SIRIUS ASTRONOMER

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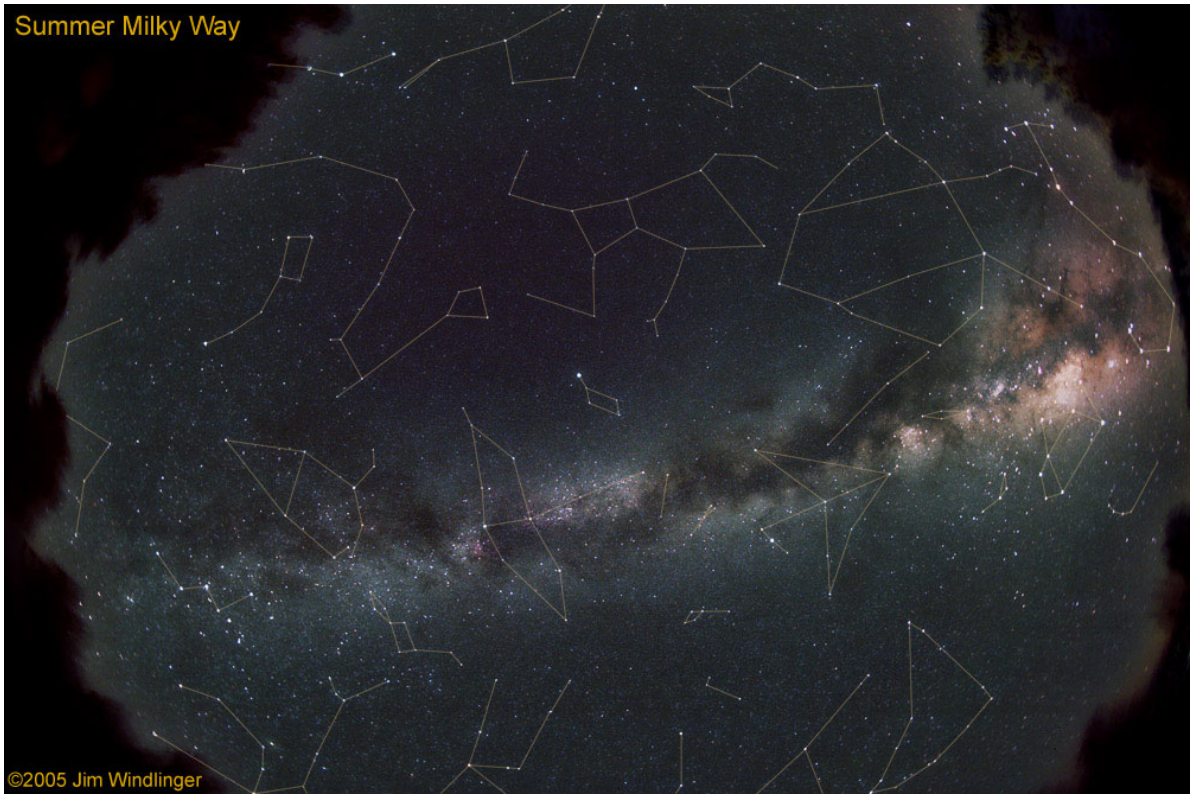
The Newsletter of the Orange County Astronomers

August 2010 *Free to members, subscriptions $12 for 12 issues* **Volume 37, Number 8**



A fisheye view of the Summer Milky Way, with the summer constellations marked, as captured by Jim Windlinger on September 2, 2005. Catch these constellations now--it's not much longer before they're gone, and we're on to winter!

OCA CLUB MEETING

The free and open club meeting will be held August 13th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Dr. Robert Piccioni will present 'Einstein for Everyone'.

NEXT MEETING:
September 17th (NOTE: Third Friday in September)

STAR PARTIES

The Black Star Canyon site will be open on August 14th. The Anza site will be open on August 7th. 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, August 6th at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.
GOTO SIG: TBA
Astro-Imagers SIG: Aug. 17th, Sep. 21st
Remote Telescopes: Aug. 23rd, Sep. 27th
Astrophysics SIG: Aug. 20th, Sep. 17th
Dark Sky Group: TBA

August 2010 President's Message

by Craig Bobchin

As I write this month's president message it is late July almost August and people are winding up the summer and starting to get prepared for school and the end of vacation season.Â The club's annual Star-B-Que is history and it was a good one by all accounts. As in years past we've had some wonderfulÂ food and good times. The skies were also pretty good by the reports I've heard.

Personally I hate harping on a subject, but I need to reiterate a few points that I've been raising the past few months.

The Anza site is a resource for all members, and while all members don't use it, enough of us do use it and those of us that do need to help maintain it. It's come to mine and the board's attention that there is maintenance needed around the site and especially at Anza House. There are a number of handles missing in the bathrooms. First I have to wonder where they've gone, and second, I have to wonder why no one has reported this to myself or any of the board members that are usually at Anza.

Anza house is still in need of cleaning and removal of some broken appliances and furniture. The board is considering several options in terms of how to fix, and maintain Anza house. Most of these involve expenses that the club would rather not incur. If we as a club work together to take care of the Anza house and rest of the site, it would be less expensive and instill a pride of ownership that we all share. So please try and abide by the old adage and "If you can't leave Anza House as in as good condition as you found it, leave it in better condition." Otherwise if current trends continue it won't be long before we as a club will not have a usable house at Anza.

Also if you want volunteer for the Anza House cleaning crew contact Steve Condrey, the Anza House house coordinator, or any board member. (NOTE: you can reach Steve for any immediate concerns about Anza House by e-mail at the address given on the back page of this newsletter)

I appreciate the members who have done their civic duty and created a defensible area around their pads. But there are still a few members that need to do so. remember that Fire season is upon us and we do not want to have any damage to the site. So please trim the weeds around you pad/observatory and if necessary your neighbor's pad/observatory this way when the inevitable fire season comes we won't have as much to worry about.

