SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

November 2010 *Free to members, subscriptions $12 for 12 issues* **Volume 37, Number 11**

A double shadow transit of Europa and Ganymede is seen in this picture taken by Pat Knoll from Kearney Mesa, CA on 10/30/10.

OCA CLUB MEETING

The free and open club meeting will be held November 12th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Chris Butler will present 'SIX SISTERS: The Space Shuttle Program'

NEXT MEETING: December 10th

STAR PARTIES

The Black Star Canyon site will be open on November 13th. The Anza site will be open on November 6th. 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, November 5rd at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana. Next month the class will be offered on December 3rd.
GOTO SIG: TBA
Astro-Imagers SIG: Nov. 16th, Dec. 21st
Remote Telescopes: Nov. 22nd, Dec. 27th
Astrophysics SIG: Nov. 19th, Dec. 17th
Dark Sky Group: TBA

November 2010 President's Message

By Craig M. Bobchin

I want to start this month's message by apologizing for the lack of a President's Message last month. I fully intended to put one out, but life got in the way as it often does and time just slipped away. But I'm back for better or worse.

Election Season

While the national and state elections are taking center stage and will be over by the time you read this, our club holds elections for the board of trustees and officers on an annual basis. Nominations are taken at the November and December meetings and votes are taken up until the January meeting. You can mail in your ballots or deposit them in the ballot box at the meeting in January.

In order to run for a trustee position, there are a few basic rules. You must be at least 18 years old, and a member in good standing. This means that your dues must be current and you must have your pad/observatory fees up to date. You must also have been a member for at least a year.

In order to run for one of the officer positions (President, Vice President, Secretary, or Treasurer) All of the same criteria for the trustee are in effect plus you must have served on the board for at least a year.

If you do want to run for the board I encourage you to attend a board meeting. We meet every other month to discuss club business and make decisions to guide the club in a manner we hope improves the club. Board meetings are open to the general membership, but we do ask that you let someone on the board know so we can give you directions to the board meeting.

While all the current board members are standing for re-election, don't let that deter you from running. As in the rest of the club we value a diverse set of opinions and want to hear different perspectives.

We have seven trustee positions and the four officer positions.

What can you expect if you do join the board? For one, there is a lot of good discussion about how best to run the club and set policies that hopefully improve it. We allocate money for various club needs such as Anza House, and the Anza site in general. We also deal with how to grow membership and what to do about various astronomical goings in the Southern California area.

I can tell you from personal experience that my time on the board has been interesting, a learning experience and very rewarding. So I encourage you to throw your hat in the ring and run for the board. We love people who volunteer and it really does make the club better. Plus there are no negative political ads--heck, there are no political ads of any sort.

Other Goings On

In other club news, we still need people to help out at Anza for a general clean up day. There are many projects out at Anza that need doing. First is a general clean up of Anza house and the removal ot the old carpeting and replacement of that with linoleum tile. We also need to get rid of the old and broken furniture and refrigerator. If you can help out in this area contact myself, Barbara Toy or Steve Condrey and we will gladly accept your help.

Granted this should have been covered last month, but the Pacific Astronomy and Telescope Show (PATS) has come and gone for a third year. We had lots of help manning the booth during the two days and I would like to thank Barbara toy, Alan Smallbone, Dave Kodama, Don Lynn, Shelia Cassidy anyone else who I might have missed who helped out at the booth. I was there both days and while I did not officially work the booth on Sat. I did stop by and help out on ocassion. I did man it on Sunday and we had a pretty good turn out and I spoke with several individuals that were impressed enough with Anza that they were considering joining just for access to the site itself. One of these was a gentleman from Simi Valley, which would be quite a commute for him.

Well until next month, here's wishing you clear dark skies.

TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE

#11 Venus in Daylight

By Helen Mahoney

When the sun comes up, the rest of the objects in the sky don't go away. They are harder to see, obviously, but seeing many of them is still possible. Some require binoculars or a telescope, but for much of its orbit, Venus is bright enough to be seen naked eye.

Venus is the closest planet to earth, coming within about 23.7 million miles of the earth at the closest approach, and its carbon dioxide and sulfuric acid clouds cause it to reflect a large fraction of the sunlight that hits it. (This is called albedo, and Venus has an albedo of 0.67, compared with that of the earth 0.37 and the moon 0.12.)

The orbit of Venus is inside of Earth's orbit, so we see Venus go through phases like the moon. Coming toward the Earth, it is east of the sun, and appears as the Evening Star; going away from the earth it is west of the sun, and is the Morning Star. When it is the Evening Star, and at its greatest elongation (distance from the sun from our vantage point), it's half lit, like a first quarter moon. As it drops in between earth and the sun, it moves closer to us and becomes a larger crescent. It becomes brighter and brighter—to a magnitude of *minus* 4.4. After that, the crescent becomes thinner and the brightness drops as Venus itself drops into the sunset.

Venus was captured at 1:45 PM PST on December 4, 2005 by Bruce Lucero from Garden Grove, CA. Bruce used an 127mm Orion Starmax with a Canon Powershot A40 camera to compose this image.

I like to find Venus in daylight and amaze my friends. How I do it is simple: as soon as I see Venus after the sun sets, I make note of how many degrees away from the sun Venus is. That helps me to know where to look in the day sky. The easiest time to see it is when it is near the moon. If you see the positional relationship between the moon and Venus in the evening, then the next day you can find the moon in the day lit sky and figure approximately where Venus should be. When Venus is higher in the sky, you are seeing it through less atmosphere, and it thus stands out better.

Also, to be able to pick Venus out from the bright background sky, you need to focus your eyes on infinity, which is not easy to do. When the moon is close to Venus, you can focus on the moon, and then look over to Venus. Or, you can use a high flying jet to help you focus on infinity.

I was able to see Jupiter naked eye before sunset one time at Anza. It was close to Venus, so I found Venus and then Jupiter popped in. People began lining up behind me to follow my finger pointing to the pair. Most of them were able to pick both of them out, too.

