SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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Image of the Carina Nebula, NGC3372, taken by club member Leon Asian at Las Campanas Observatory in Chile on 4 March 2019. It was captured with FLI Proline 16803 camera through AP 12 inch f/8 telescope

OCA CLUB MEETING

The free and open club meeting will be held on April 12 at 7:30 pm in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange.

This month, Physicist Shelley Wright from UCSD will speak on New Ways to Search for Extraterrestrial Intelligence

NEXT MEETINGS:
May 10 (speakers TBA)

STAR PARTIES

Both the Irvine Lake and Anza sites will be open on April 6. Members are encouraged to check the website calendar for updates on star parties.

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

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

COMING UP

The next session of the Beginner's class will be held on April 5 at Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana.

Youth SIG:
contact Doug Millar
Astro Imagers SIG: April 3
Astrophysics SIG: April 17
Dark Sky Group:
contact Barbara Toy

President's Message

By Barbara Toy

We are really sorry about the long hiatus for the Sirius Astronomer, and delighted to welcome our new Editor, David Fischer, who has great plans to get our newsletter back on track. David is a long-time member of the club, active in the AstroImage group, and frequently images at the Anza site. His contact information is on our website Contacts page and the back page of the Sirius Astronomer. If you have pictures or articles you'd like him to consider, please do contact him at newsletter@ocastronomers.org. Thanks for taking on this important position for the club, David!

Speaking of Volunteers…

Our club runs on volunteers, including our Board. Although the Board governs the club, its role in our success is eclipsed by that of our volunteers, past and present, whose energy and creativity makes our many activities possible. If you look at the "Contacts" page on our website, or the contacts listed on the back of the Sirius Astronomer, you can see the list of volunteers currently holding specific roles in the club, among them:

Dave Pearson, who developed his own materials and teaches our Beginners Astronomy Class, which is six sessions long, one session per month, and cycles through twice per year, introducing members of the general public as well as club members to astronomical basics;

Karen Schnabel, our librarian, who continually updates the books, videos and other materials available in our library for members to check out and also runs a sales table of items she can't use in the library to help fund further purchases;

Don Lynn, who has been our Anza Site Custodian since the early days of the Anza site, handling all kinds of repairs and ongoing maintenance there and also lending a hand in almost all of the development of the Anza site. He still checks on things and does maintenance and repairs when he's here, even though he's mainly living in Colorado these days. Fortunately for us, he can still send in his regular AstroSpace Update columns for the Sirius Astronomer, from almost anywhere he happens to be…;

Manuel Baeza, our current Anza House Coordinator, who took that position on when Doug Acrea was no longer able to do it, and who has been keeping Anza House supplied and ready for use (hopefully with help from those who use it regularly – keeping the place clean is not a one person job);

Steve Mizera, our Orange County Star Party Coordinator, who arranged for a new and much larger location for our local star parties, keeps us in good standing with the authorities so we can continue to have access, handles getting the gates opened at the start of the star parties and closing things up at the end, and whatever else is needed to make these a continuing success;

Bob Sharshan, current chair of the Astrophysics SIG, though he recently advised me that he is planning to pass the position on to someone new. In the years he's held the position, he's continued to find new lecture series for the group for the monthly meetings and also sends out regular notices of upcoming talks and other events of interest to the group. He'll be missed as the chair, but I hope he'll stay active in the group. For those who may not be familiar with it, the Astrophysics meetings are centered around a couple of video lectures, generally from different courses through Great Courses, though others have been used at times, with discussions of the material covered and other matters of astrophysical interest – basically, the best parts of a good seminar discussion class with no tests (and often with cookies).

We are fortunate to have a number of Board members who also volunteer for non-Board activities:
Trustee Andy Lowry is our current Outreach Coordinator and is continuing the program of having club volunteers take telescopes out to different schools for viewing events for their students (and their families) that was developed by Jim Benet, who is still an active participant. She has some good ideas for new ways the program could go – her energy and enthusiasm are infectious, and it's going to be interesting to see how it develops;

Trustee Doug Millar is our Youth Coordinator. Over the years, many people have wanted to have an active youth program in the club, and Doug is making it happen – we're fortunate that he has experience working with youth groups in the past that he can apply to help keep young people interested in astronomy and in the club with activities tuned to their interests;

Vice President Reza AmirArjomand is also our Webmaster. Anyone who attends our general meetings knows he does an incredible job of finding great speakers for us as Vice President – if you've enjoyed the talks, Reza is the person to thank for arranging them. As our webmaster, he has had to keep our current website patched up enough that it continues to function. Fortunately, (hopefully by the time you read this) our new website will soon take its place, and will be much easier to manage, but in the meantime we're grateful he's been able to keep the site we've had since the early 2000s going.