In regards to the Health & Safety of members at Anza, a few months ago we had a member suffer an apparent case of heatstroke at the site. You need to remember that there are only rudimentary first aid kits at the site. So members and guests are *on their own* at the site facilities.

In case of a medical emergency, dial 9-1-1. The typical ambulance response time is about 15-20 minutes. From Anza to a hospital, the trip will be about 40 minutes (unless helicopter evacuation is arranged).

We also had another rattlesnake sighting, this time on the steps heading up to the Kuhn Observatory. In the event that you see a rattle snake do not attempt to capture or trap it, you will likely get bitten. Also try not to kill the snake. Let it go about its way. If you are bitten, the current medical recommendation in the event of rattlesnake bite is to keep the affected limb elevated, iced if possible, keep victim calm, and call 9-1-1 to get the victim to a hospital for anti-venom. (*Don't* bother with the snake-bite kit).

There are have several pads available for those people that want a more permanent home at Anza. Contact Barbara Toy or Charlie Oostdyk for more information on the pads available.

The September general meeting date has been changed. This year like in previous years We have had to move our general meeting to the third Friday of September. this is due to our generous hosts Chapman University needing the room for their back to school activities. So DO NOT come to the meeting on the usual second Friday (9/10/2010), instead make sure you mark your calendars for the correct date of 9/17 2010. Hope to see you at the meeting!

Until next, month clear dark skies!

2010 Symposium on Telescope Science (Society for Astronomical Sciences)

report by Bob Buchheim

The 2010 Symposium on Telescope Science saw over one hundred amateur and professional astronomers gather in Big Bear, CA to share recent research results, methods, and instrumentation related to small-telescope astronomical science. This year's Symposium was a joint gathering of the Society for Astronomical Sciences (SAS) and the Center for Backyard Astrophysics (CBA). During two full days of technical presentations, the topics ranged from variable stars (of several different types) to asteroids to Jovian satellites, and included CCD photometry, video photometry, spectroscopy, polarimetry, and radar methods of observation. In addition, about fifty people attended the "day before" tutorial workshops on "Small-telescope Spectroscopy" presented by Olivier Thizy and "Calibrating CCD Imagers" presented by Richard Berry. Attendees were treated to new-product highlights from several of the sponsor companies, and quite a few impromptu networking discussions could be found surrounding the conference location. The event was rounded out by the traditional banquet and a wonderfully entertaining presentation by Chris Butler on "Our Little Corner of the Galaxy".

Epsilon Aurigae

The ongoing first-half of the eclipse of epsilon Aurigae naturally generated several presentations. Considering its 27-year interval between eclipses, this may not be a "once in a lifetime" event, but it is certainly an "only two or three chances in a lifetime" opportunity to gather data about this stellar eclipse. Dr. Bob Stencel described his photometric and spectroscopic results: modulation of the potassium line hints that there may be rings in the occulting object, and the reason for the excess H-alpha absorption is still a mystery. Jeff Hopkins showed the photometric evolution of the entry into eclipse, providing detail that isn't available for previous eclipses. He pointed out that continued consistent monitoring of this object is still important. The next effect to watch for is the mid-eclipse brightening, which might begin any time now and continue through late 2010 (and which was not captured at all during the last eclipse).

Gary Billings described his rapid-cadence observations, which gave the important "null result" that there are no coherent variations in brightness at periods between a few minutes to a few hours (to within about ±0.01 mag).
If the occulting object contains a mass of dust, we'd expect to see a change in polarization as the eclipse progresses. Gary Cole described the polarimeter he developed to search for this effect. So far the polarization of the star seems to be constant at 2.3% ±0.1%, but monitoring must continue throughout the eclipse.

Variable stars

The small-telescope research community has long needed an all-sky network of photometric "secondary standard" stars. Such a network will be a boon to both variable-star and asteroid studies. Tom Smith described the equipment, procedures, and progress of the APASS (AAVSO Photometric All-Sky Survey). This project will yield an all-sky net of photometry in B, V, g', r', i' bands, from magnitudes 10 to 16.5 – meaning that we can be pretty sure that several well-characterized stars will be in any CCD field of view. Creating accurate lightcurves of variable stars is an ongoing need, to augment the data coming from surveys and enable complete and accurate characterization of these stars. Jerry Horne made detailed follow-up observations of several stars that had been tentatively identified as RRc-Lyra stars by the ROTSE satellite data. He was able to see multiple periods, and in a few cases show that the RRc-Lyra classification was questionable.

Since this was a joint meeting with the Center for Backyard Astrophysics, there were naturally several presentations on cataclysmic variable stars, including an excellent introduction and overview of the physics and observational aspects of these stars, by Dr. Joe Patterson. Small-telescope photometry by amateur observers – who can collaborate to provide 24-hour coverage of a target star – is critical to characterizing the behavior of these stars.

Robert Koff presented the photometric study of cataclysmic variable TT Arietis, coordinated by CBA during its fade in late 2009, and supported by a large number of CBA and AAVSO observers. The lightcurves showed 1-2 magnitude "spikes" every few days, along with lower-amplitude, very rapid fluctuations. These CCD data can be evaluated in conjunction with contemporaneous UV (Galex satellite) and x-ray (Swift satellite) observations.

Mike Simonsen described the "Z CamPaign" to observe a particular type of dwarf nova whose prototype is Z Camelopardalis, which is being coordinated by the cataclysmic variable section of the AAVSO. These stars are in need of careful photometry and, because they are relatively poorly studied, there is good potential for finding something new and interesting.