I have also seen Jupiter and a couple of first magnitude stars in the day time with a telescope. One way to do it is to use a go-to telescope. If you carefully align it during the night and keep it running, then it can be used to locate planets and even some first magnitude stars in the day. Be careful not to let the scope hit the pier as it tracks all night.

One day, I was in a hospital parking lot looking up at the crescent moon to find Venus, which I knew was close by. A man passing by asked what I was looking at. I pointed to the moon, preparing to tell him I was using the moon to find Venus. "My gosh!" he exclaimed. "The moon is out in the day time!" He then ran off to tell others. He was so excited about seeing the moon that I didn't get a chance to tell him about Venus. But I did see it.

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AstroSpace Update

November 2010
Gathered by Don Lynn from NASA and other sources

Exoplanets – On September 15 scientists announced that they had analyzed the rate of finding exoplanets and the trend to finding smaller and smaller ones at more difficult-to-measure distances from their stars and determined statistically that we are likely to find an Earth-like planet (a rocky planet at a distance from its star where the temperature is right for liquid water) in 8 more months.

Fourteen days later, astronomers announced the discovery of Gliese 581g, an exoplanet with a size that makes it likely rocky, at a distance from its star where liquid water could exist, clearly the most **Earth-like planet** found yet. The star Gliese 581 is a red dwarf star that was already known to have 4 planets (b though e), and the new announcement was that 2 more (f and g) have been found. The system is only 20 light-years away in Libra. 581g has 3.1 times the mass of Earth, is roughly 30% larger in diameter, and has roughly 30% higher surface gravity, which should be enough to hold an atmosphere. Its year (orbital period) is only 36.6 Earth days. The year is so small because the star is so dim, and therefore the temperate zone is much closer, causing the orbital period to be short. Tidal forces should have forced one side of the planet to always face its star, so one side would have forever day and the other forever night. This would probably limit liquid rain, rivers, lakes, etc to the areas near the line between day and night, as the rest would be too hot or too cold. 6 planets are the most known in any exoplanet system. The discovery was based on analysis of 11 years of spectroscopic data, in which was detected the complicated wobble in the star's motion caused by the gravity of the moving planets. A cautionary note: a different team of astronomers, who also took years of data on Gliese 581, has stated that they are unable to find any signal indicating the existence of planet g.

Exoplanet atmospheres – One of the surprises arising from discovery of the "hot Jupiter" class of exoplanet is that many are puffed up beyond what theory says they should be for their mass and temperature. Astronomers have been looking for a source of energy that would puff them up. New research suggests that ionized winds passing through magnetic fields may be this source. The magnetic field resists ionized (electrically charged) atmosphere, inducing drag that heats the atmosphere beyond the temperature supplied by the planet's star, and the extra heat puffs up the air. Calculations show that magnetic fields of about 10 Gauss would be sufficient to explain observed puffing. Jupiter's magnetic field is known to range about 4-13 Gauss, so 10 is a reasonable guess at how strong fields will be at "hot Jupiters".

Ring formation – There are 3 theories of how the rings formed at Saturn: 1) a moon broke up from tidal forces, 2) a moon broke up by collision, or 3) the material now in the ring was never able to clump sufficiently to form moons. But none of these explains how the rings ended up nearly pure water ice. The material out of which the moons and rings were made should have included a substantial portion of rock in addition to the ice. Many of the Saturnian moons indeed have substantial rock content. But some of the inner moons are nearly pure ice. A new theory explains all this. If the moon that broke up from tidal forces was huge, say Titan sized, then it would have formed a hard rocky core covered by a nearly pure ice layer. If the core were strong enough, it might survive passage through Saturn's areas of strong tidal forces, losing only the icy mantle to tidal breakup. The core would eventually fall into Saturn. The icy material stripped off became both the rings and the inner rockless moons. The only problem is that such rockless moons would form near where the rings are now, so this requires some force to cause them to migrate outward. Perhaps some gravitational interaction did this. A planned Cassini spacecraft observation will measure the mass of the rings, which may shed more light on ring formation theory.

Ring gap – The mystery has been solved of a gap in Saturn's C-ring that has been seen by spacecraft off and on for 30 years, changing shape and even disappearing. The gap is accompanied by a spiral vertical disturbance that hides it from some angles. The pattern rotates about Saturn once every 16 days, much slower than ring particles orbit at that point, so it is probably caused by gravity of the moon Titan, which has a 16-day period.

Titan atmosphere – In a recent experiment, scientists filled a chamber with atmosphere like that found on Saturn's moon Titan (nitrogen, methane and carbon monoxide) and injected into it radio-frequency radiation. The result created the 5 nucleotide bases used by life on Earth and the 2 smallest amino acids. Also aerosols were created that match the size of those detected in Titan's atmosphere. The experiment was inspired by 2 recent findings of unexpected material in Titan's atmosphere: high-energy oxygen ions and heavy molecular ions. The experiment tells us that it is possible to make very complex molecules in the outer parts of an atmosphere. Theories of how life arose on Earth generally have these complex molecules instead forming lower in the atmosphere with water present.

