with wavelength. Try that on your Coronado! Unfortunately, I didn't get the name of the owner/builder.



Many people complained about the low turnout of commercial vendors. But having fewer vendors has a plus side as well – it reduces emphasis on commercialization and consumerism. In my view, the true value of RTMC is the synergies of idea exchange, the chance to spend time with old and new acquaintances, the immersion in astronomical activities for several days running, the revitalization that accompanies getting away from the routines of life. All this in a peaceful and natural setting, but in rustic comfort with flush toilets, hot showers, and the choice of all levels of camping or heated indoor (or unheated outdoor) bunk rooms, convenient food service or the pleasure of fixing your own, and of course the option of deluxe accommodations and restaurants a half hour away.

For those of you who attended this year's RTMC Astronomy Expo, this should provide a reminder of the pleasant times we had there. For those who missed it, consider putting it on your calendar for Memorial Day weekend next year. It's worthwhile.

– Tim Hogle

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:

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***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.**

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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.

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