Spectroscopy

John Menke presented his spectroscopic observations of the outburst of U Scorpii, a recurrent nova that burst almost right "on schedule" in January, 2010. With his 18-inch telescope and commercial (SBIG) DSS-7 spectrometer, Menke was able to detect the Doppler shift in the H-˜ line and the gradual changes in spectral line shape and depth as the eruption progressed. These data are likely to appear in upcoming publications about the eruption.

Olivier Thizy presented a practical – and ongoing – example of pro-am collaboration in spectroscopy focused on the Be stars. These are hot "B" stars whose spectral lines change from emission to absorption as the star cycles. Amateur records of H-alpha variability

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TOP TWENTY THINGS AN ASTRONOMER SHOULD SEE

14 Messier Objects Through Binoculars or a Small Telescope

By Helen Mahoney

I discovered the Orion Nebula. No, really I did. I know it was about 190 years after Charles Messier found it, but it *was* an independent discovery. The stars in Orion's belt were the first asterism that I observed and identified as a small child, and I noticed that they moved across the sky from week to week. Then they disappeared. I was pleasantly surprised when, several months later, I saw them again. I was about seven years old, and didn't know that the earth moved around the sun each year, but this observed progression of stars fueled my interest, and caused me to check out some astronomy books from the library.

The Orion Nebula, M42, seen with diffuse nebula NGC 1977 (left). This image was created by Alan Smallbone using a Borg 45mm ED with a 0.5X reducer. M42, like most of the Messier objects, may be observed with very modest equipment under the right conditions.

I asked my Dad if I could use his binoculars to see the stars. The binoculars were very big for me, and he warned me to keep the strap around my neck so I wouldn't drop them. (I always thought they were at least 20 x 80's, but I saw them at my brother's house a few years ago, and they were only 10 x 50's. I guess I was a lot smaller.) I scanned my three star friends of Orion's belt, and then moved over to the stars in the sword. I was shocked to see that the middle star was actually a glowing cloudy object! I ran into the house and reported my finding to my parents, and dragged them outside to see my discovery for themselves.

Interestingly, as my interest in astronomy was stimulated by my first sight of one of Frenchman Charles Messier's objects, Messier himself was excited by astronomy at the age of 14 with the appearance of Comet de Chéseaux, also known as The Great Comet of 1744. He eventually became an astronomer and, among other things, endeavored to discover other comets. He made many astronomical observations, and carefully recorded them. He did discover 13 comets, but he also encountered many comet-like fuzzy objects, and noted their celestial coordinates, so he would not mistake them for comets again. These were numbered and combined into his catalog, which we use to *find* these "non-comet" objects that got in his way. These objects (they number up to 110, but 102 and 110 may be duplicates) are referred to as Messier 1, 2, etc., or just M-1, M-2, etc. They include galaxies, open and globular star clusters, diffuse and planetary nebulae, and one supernova remnant, M-1, or the Crab Nebula. The numbering is the order in which Messier discovered them, and unlike the NGC (New General Catalogue) is not related to their position in the sky.

The fact that in the 18th century, Messier had fairly limited equipment to view his objects means that they are big and bright enough to be seen by even small telescopes and binoculars. They are a great place to start for beginning amateur astronomers, who usually also have limited equipment. Messier's catalogue makes it easy to locate the objects, especially if you have a good star chart, which will help you to find them by "star hopping." These objects are also programmed into all of the Go-To telescopes. A good resource book that shows photographs and coordinates of all the objects is The Messier Album, by John H. Mallas.

In March, the placement of the sun in the sky allows for all of the Messier objects to be seen in one night. This has given birth to an annual amateur astronomy ritual called the Messier Marathon. Starting right after sunset, M-77 and M-74 start it off, just emerging from the evening twilight before they set. M-30 rises shortly before morning twilight overtakes the night and ends the show, with all the others in between. A great book to guide you through the marathon is Don Machholz's Messier Marathon Observer's Guide.

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are being collected into the BeSS (Be star spectra) library where they are available to professional astronomers who are studying these systems. A measure of the success of this project is that there are now 10,000 spectra in the database, the vast majority of them contributed by amateur astronomers with modest-size telescopes and modest-cost commercial spectrometers.

Solar System

The mutual events of Jovian moons have been exploited for a variety of purposes over the centuries. Scott Degenhardt appears to have broken new ground by combining video observation of mutual events (occultations) with photometry of the video stream. He presented compelling evidence of the lightcurve signature of the atmospheres of Io and Europa. This is a remarkable achievement from a small ground-based system.

Asteroids continue to provide a diverse array of opportunities for amateur scientists. Dr. Lance Benner showed some recent very detailed radar observations of near-Earth asteroids, and noted that this is one of the subjects where pro-am cooperation has recognized value. Amateur asteroid astrometry improves the ephemeris so that the narrow-beam radar can be accurately aimed in three dimensions (RA, Dec, and Doppler range-rate). Dr. Benner suggested two important upcoming targets for which both pre-encounter astrometry and photometric lightcurves will assist in the radar data analysis: 2002 CY46 will be about mag 16.3 in August, and (3838) Epona will reach mag 15.5 in November.

Dr. Alan Harris discussed "the Divine Dypsomania" of asteroid studies – once you begin it is difficult to quit! – and he offered several topics (and challenges) for small-telescope research, such as characterization of recently-separated heliocentric asteroid pairs.

Asteroid phase curves present a challenging photometric project that can yield good rewards by providing relatively rare data (fewer than 150 phase curves have been published) and unique information about the surface properties of asteroids. Robert Buchheim described his observation and data reduction methods, and presented two phase curves created from his observations of 1130 Skuld and 535 Montague.