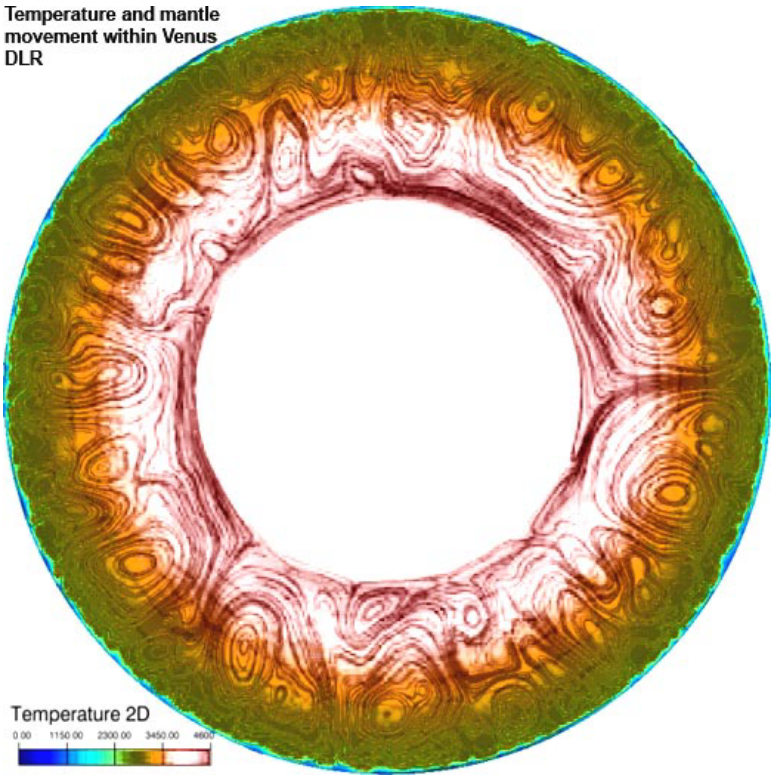
Tinted moons – Scientists using Cassini spacecraft data have learned that distinctive faintly-colored bands and splotches embellish the surfaces of Saturn's inner midsize moons. The patterns can be traced to particles drifting out of the E-ring and colliding with those inner moons. The source of the E-ring particles has been known for a few years to be the material thrown out of the moon Enceladus by its geysers. The temperature pattern recently discovered on Mimas, with a warmer region shaped like Pacman, is probably a result of the pattern of particles impacting Mimas. The colored bands and splotches were found by combining infrared, visible light and ultraviolet images of the moons, then using computers to emphasize faint differences. Some of the areas are rust colored and some bluish, perhaps due to different types of particles involved. The colored areas include Enceladus itself, since there is fallback of material to the source moon. Tethys, Dione and Rhea orbit more slowly than the E-ring, and so the splotches are on the trailing sides, due to particles overtaking the moons. The opposite is true for Mimas. Some of the bands on Rhea appear not to

be connected with E-ring particles, and it is being theorized that these are due to a present or past ring around Rhea, some of which has impacted the moon. Such a ring has been previously proposed from other evidence.

Cassini (Saturn orbiter) has detected sodium and potassium salts and carbonates in the water vapor plumes spewing from Enceladus. This implies a liquid ocean with dissolved bubbles beneath the ice surface. Some astronomers are calling it a Perrier ocean. The bubbly water seeps into chambers near the surface, the bubbles release, and the geyser erupts. The process helps release internal heat from the planet. The water cools when expelled, and some of it falls back into the subsurface chamber, gets recharged with salts and gas from the interior, and repeats. The heat flow has been measured (by Cassini) around the geysers at about 50 times the average of internal heat radiating out over the entire surface of Enceladus. For comparison, heat flow in the Yellowstone geyser area on Earth is about 30 times the average of the whole Earth. Enceladus averages radiating 3 times the heat per unit area as the Earth does.

Europa (Jupiter moon) is likely hiding a surprising amount of active sulfur chemistry below its surface. An experiment in a vacuum chamber using water and sulfur dioxide at the temperatures found on Europa (minus 225 - 300° F.) has found that they react quickly to form other sulfur compounds. The reaction proceeded in seconds up to a day, depending on temperature. It had been thought that such quick reactions would occur only in the presences of liquid water, at far higher temperatures. The reactions did not require the presence of light and proceeded even with dry ice (frozen carbon dioxide) present, which is known to occur on Europa. This means such reactions could be occurring on the interior, where light does not penetrate. Sulfur compounds, such as sulfur dioxide, rain down on Europa after being expelled by Io's volcanoes. The sulfur compounds produced in the experiment are known to react with other materials to produce yet more chemicals. Similar reactions could be occurring on Ganymede and Callisto, since they have ice and sulfur at similar temperatures.

Venus Express (European orbiter) has been imaging the vortex in the clouds at that planet's north pole, and found that it continuously changes shape. When the spacecraft first arrived, the vortex was double, but then the 2 pieces merged into 1. The vortex is roughly 2000 miles across, and rotates as a single unit, but with slowly changing shape. Using different wavelengths, Venus Express is able to see to different depths into the atmosphere and measure wind speeds at those different depths. Wind typically blows 60 times faster than the very slow rotation of the planet, so the atmosphere is said to "super-rotate". In the equatorial regions winds at different heights are often greatly different in speed; this is called wind shear. This shear reduces and disappears as one proceeds to higher latitudes; that is, the wind moves near the same speed at all altitudes near the poles.



Venus volcanism – A new computer simulation of heat movement over time in both the interior and atmosphere of Venus shows that this is the most probable sequence of events: When Venus was still hot from its formation, extensive volcanic activity released massive amounts of carbon dioxide into the atmosphere. This carbon dioxide and other greenhouse gases held the heat from sunlight within the atmosphere to reach very high temperatures. This kept the crust warmer, prolonging the period when molten rock could rise through the crust, resulting in continued volcanic activity and more carbon dioxide being released to the atmosphere. Eventually much of the internal heat is lost, and volcanic activity halts. The computer simulation showed that volcanic activity halts at different times for different locations on the surface. There is some observational evidence that volcanic activity has taken place on Venus in relatively recent geological times, and this may be explained by these differences by location seen in the simulation. Venus Express is continuing to look for evidence that volcanic activity might be currently occurring on the planet.

Phobos – Many astronomers believe that the moons of Mars, Phobos and Deimos, are captured asteroids. New study of Phobos suggests that it instead formed near its current location by accretion of material that was thrown off Mars by an impact. This may apply to Deimos also. Measurements show that Phobos is highly porous, that is, full of internal holes (voids). This would be true of a small body formed by accretion. Recent infrared observations show that Phobos does not match well with the types of materials found on asteroids. Phylosilicates (a type of mineral) have been found on Phobos, and these usually form in the presences of water on a planet-sized body. This fits with Phobos forming out of material splashed up from Mars. Phobos is in a nearly circular orbit, while a captured object is typically in a very elliptical orbit. The new study produced the most precise measurement of Phobos's mass, volume, and density (1.86 times that of water). This confirmed earlier results that implied more than ¼ of its volume consists of voids. A body this porous would probably have been torn apart during a capture event.

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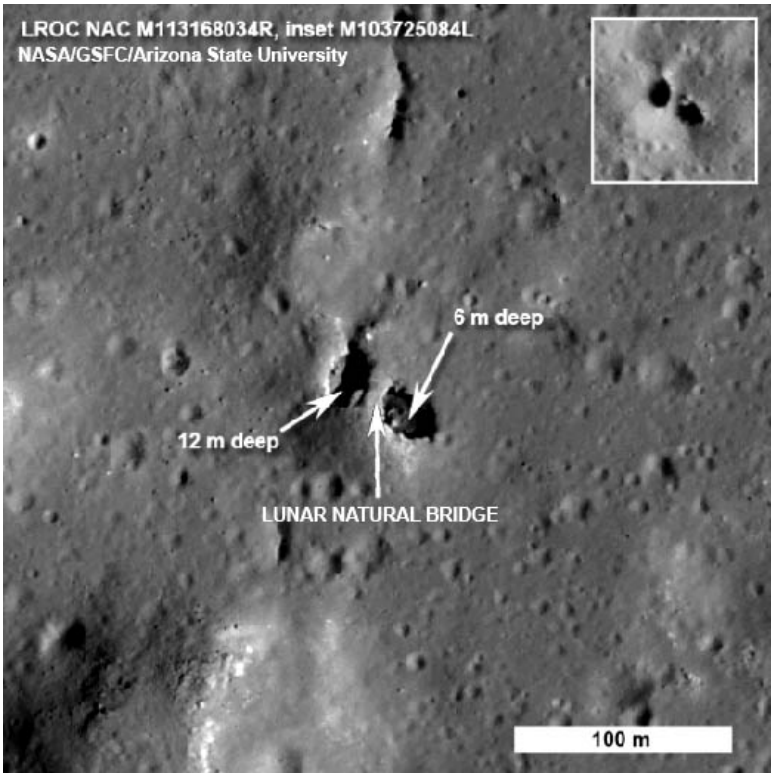
Herschel (space infrared observatory) has been observing Mars's atmosphere and has obtained an accurate globally averaged temperature profile. Also the first continuous spectrum of the Martian atmosphere in far infrared and submillimeter and the first complete set of water vapor and carbon monoxide content in far infrared and submillimeter were obtained. The atmospheric model that best fits this new data shows important differences from previous models. Some altitudes were found to be 18° F. colder. Content of oxygen molecules was found to vary with altitude, which was not known previously.

Martian methane – The Martian atmosphere contains trace amounts of methane. The observations of methane made by the Mars Global Surveyor have been collected to produce a map of where it is concentrated. The data showed that methane is rather short-lived at Mars, being destroyed in less than a year. In fact methane is destroyed so fast that its breakup by sunlight high in the atmosphere, the accepted theory for destroying methane, could not accomplish destruction that fast. This implies there is another means of methane destruction. The best theory is that windborne perchlorate is the means. Perchlorate was recently found in surface dust. The quick destruction, and the uneven distribution of methane over the surface, show that methane is being released at several locations on the planet. It was also found that methane concentration varied by season, indicating more was released during spring and especially summer. Two of the three regions with the highest concentration of methane are known volcanic regions, though it is believed that Mars volcanoes are all extinct. So this points to a possible volcanic source for the methane. But it doesn't explain the third region of concentration. The seasonal release of methane fits with the theory that underground bacteria are producing the methane. But since there is no evidence for bacteria on Mars, and no evidence of current volcanic activity, both theories need much further evidence before they can be accepted.

Lunar water – The recent discovery of small amounts of water forming and then dissipating daily on the Moon have prompted scientists to determine what effect that has on the exosphere (extremely thin atmosphere). It is calculated that vapor from the water dissipation and its byproduct hydroxyl should make a noticeable haze. This is of particular concern to scientists working on Chang'e-3, the planned Chinese lunar lander that will include an ultraviolet telescope, which would be hindered by such a haze.



Lunar Reconnaissance Orbiter (LRO) has imaged a couple of natural bridges on the Moon. On Earth, natural bridges usually occur where erosion has worn a hole through a rock wall, but on the Moon there is no wind or water to cause erosion. The best studied bridge on the Moon has been found to be a lava tube, a cavern left when long-ago lava flowed just beneath the surface and then stopped its flow. 2 places caved in where the roof of the lava tube was thin, leaving a bridge between the cave-ins.

Data from **LRO** has shown that the Moon's surface is more complex than previously thought and that it suffered 2 distinct bombardments early in its history, not just the 1 previously known. It was found that some areas have a different distribution of sizes of impact craters, and the conclusion was made on that basis that 2 different bombardments occurred. 5 separate areas were found to be rich in silica materials. These were found in the global high-resolution infrared map being made from LRO data. The silicic regions contain such materials as quartz and feldspar, minerals generally present after rocks have undergone extensive processing. Those areas were already known to possess more thorium than normal, another sign of processing. Lunar geology has long broken the surface down into 2 general categories: the highlands, rich in calcium and aluminum; and the basaltic "seas", giant impact basins filled with solidified lava, abundant in iron and magnesium. While most of the Moon, as seen in the LRO map, has been found to fit these 2 categories, there are also areas with more sodium than typical for highlands. Scientists are trying to figure out if those areas formed with excess sodium, or whether later geological processes affected the sodium content. One thing that has not been found in the LRO map is unaltered mantle material. It had been expected that some large impact craters would have penetrated into pristine mantle material and left it exposed. Scientists are guessing that such areas may simply be too small for LRO to detect or perhaps too much mixing of material occurred after mantle was exposed.