The very-nearest astronomical targets discussed this year were meteors. Wayne Green presented imaging system parameters and a data analysis approach to determine meteor trajectories from multi-station wide-field camera systems. Robert Stephens and Ralph Megna then reported on observations and trajectory analysis of a bolide observed at the Riverside Astronomical Society's Goat Mountain Research Station – one of which was coincidentally featured in an "Astronomy Picture of the Day" imaged by Wally Pacholka.

Telescopes

There are some projects where light-gathering aperture is the enabling parameter, and optical quality is relatively unimportant. Dr. Russell Genet described some of the science programs that can be conducted with a "light bucket" telescope – such as lunar and asteroid occultations, fast-cadence photometry, polarimetry, and (maybe) stellar intensity interferometry – and which should be within the reach of energetic amateur astronomers and small college observatories.

Education

One of the neat things about small-telescope research is that it is readily accessible to undergraduate students, and that astronomical projects provide the students with practical application of a variety of mathematical, statistical, and critical-thinking skills. Doug Walker described his experience injecting astronomical projects into a non-astronomy class.

The Future

Where is small-telescope research going? How and where are amateurs contributing to astronomical science? What are the "next big things" for pro-am collaboration? The professional astronomical community has its Decadal Surveys to focus funding requests and strategic goals. Aaron Price described a recently-organized initiative of AAVSO to conduct the first Decadal Survey of Amateur Astronomy and Astrophysics to assess these topics and make specific recommendations. White papers contributing to this goal are currently being solicited. To participate, go to www.decadal.aavso.org.

Dr. Arne Henden provided some "extreme photometry" challenges for the assembled multitude. Every nova is different and each one needs continued observations through at least one year after the outburst. Will more amateurs step up to this need and fill in the too-sparse data sets for many novae? One of the Cepheids in M-31 is "only" mag 19.4. Can any backyard scientists reproduce Hubble's groundbreaking observation of its lightcurve? HM Cnc is the fastest-known eclipsing binary, with a period of only 5.4 minutes. At mag 21, can any amateur reproduce its eclipse lightcurve and determine reliable times of minimum?

Conclusion

The 2010 Symposium provided a window into small-telescope science, and some of the opportunities for collaboration between amateur and professional astronomers. This was the 29th SAS Symposium, and the progress on display bodes well for the future of small-telescope astronomical science!

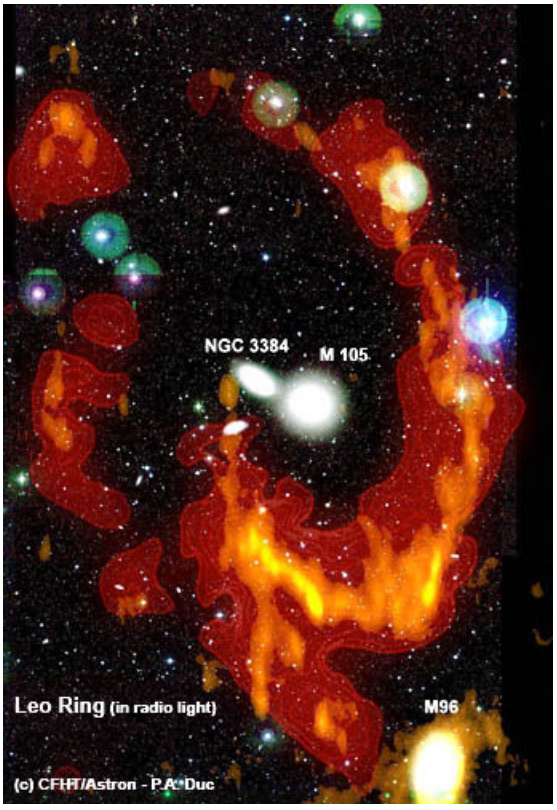
The 2011 Symposium will be held at Big Bear, CA on May 24-25-26.

AstroSpace Update

August 2010
Gathered by Don Lynn from NASA and other sources

Exoplanet wind – Spectrographic analysis of light shining through the atmosphere of an exoplanet named HD209458b during its transit (passage in front) of its star has determined that there are winds on the planet blowing at 3-6 thousand mph. The planet orbits quite close to its star (20 times closer than Earth is to the Sun), and tidal forces have locked one side of the planet to always face its star, so one side is really hot (nearly 2000 °F.) and the other cold. This huge temperature difference apparently drives the super-speed winds. The spectrum also allowed measurement of the planet's orbital velocity, and previous measurements had shown the wobble induced gravitationally in its star, and from these the masses of both and the orbit can be calculated. The planet is 60% the mass of Jupiter, and its star is 110% the mass of our Sun. The planet transits twice a week, taking 3 hours for each passage. The spectroscopic observations were made with one of the Very Large Telescopes in Chile. Carbon monoxide was found in the atmosphere. The exoplanet's atmosphere was found to be about as rich in carbon as Jupiter and Saturn, and so probably formed the same way, though it now orbits far closer to its star than where they must have formed. The planet and its star are located 150 light-years from us in Pegasus.

Another team observed the same **exoplanet's atmosphere** with the Hubble Space Telescope's spectrograph. Previous observation implied that the atmosphere was losing material to space, and that it ought to be blown outward like a comet's tail. The new observations showed the material moving away from the planet. Further, it showed different speeds for different parts. While the planet itself blocks 1.5% of the starlight during a transit, the atmosphere increases the blockage up to 8%. This confirms how bloated the atmosphere is, due to its high temperature. Silicon and carbon were found in the atmosphere, indicating that even what are normally considered solid materials are evaporating into the atmosphere and escaping to space, also due to the high temperature. At the current rate of loss it will take a trillion years to evaporate the entire planet. The Hubble was able to find more about this planet and its atmosphere than previous observations because it can take ultraviolet spectra, and the Hubble spectrograph has very high resolution.