Neptune Trojans – 2 months ago this column reported the discovery of a new Neptune Trojan, one of those asteroids that share Neptune's orbit, but stay about 60° ahead or behind the planet. A new computer simulation of Trojans shows that most Trojans in Jupiter's orbit should stay there for billions of years, while Neptune Trojans are not as stable. The typical life at Neptune's orbit is about ½ billion years, after which some passing body will gravitationally disturb it out of Trojan orbit. Possible orbits after such a disturbance include short-period comet and Centaur asteroid (a group outside the main asteroid belt). The authors of the new

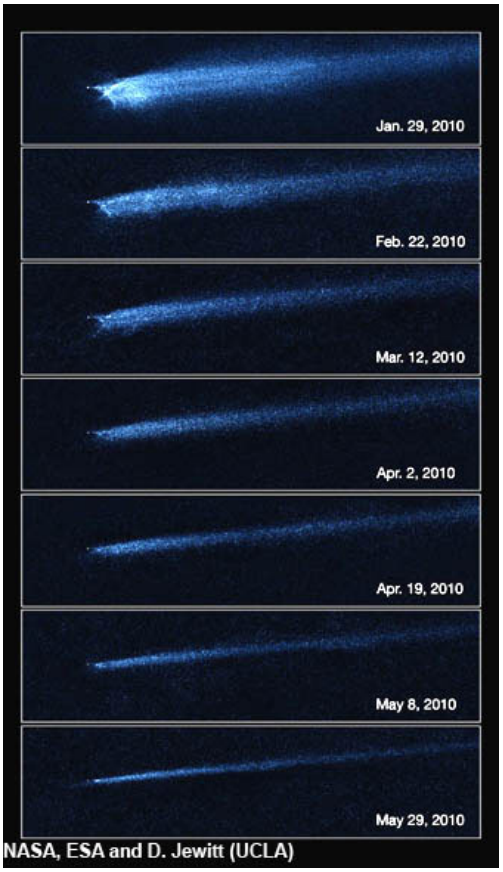
computer study believe that a substantial fraction of the short-period comets that we see were once Neptune Trojans. They also attribute a substantial portion of the objects hazardous to Earth to former Neptune Trojans.

Asteroid water – The second asteroid in the main asteroid belt, 65 Cybele, has been found to contain substantial amounts of water ice on its surface. The first was 24 Themis in April. Previously asteroids in the main belt were thought to be very dry, but it now appears that substantial ice may be included in main belt asteroids since their formation. Icy objects were thought to have formed farther away from the Sun than this. Planet formation theory may have to be adjusted. The Earth's water (oceans, etc.) may have come from asteroid impacts early in its history, rather than comet impacts (the principal theory for Earth's water).

Rosetta (comet mission) has found that Lutetia, the asteroid it recently encountered, is covered by a 2000-foot thick blanket of rocks and dust, similar to the regolith that covers the surface of our Moon. It probably consists of pulverized material that has accumulated over billions of years from impacts. The thick covering softens the sharp edges of impact craters in many of the images. It remains to be seen if this covering is typical for asteroids of this size.

Hayabusa (asteroid sample return mission) – About 100 very tiny particles have been removed from the 1st of 2 sample return capsules of Hayabusa, which visited asteroid Itokawa. It is hoped that these are asteroid dust, even though the sample mechanism misfired. The particles are being examined by electron microscope and particle accelerator to rule out that they might be contamination rather than asteroid material. So far the examination showed that the particles are not made of the same material as the chamber itself, ruling out one type of contamination. Full results are expected about February. The 2nd chamber, because of its position, should have received more splash when the Hayabusa struck the asteroid's surface, and is scheduled to be opened about the time I am writing this.

Asteroid formation – Recent observations of the Kuiper Belt, that ring of icy asteroids beyond Neptune, show that it has a substantial number of binary asteroids (about 30%), many of which orbit each other at large distances, and therefore are weakly bound by gravity. Current theory of how the Kuiper Belt formed is that icy asteroids would have to form closer to the Sun than where they are now found, so something must have pushed them out to the current location. This fit with the theory that Neptune would have to have formed closer in, and that gravitational interactions between the major planets would have pushed Neptune out, and Neptune in turn pushed out the Kuiper Belt. But this theory needs to be reexamined because that would have destroyed the loosely held binaries in the Kuiper Belt. The astronomers who made the observations of the binaries believe that the Kuiper Belt formed just where it is today.



X-shaped comet-like object updated – Last January astronomers thought they had witnessed a fresh collision between 2 asteroids, perhaps a week old, when images from the Hubble Space Telescope (HST) revealed a bizarre X-shaped object at the head of a comet-like trail of material (reported here in March). Further observations have now shown that the material is dissipating more slowly than expected, so now it is believed the collision took place about 11 months before discovery. The knowledge of how debris behaves in this case can be applied to the dusty debris disks around other stars, though they are too far to see such detail. The theory that best fits the data is that a small asteroid, 10-15 feet across, collided with a larger one, about 400 feet across, at high speed, about 11,000 mph. The particles produced range in size from 1/25 inch to 1 inch across. Collisions such as this are thought to be one of the main processes that change the asteroid belt over long time periods. It is possible that the event was instead a small asteroid whose rotation increased from sunlight pressure until it broke. Further observation will be made to try to rule this out.

Geminids – Most meteor showers have been shown to be caused by material cast off by comets. One exception is the Geminid shower, which consists of material from the asteroid 3200 Phaethon. Some have claimed that it must be a dead comet, one that lost its outer layers of ice, in order to have shed material like a comet in the past that created the meteor shower. However, last year Phaethon brightened by about 2 magnitudes, but the brightening didn't appear like that of a comet. A new study of observations of the brightening claims that a blast of solar wind which was observed ½ day before blew loose dust off the surface of Phaethon. The expanding cloud of dust was seen as the brightening. Lab experiments have shown that heat from the Sun during close passes can decompose rock sufficiently to continually supply dust on the surface, and ultimately sufficient dust to resupply a meteor shower stream (which loses material and must be resupplied). The study authors are calling this a "rock comet". Observations of Phaethon on its next pass close to the Sun will be made to confirm the "rock comet" theory.

STEREO (twin solar observatories) have observed 2 behaviors of coronal mass ejections (huge clouds of particles thrown off by the Sun) that were unexpected. The 1st is that mass ejections headed up out of the plane of the solar system change direction back into the plane. The 2nd is that mass ejections suddenly speed up when they reach the plane of the solar system. The 1st behavior

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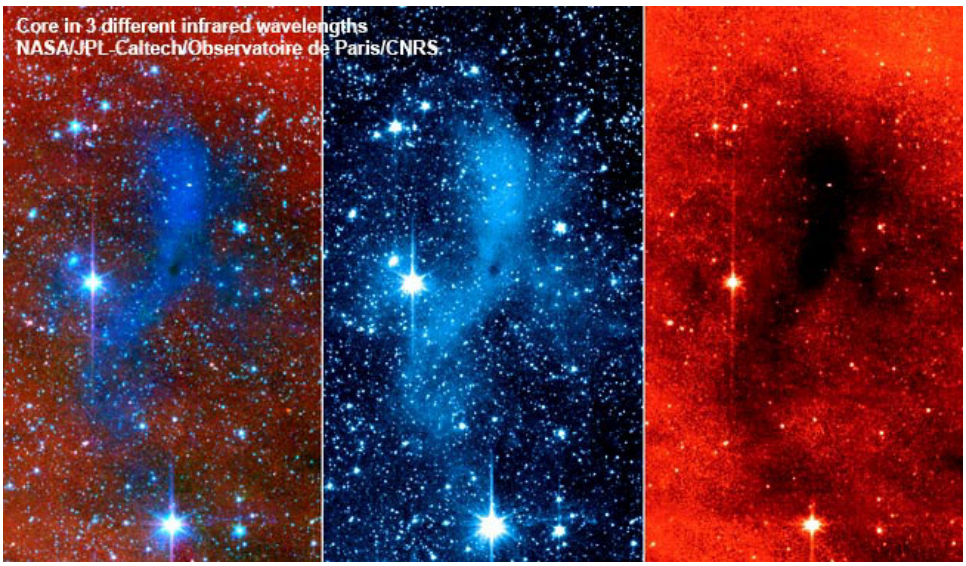
was found to be caused by the Sun's magnetic field deflecting charged particles, and the 2nd is caused by mass ejection particles being caught up in the solar wind, which is moving faster. The discoveries were made possible by using multiscale image processing, a technique used in medical imaging, but new to solar astronomy. It sorts the objects in an image by size, and was used to identify and track features in mass ejections and solar wind.

IBEX, which observes the boundary of the solar system, where solar wind meets the interstellar gas, has completed its second scan of the entire sky. It shows that the boundary is moving and changing since the 1st scan. The fact that the changes occurred in only a matter of months surprised scientists. The boundary gives off no light, so can be seen only by the neutral particles that it gives off. IBEX is a particle telescope.

Year of the Solar System – NASA has declared that the year starting with October is to be called the Year of the Solar System (YSS), to mark an unprecedented flurry of exploration. Not all the missions fit into the next 12 months, so it's going to be a Martian year (about 23 months). These events are scheduled: Comet Hartley 2 passes close to the Earth (October) and the EPOXI/Deep Impact spacecraft (November); O/OREOS is launched, a shoebox-sized satellite to test the durability of life in space; NanoSail-D, a solar sail, is launched, on the same rocket as OREOS; Japan's Akatsuki Venus Climate Orbiter enters Venus orbit (December); Stardust Next encounters comet Tempel 1 (February); MESSENGER enters Mercury orbit (March); Dawn enters Vesta orbit (July); Juno is launched to Jupiter (August); GRAIL is launched to orbit the Moon and map its gravitational field (September); Curiosity nuclear-powered rover is launched to Mars (November) and lands (August); rover Opportunity reaches Endeavour Crater (mid-2012), where it can see huge amounts of Martian geological history in the crater walls; Dawn leaves Vesta orbit to travel to Ceres. This is all in addition to continued operation of other currently active spacecraft: solar (6), Venus (1), lunar (2), Mars (4), Saturn (1), Pluto (1), beyond the planets (2), and space telescopes (at least 12).

Quasars – Astronomers using the new spectrograph on HST observed a very distant quasar in order to find spectral lines impressed upon the quasar spectrum by otherwise invisible gas clouds through which the light passed on its way to Earth. What they found was that from 11.7 to 11.3 billion years ago, gas between the galaxies became so hot that helium became ionized (its electrons knocked off), apparently due to a burst of energy from quasars. Other previous observations had shown that this same time period was when the largest number of quasars ever existed. The resulting hot ionized helium then resisted collapse into stars (due to its heat pressure), essentially stunting star formation for some time, until the helium could cool down. It was already known that a burst of energy had done the same thing to hydrogen nearly 2 billion years earlier, but that earlier burst was caused by the light of the first blasts of star formation. Further similar observations will be made on other very distant quasars to make sure that this was a universal phenomenon, not local to the direction of this one observation.