Leo Ring – Back in the 1980s, astronomers discovered a huge (650,000 light-years wide) ring of cold gas near one of the trios of Leo galaxies (M95, M96 & M105), which has become known as the Leo Ring. It was seen only in radio light (with radiotelescopes), not in other forms of light until recently. What caused the ring to form has remained a mystery. Some thought it was primordial gas, which has never been in a galaxy or been subjected to star formation. New observations by the CFH Telescope in Hawaii made in visible light detected star formation in the ring, disproving the primordial theory. A supercomputer simulation of galaxies colliding then showed that M96 must have hit nearby NGC 3384 about a billion years ago in order to have created the Leo Ring as observed. M96's greater gravity stripped the gas from the other galaxy and flung it outward in a ring shape.

Hanny's Voorwerp, the green cloud of gas like no other, near galaxy IC 2497, has been imaged by high-resolution radiotelescope arrays. The observations show 2 bright and very compact sources with spectra that indicate one is a supermassive black hole at the center of IC 2497, and the other a jet emitted from the black hole. The radio astronomers concluded that the Voorwerp is glowing because radiation from the active galactic nucleus (specifically the jet) is heating the gas cloud to about 10,000°. These observations seem to have ruled out 2 other theories, that the glow of the Voorwerp was a light echo of a past outburst of the active galactic nucleus, or that the Voorwerp was heated by a shock wave. The observations also showed a burst of star formation is occurring near the center of the galaxy. The rate of star formation is 6 times as high as the famous starburst galaxy M82. The Voorwerp (means "object" in Dutch) was noticed by Dutch school teacher Hanny Van Arkel while she was classifying galaxies as a volunteer for the Galaxy Zoo project. This story is becoming so famous that a comic book (politely called a graphic novel) is being written about Hanny's discovery. It has been identified as a cloud of gas without any stars in it, and sporting a hole in it 16,000 light-years across. Why it is glowing has been the subject of much debate and cause for much observation. Current observations using the Hubble Space Telescope should soon add more information to the debate. Other studies are being made to try to find objects similar to the Voorwerp.

Black hole – Observations by the Chandra orbiting X-ray telescope and the Very Large Telescopes in Chile have discovered the most powerful jets known from a stellar-size black hole. The object is known as S26. The jets have blown a huge bubble of hot gas 1000 light-years across. Most other such jets blow bubbles less than 10 light-years across. It was calculated that the jets must have been active more than 200,000 years to create a bubble this large. The bubble is expanding at 170 miles per second. The jets are about 1000 light-years long. S26 is located in the outskirts of galaxy NGC 7793, about 12 million light-years away. The jet is very bright in

X-rays, comparable to ultra luminous X-ray sources. Most of the energy coming from the newly discovered jet is in the form of motion of material rather than as light. S26 is classified as a microquasar, which is either a neutron star or stellar-sized black hole with a companion star dumping material into it.

Neutrino mass – Cosmologists combining observations of the distribution of galaxies with observations of the cosmic microwave background have calculated that if the mass of the neutrino (sub-atomic particle) were to exceed 0.28 electron volts, that it would have smoothed the distribution of galaxies more than observed. Experiments with particle accelerators have been unable to pin down the exact mass of the neutrino, because it is too small to measure by current methods. It was proved to be non-zero some years ago. So the new calculation is the best upper limit known for the neutrino mass. It is less than a billionth of the mass of a proton. The masses of particles are often given in terms of the energy equivalent of the mass, using the formula $E=mc^2$ to convert. The electron volt is an extremely small unit of energy that is convenient for particle physicists. Data used for the new calculation was from the Mega Z survey of over 700,000 galaxies extracted from the Sloan Digital Sky Survey. Distances were calculated from the colors of the galaxies (spectra for redshift distances are not available for such a large number of galaxies), giving a 3-dimensional map of galaxy distribution. Larger surveys of galaxies are underway, which should allow a more precise calculation of the upper limit for the neutrino mass.

Cool brown dwarfs – Astronomers have found 14 of the coolest brown dwarf stars known. They are so cold and faint that they haven't been seen in visible light, so were found in infrared, by the Spitzer space telescope. They range from 350 to 620°F. Some planets are hotter than this. The WISE space telescope, now surveying the entire sky in infrared, is expected to find hundreds more of these, though only a few are known now. Brown dwarfs form like ordinary stars, but they never collect enough mass to permanently ignite nuclear fusion. They glow dimly from the heat of formation, then slowly cool, becoming even more difficult to find, even in infrared. Most of the newly found brown dwarfs belong to the T class of stars, but the coolest one is probably the first member of the proposed Y class, defined by its even cooler temperature than T class.

Star birth – Astronomers have glimpsed what could be the youngest known star. It is not yet a fully developed star and has just begun pulling in matter from a surrounding envelope of gas and dust. The Submillimeter Array Telescope in Hawaii and the Spitzer Space Telescope were used to find and identify it. Such objects are very difficult to detect because they are very short-lived and they emit very little light. It was found due to the emission of infrared light from the dust surrounding the object. Most protostars are more luminous than the Sun in infrared, but this object is less than 1/10 as luminous as the Sun, so the discovering team believes it is too dim to be a protostar yet. The object is ejecting streams of high-velocity gas from its center, implying that some mass has already concentrated, so it has moved past the prestellar phase. The team hopes to use the new Herschel Space Telescope to look for more of these objects.