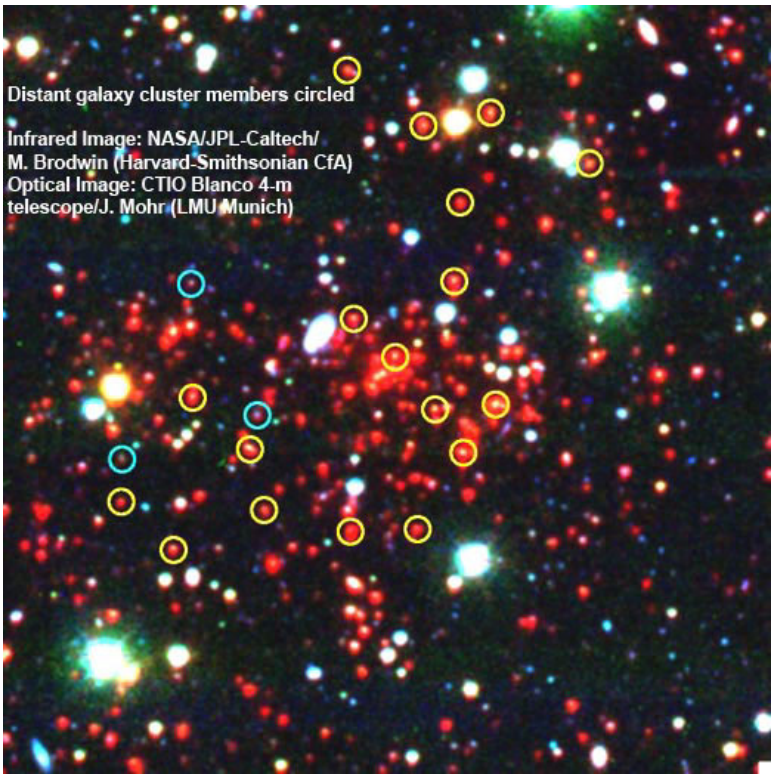
Magellanic Stream – The Small and Large Magellanic Clouds are 2 dwarf galaxies that apparently orbit the Milky Way. It has been known for some time that a structure of hydrogen gas connects the Clouds (called the Magellanic Bridge), and that a stream of gas trails behind them (the Magellanic Stream). It has generally been agreed that the tidal forces of the Milky Way formed these gas structures. But some recent studies showed that such forces were insufficient to form the gas structures unless the orbit of the Clouds is closer to the Milky Way than it appears to be (The orbit of the clouds is somewhat uncertain because they have not moved detectably across the sky in the centuries they have been observed.) A new computer simulation of the Clouds' motions shows that the Clouds likely passed close to each other in the past, and the tidal forces of the Large Cloud on the Small caused the Bridge and Stream to form. Tidal forces from the Milky Way are now distorting the Stream, but this has occurred after the Stream formed.



Coreshine – Astronomers have discovered a new phenomenon termed "coreshine". The dense cores of dark nebulas were found to act like a reflection nebula at certain infrared wavelengths. At other infrared wavelengths the cores are dark, and in visible light such nebulas completely block the light from stars behind and within. Young stars and planetary systems form inside such dark nebulas. The discovering astronomers have found coreshine on dozens of dark cores. The wavelengths of infrared light that participate in coreshine show that the cores contain dust of size about a micron (1/25000 inch), which is 10 times the size that was predicted theoretically. The dust grains grow as the cores move toward star formation, so this unexpectedly large dust shows that the star formation process had proceeded farther than expected. Observing coreshine can be used as a tool for assessing the ages of dark nebulas.

Galaxy growth – In the recent past many astronomers believed that collisions of galaxies were the only cause for growth of galaxies. New observations made with the Very Large Telescope in Chile suggest that galaxies also grow by accreting material from hydrogen and helium gas that permeates the space between galaxies. The study observed a group of distant galaxies, so we are seeing them as they were many billions of years ago, had concentrations of only hydrogen and helium at their cores, not the mix with heavier elements found in the cores of galaxies now. This could happen only if the galaxies studied were accreting hydrogen and helium from their surroundings. It had been thought that intergalactic gas was too hot in these early times to be pulled into galaxies, but recent theoretical work has shown that streams of cold gas can exist between the hot gas. It is probably such cold streams that are being observed in the new study.

Planck's goal is to survey the entire sky for cosmic microwave background (CMB) radiation, but over a wider range of wavelengths and finer resolution than done before. This will allow identifying all the foreground objects so that they can be subtracted, giving a more precise measurement of the CMB. A byproduct is that it provides a map of all foreground objects (galaxies, stars, nebulas, dust, etc) in microwaves (short radio wavelengths) and submillimeter wavelengths (bordering on far infrared) that other astronomers can use. In this map has been found the 1st supercluster (that's a cluster of clusters) of galaxies discovered by Planck. The XMM Newton spacecraft confirmed the supercluster in X-rays. Planck found the supercluster by looking for the Sunyaev-Zel'dovich Effect, which describes how the CMB is distorted as it travels through a galaxy cluster, due to the effects of electrons in the intergalactic gas.



South Pole Telescope (microwave telescope located – you guessed it – at the Earth's South Pole) has found a very massive cluster of galaxies so far away that the (microwave) light we are seeing left there 7 billion years ago, when the Universe was just under half its current age. It is the most massive galaxy (800 trillion Sun's masses) known that is this far away. It contains hundreds of galaxies. The cluster is full of old galaxies, meaning the cluster had to have formed within the first 2 billion years after the Big Bang. This discovery, like the one above, was made by finding the Sunyaev-Zel'dovich Effect. At the time light left there, the cluster was almost as massive as the nearby Coma galaxy cluster, but should have grown in the last 7 billion years to 4 times that size. The discovery was confirmed by observations with the Spitzer infrared space telescope and the Magellan telescopes in Chile. The goal of the South Pole Telescope's current observations is to find a large sample of massive galaxy clusters in order to measure the equation of state of dark energy, the force that is causing the expanding Universe to accelerate.

Space budget – Congress has passed a new NASA budget and the President has signed it. The budget differs from the President's original proposal in that it: moves earlier the schedule for developing a heavy lift rocket that will be rated to carry persons (but still heavily financed by private companies involved), aims at flying people to an asteroid by about 2025, continues work on the Orion deep-space crew vehicle, somewhat slows the funding for developing commercial spaceflight, and adds one more Shuttle flight (see below). The other features proposed by the President generally remain: dropping manned lunar plans, dropping the Ares rocket, extending the use of ISS until at least 2020, slightly increasing NASA funds, depending on private industry to develop person-rated rockets for trips to ISS (in addition to the existing Russian rockets).

Instant AstroSpace Updates

MAXI, the X-ray camera mounted on the outside the Japanese KIBO laboratory module in the International Space Station (ISS), has discovered an **X-ray nova** in Ophiuchus.

Cassini has observed the cloud patterns change on Saturn's moon **Titan**, in response to the changing season there. Some of the largest clouds have been seen, some of them in the equatorial regions, that have previously been fairly cloud free.

Venus Express has been studying **lightning on Venus**, and found that the rates of discharge, intensity and spatial distribution are similar to those of lightning on Earth. This is surprising considering that the Venusian atmosphere is nearly 100 times higher pressure, 900° F. hotter, and made of different gases than Earth's.