Lunar carbon – A new analysis of a lunar sample collected on the Apollo 17 lunar landing has found and dated carbon in the form of graphite, which survived from about 3.8 billion years ago, when the Moon was heavily bombarded by meteorites. The analysis ruled out the other possibilities for the source of the carbon, namely contamination or exposure to the solar wind. The analysis used a new technique known as Raman spectroscopy, which is more sensitive and also allows scientists to create an image of the minerals. Some of the graphite appeared in a rare rolled form known as graphite whiskers, which scientists believe formed in the high-temperature reactions caused by a meteorite impact. The whiskers are up to 1/2500 inch long, and a bit thinner. Things learned about the impact history of the Moon apply to the Earth also, since similar material falls from space on both the Earth and Moon. However, the evidence on Earth from billions of years ago has been destroyed by weather and plate tectonics.

Titan (Saturn moon) atmosphere – The first experimental evidence has been produced that shows how ultraviolet light striking an atmosphere like Titan's (low pressure nitrogen and methane) can produce complex organic chemistry that incorporates nitrogen. At first the experiment was thought a failure, since the gas contained no detectable new nitrogen compounds, but then they noticed goo on the sides of the experiment tank, which proved to be just what they were looking for, but solid, not gas. The purpose was to show how some of the smoggy compounds are created in Titan's atmosphere, but the results probably apply to the Earth early in its history, since it is believed to have had a nitrogen-methane atmosphere then. Complex nitrogen compounds are thought to have participated when life developed on the early Earth. The analysis by mass spectrometer of the chemicals produced (in the goo) should help scientists know what to look for and with what instruments in future Titan missions that observe its atmosphere.

Cassini (Saturn orbiter) has made its closest pass by the moon Titan at an altitude of only 547 miles, and a relative speed of 13,200 mph. The low pass was made to get under Titan's ionosphere, which will shield the spacecraft from Saturn's powerful magnetic field, so Cassini can search for a much weaker field thought to emanate from Titan. If such a field exists, it probably means that Titan has a liquid metal core, where a dynamo effect would generate a magnetic field. About 3 years of planning went into the flyby to determine if it could go that far into the moon's atmosphere without overheating or losing orientation from air friction. The onboard thrusters had to fire about twice as often as predicted during the flyby to counteract the friction, but it was still well within capabilities. Apparently the atmosphere was a bit denser than had been previously measured. As luck would have it, the night before the flyby an alarm went off in the magnetometer, but spacecraft controllers were able to reset it and resume full operation before the flyby.

New Horizons (Pluto mission) fired its thrusters for about a half minute to change speed by 1 mph. This correction was made necessary because the hot nuclear electric generator that powers the spacecraft emits infrared light, which was accounted for in plans for the trajectory, but then the infrared was found to reflect off the antenna, slowly pushing the spacecraft slightly off the

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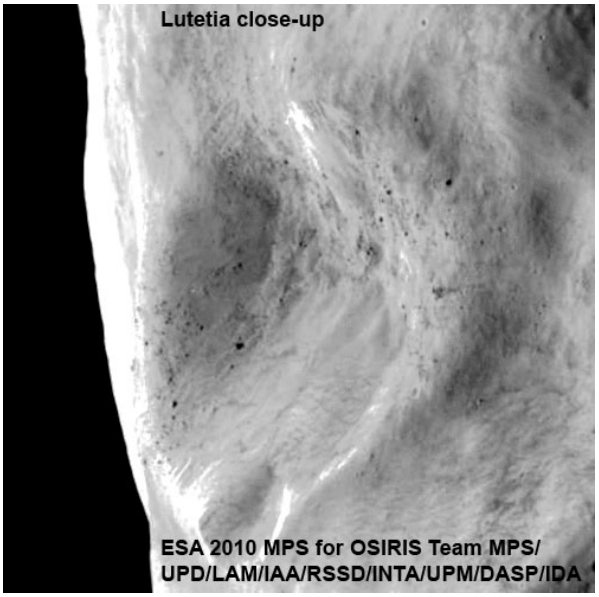
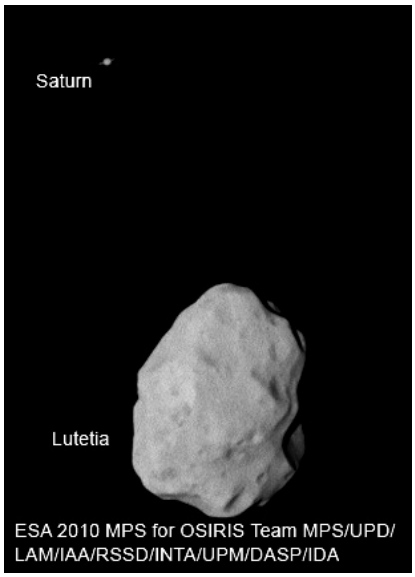
planned course. Though 1 mph sounds negligible compared to the spacecraft speed of about 40,000 mph, it is enough to make New Horizons miss some of its planned observations at Pluto in 2015. The spacecraft spends most of its cruise time in hibernation, waking up for check-ups, flyby rehearsals, deep space observations, and occasional thruster burns.

Kuiper Belt Object (KBO) – Astronomers across the globe teamed up to try to observe a KBO named 55636, a small body orbiting past Neptune, as it passed in front of a star. Only 2 locations (both in Hawaii) succeeded, but that was enough to determine the size and approximate shape. From the size, the albedo (reflectivity) was calculated. The result was smaller (about 190 miles) and more reflective than expected. This means it is covered with bright snow. This was unexpected because only much larger bodies have been found to have sources of snow, and all long-exposed ice or snow on other bodies has been found to be darkened. This was the first planned occultation by a KBO, though one previous such event was found in archived Hubble Space Telescope data. 55636 is believed (due to orbit similarities) to be a fragment of a collision between the KBO (and dwarf planet) Haumea and some other object about a billion years ago.

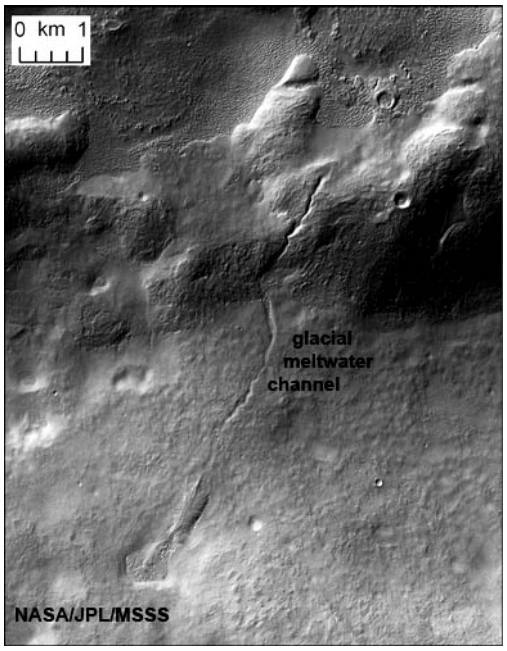




Rosetta (European comet mission) flew by Lutetia at a distance of under 2000 miles on July 11, returning 400 close-up images of the asteroid. Less than a dozen asteroids have ever been imaged close-up, and Lutetia is the largest of these, at about 83 miles across. Rosetta mapped the asteroid, measured its temperature and magnetic field (if any), looked for any trace of atmosphere, and did spectral analysis to determine surface constituents. First looks at the images showed grooves, landslides and boulder fields on the irregularly shaped and cratered body. Even after more than 1.5 centuries of study, it has not been determined whether Lutetia is an M-type (metallic) or C-type (carbonaceous) asteroid, due to puzzling spectral measurements. It is hoped that data from Rosetta will settle this question. Rosetta is on its way to a rendezvous with Comet Churyumov-Gerasimenko in 2014. It will spend most of the time until then in hibernation.

Asteroid sample return capsule from the Japanese Hayabusa spacecraft, which landed in June in the Australian outback, was opened and found to contain a few grains of dust and a trace of gas. Further analysis will show if the gas or dust came from the asteroid visited (Itokawa), or was contamination or interplanetary material. Telemetry at the time of contact with the asteroid in 2005 showed that the sample blaster failed to fire, so a little dust was all that could be hoped for. The flight was the first round trip to an asteroid, and the second spacecraft to contact one. The spacecraft suffered a large number of failures, including exhausting all chemical fuel, failure of all ion thrusters, loss of the lander sub-craft, failure (twice) of the sample blaster, failure of the spacecraft orientation system, tumbling out of control and out of radio contact, and missing the return-to-Earth launch window, but somehow controllers got it back to Earth anyway.

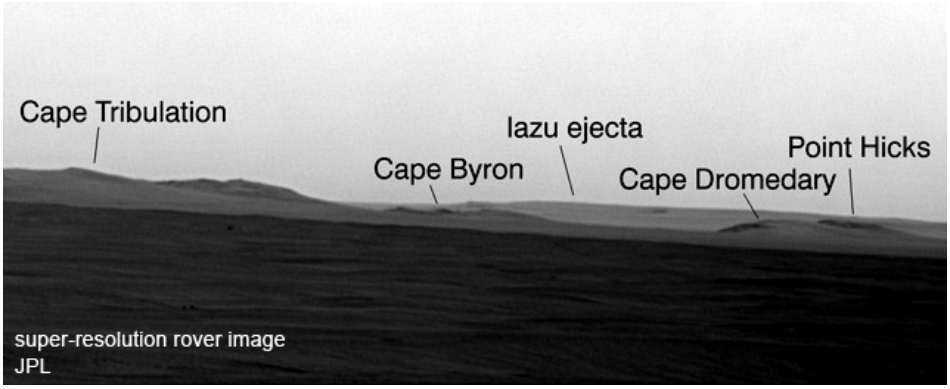
Martian water – A research team has documented dozens of channels carved by melted water from glaciers located in the mid-latitudes of Mars. The valleys were carved in Mars' most recent epoch. This means that this source of flowing water occurred much later than the river channels that date from when Mars had a much thicker and wetter atmosphere, early in its history. 15,000 images from the Mars Reconnaissance Orbiter were examined to find the glacier-fed valleys.



More Martian water – A new study of the minerals found within craters in Mars's northern hemisphere finds that many contain minerals that could only have formed in the presence of water. Previously such minerals had been found in many areas of the southern hemisphere. The difference is that in the north, a layer of volcanic material lies over the water-indicating minerals, so they only appear where impact craters have punched through the volcanic layer. This indicates that a water (hydrological) cycle (evaporation, clouds, rain, flowing and standing water) existed over the entire planet roughly 4 billion years ago. The water cycle had been previously

proved to exist only in the southern hemisphere, also billions of years ago. But because the minerals found were unaltered by later water, the water cycle had ceased to exist by the time of the volcanic flows in the northern hemisphere, which was about 3 billion years ago. The minerals found in the new study were phyllosilicates, clays and other hydrated silicates. The study appears to rule out the possibility that a northern ocean existed after 3 billion years ago. Other researchers have proposed such an ocean to have persisted past this time point.

Opportunity (Mars rover) has taken a super-resolution image (a technique combining multiple images to produce higher resolution than any one) of the rim of Endeavour Crater, still a few miles away. Since summer 2008, this crater has been the goal of the rover. It cuts far deeper through surface layers than any previously visited crater, to reveal more Martian geological history. Details in the new image have been correlated with locations seen from orbit. Clay minerals, which form under wet conditions, have been found in Endeavour Crater from observations from orbit, and an area with clay will probably be chosen as the first target for the rover to examine when it arrives.