The mirror has been cast and the site chosen (Haleakala in Hawaii) for the Advanced Technology Solar Telescope (**ATST**), a 4-meter adaptive-optics Sun telescope, by far the largest and highest resolution such instrument. Completion is planned for 2017.

(continued next page)

Astronomers have been observing dwarf planet **Eris** and found that its surface is much like Pluto, the planet that Eris demoted. About 90% of Eris's surface is nitrogen ice and 10% methane ice, similar to Pluto.

Chang'e 2 (Chinese spacecraft) went into orbit about the Moon in early October, and will eventually settle into a 60-mile high orbit to map the Moon for at least 6 months and find a suitable spot for a future lander mission.

Popular Mechanics magazine gave the **LCROSS** mission their Breakthrough Award for innovation in science and technology. LCROSS detected water and much other chemistry in the plume thrown up by the impact of the spacecraft's rocket body near the Moon's south pole.

Kepler (orbiting planet search telescope) was chosen for the NASA Software of the Year Award for the innovative computer programs that find and measure planets as small as Earth passing in front of the 160,000 stars being continuously imaged.

WMAP (cosmic microwave background telescope) has completed its 9-year mission, which determined the most precise measurements of the age and constituents of the Universe.

WISE (orbiting infrared telescope) has warmed to its final temperature (minus 334° F.) now that its frozen hydrogen coolant is gone, but continues repeating its all-sky survey with the 2 detectors that still work at elevated temperature, in order to find what changed or moved since the first survey. It has so far discovered 19 comets and 33,000 asteroids, including 120 near-Earth ones.

The new NASA budget contains funds to launch next summer the spare **Space Shuttle**, if it is not needed for a rescue mission (and that has never occurred yet), as a supply mission to the ISS, to better prepare it for years of use after the Shuttles are retired.

FOR SALE:

5.5" f3.64 Celestron Comet Catcher. includes eyepiece and photo tripod+original case and mounting rings. $275

Celestron 15x70mm 'Skywatcher binoculars' with case. $65

Super Abbe orthoscopic eyepieces (1 1/4" dia.) 4.8;7.7;10.5 and 16.8mm $25 each or $90 for whole set.

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Orion EQ-1 mini mount with RA drive and connections for small scopes $75

All items in excellent conditions. I can meet with interested parties in local OC area.
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Report from the DPS Convention

by Bob Buchheim

The 42nd annual meeting of the Division for Planetary Sciences of the American Astronomical Society was held at the Pasadena (CA) Convention Center in early October 2010. Roughly 900 attendees filled five full days with technical presentations, workshops, and poster papers spanning the wide range of planetary science topics. Working from the most-distant inward, the objects under study included extra-solar planets, trans-neptunian objects, satellites of the outer planets, spacecraft data from Saturn, Jupiter, and Mars, trojan, main-belt and near-earth asteroids, short-lived Earth satellites, and (on the home world) computer simulations of everything from solar system dynamics to hypervelocity impacts.

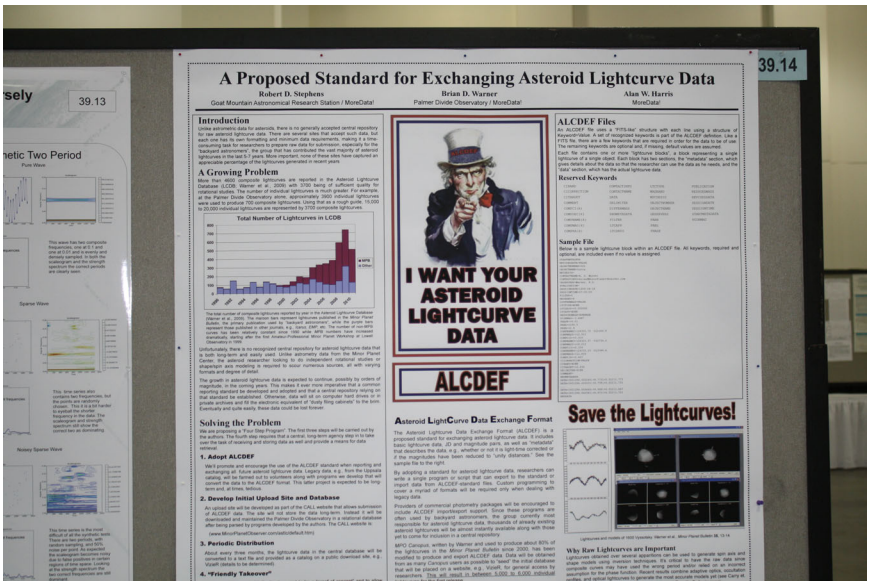
A break in the DPS meeting – perhaps the highest density of IQ per square foot that the Convention Center has seen!

This is a meeting for professional astronomers, but it was impressive to see that quite a few non-professional participants were in attendance, and that some of them presented papers.

OCA members David Snead and Shelia Cassidy were there (did I miss anyone?) Shelia and I worked as volunteers during the meeting; this, by the way, is a good deal – free registration in return for 20 hours of easy work assignments.

Three papers may be of particular interest to OCA's to backyard scientists.

SAS's Brian Warner gave an oral presentation of "Potential Biases in Future Asteroid Lightcurve Surveys". He highlighted the pitfalls of attempting to use sparse data to interpret asteroid rotational properties: such data can miss unusually short or long periods, small-amplitude lightcurves, binary objects, and tumblers (all of which are of special interest). There is an ongoing need for high-quality complete lightcurves of such objects. In a companion paper, Dr. Alan Harris showed some specific cases that illustrated these pitfalls. His message was "don't try to use sparse data to describe the statistics of a population".



Brian Warner, Bob Stephens (from the Riverside Astronomical Society), and Dr. Harris also presented a description of "A Proposed Standard for Reporting Asteroid Lightcurve Data" (ALCDEF). There has long been a need for a universal archive of asteroid lightcurve data, and it appears that we are on the verge of having one.

Look for a complete description of the database, the procedures for using it, and examples of what it can do, at the May 2010 Symposium of the Society for Astronomical Sciences at Big Bear CA.

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