Venus Express has measured the rate of escape of gases from the planet's atmosphere into space. It found about twice as many hydrogen atoms as oxygen, indicating that water was being broken down into its atoms and lost to space. This indicates that billions of years ago water was fairly plentiful on Venus. A computer simulation of the atmosphere over the life of the planet, using the new water-loss data, suggests that there was probably not enough water to form an ocean after the time that the molten newly-formed planet cooled and hardened. Before that time, even with sufficient water, it was too hot to form an ocean.

Planck (orbiting microwave telescope) has released the first all-sky map in microwave light (covering the frequency range 30-857 GHz). Eventually the microwaves emitted within the Milky Way will be separated from the Cosmic Microwave Background (CMB) to obtain the most precise picture ever of the CMB. Planck will complete 4 full scans of the sky by the end of its mission in 2012.

Supernovas – Type Ia supernovas have long been known to happen when material is added to a white dwarf star until it exceeds the mass it can support, and it explodes. There are 2 theories of how that material is added: stripped off the atmosphere of a closely orbiting companion star, or colliding with another star. A recent item here reported that astronomers were unable to find sufficient numbers of X-ray sources to support the stripping theory (since stripped material should generate a certain spectrum of X-rays [called a super soft X-ray source] when it hits the white dwarf). A new study reports that colliding stars will also go through a period of similar X-ray emission while swirling into each other. So now the problem to be solved is whether X-rays are not produced prior to going Type Ia supernova or are absorbed or hidden. This throws open again the issue of stripped versus collision as the source of material added to the white dwarf.

Massive star formation – Two of the Very Large Telescopes in Chile were linked together as an interferometer to observe a very massive star still in its formation stages. It found for the first time for any massive star a disk of dust and gas orbiting around it. This implies that very massive stars form the same way that smaller mass stars have been observed to form (but scaled up in size), despite computer simulations that fail to create massive stars by the normal means. Images from the Spitzer infrared space telescope and a submillimeter wavelength telescope showed material being ejected from the poles of the disk, also like smaller forming stars. One implication is that planets should also form about massive stars in the same way they do around smaller stars, although the powerful stellar winds and brilliant radiation of fully formed massive stars should eventually destroy its planets.

TDRS 1 (relay satellite) has been retired after forwarding data and communications between satellites and the ground since 1983. It, along with 8 later additions to the TDRS series, allows constant communication, even when satellites are out of sight of any ground stations. TDRS 1 relayed data from the Space Shuttles, the International Space Station, the Hubble Space Telescope, the Antarctic iceCube neutrino detector, the South Pole Radio Telescope, as well as the South Pole Research Station itself, and many other satellites and isolated ground experiments. TDRS 1 was launched by the shuttle Challenger on its first voyage.

Instant AstroSpace Updates

Galaxy formation – According to a new computer simulation of galaxy formation, many of the ancient stars in the Milky Way's halo actually formed in other smaller galaxies and were ripped off (literally) during collisions of the galaxies. The halo is spherical, much larger than the Milky Way's disk, but is so sparsely populated that it contains only about 1% of the galaxy's stars.

The **Lunar Reconnaissance Orbiter** celebrated one year in lunar orbit, and has gathered more digital information than any previous planetary mission in history. It found the coldest place in the Solar System, imaged the tracks of the Apollo astronauts, and found caves on the Moon, among other accomplishments.

(continued next page)

The Crescent Nebula (NGC 6888) was imaged by Bill Hall using a Celestron C6 6-inch f/5 Newtonian and an ST-402ME imager. Bill used an Hydrogen-alpha filter and a 100-minute exposure with a 5-minute subexposure. This image was taken from Yorba Linda, so there is still great work that can be done with a relatively small aperture from Orange County!

(continued from page 9)

Swift (gamma-ray burst [GRB] orbiting telescope) was temporarily blinded in its X-ray telescope in June by the brightest X-ray GRB ever observed, while Swift's visible light and ultraviolet telescope saw it as having only typical GRB brightness. Peak X-ray brightness was calculated by the brightness of pixels away from the center of the image, which were not blinded.

Imaging exoplanets, those orbiting other stars, is notoriously difficult because the starlight swamps the planet light. A new device has been built that combines the light of 4 telescopes interferometrically, and that reduces the light of a single star by a factor of 100 million, and it will be used to search for planets.

Germany launched (using a Russian Dnepr rocket) a 2nd radar satellite, called **TanDEM-X**, which will fly in formation with the 1st, and make a stereo (3-D) map of the entire Earth's land surface in the greatest detail ever, unaffected by night, clouds or precipitation. The results will be sold as a commercial product.

Russia has built a launch pad for **Soyuz rockets** in the French spaceport in Guiana, South America, in order to be able to launch satellites in the plane of the equator, and profit from the faster rotational speed of the Earth near the equator. All previous launches of Soyuz rockets have been from launch pads in Russia and Kazakhstan.

The U.S. Air Force had planned to launch on July 8 its **SBSS** satellite to track from space all other Earth satellites and orbiting debris, a job that has always been performed from the ground. A problem with the launch rocket has delayed the launch, but SBSS is expected to soon be in orbit and operational.

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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
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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.**

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.

Joseph Busch captured the transit of Io and its shadow across the face of Jupiter on May 14,2006 using a Meade 8-inch LX200R and a Phillips TouCam. Rising late in the evening in Pisces this month, Jupiter is a good break from the faint fuzzies late at night! Be sure to look for Uranus, a 5th-magnitude tiny blue disc about three degrees from Jupiter.

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