Treasurer Charlie Oostdyk wears so many hats that it's hard to do him justice. In addition to standard Treasurer duties, he's become responsible for several functions that sort of dovetail with some of his Treasurer duties, such as keeping track of memberships as well as Anza Pad and Observatory licenses. At some point he also became responsible for processing and mailing out the print editions of the Sirius Astronomer – it generally seems that he handles most of the club's ongoing administrative duties, to our benefit. He also has a lot of stories of people and events in the club's past – he's not quite a charter member, but I think he's known pretty much everyone of note in the club since its early days.

Trustee John Hoot has now taken over the Telescope Loaner Program from Scott and Sandy Graham. He's been going over the telescopes in the program, repairing those that need it, weeding out the ones that are really beyond reasonable repair or otherwise not appropriate for the program, and working out some different procedures to make it easier to run the program and keep track of the telescopes that are out on loan. We're very grateful he's been willing to take this on – and he's also expressed interest in getting the OCA Science group functioning again, so if you're doing any research, interested in doing research, or interested in being involved in a group of club members who are interested in research done by amateur astronomers, John is the person to contact.

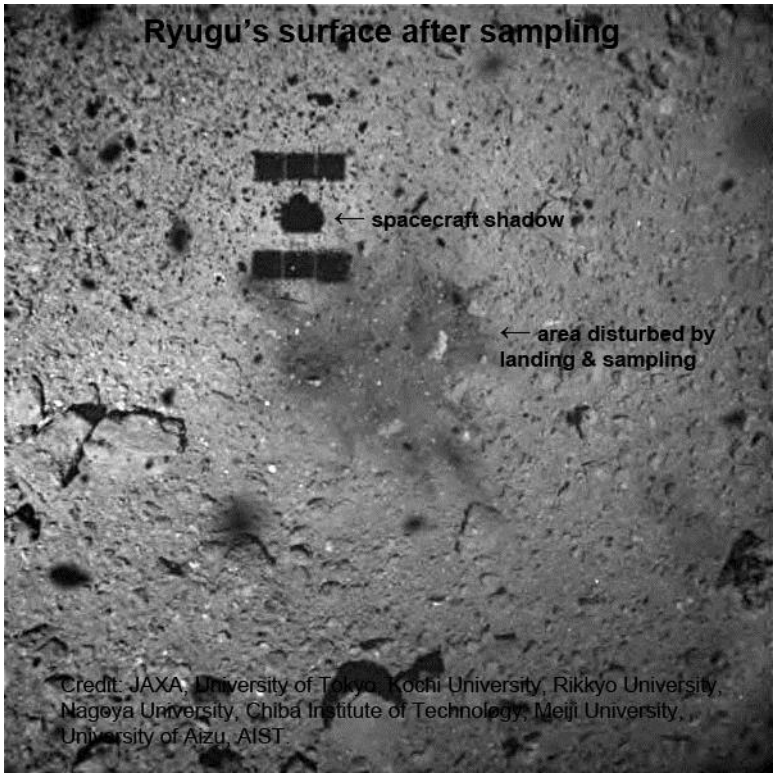
We have other volunteers whose help keeps us going, though they don't have specific titles – Kyle Coker, a former Trustee, currently puts the pre-meeting slideshows together for the general meetings and he also teaches the Intro to Astro-imaging session of the Beginners Astronomy class, Sam Saeed, a current Trustee, has been doing the announcement slideshows for the general meetings, Gary Schones, also a current Trustee, does a lot of road work and other heavy maintenance at our Anza site and was responsible for getting us Anza House, as just a few examples. The Outreach Program, in particular, wouldn't be effective without a pool of volunteers to bring telescopes out to the various events – I'm sorry I don't have the names of those who are currently active in the program, but they certainly deserve recognition.

If you're thinking there may be some motive to all this beyond giving some great people a bit of recognition – you're right. As I said, our club runs on volunteers – we have no employees, everyone who does the work of the club is a volunteer. For those of you who haven't discovered the pleasure of volunteering, that is really where you connect with the club. Going to meetings, going to star parties, going to banquets and other member events is fun and informative, but volunteering gets you involved at a different and deeper level. And it doesn't have to be a major commitment – try volunteering for some Outreach events. If you're at all like me, the pleasure of sharing just two or three bright (i.e. easy to find) objects with groups of students and their families gives an incredible high that won't impair your ability to drive, and there's also the pleasure of getting to know and learning from your fellow Outreachers. And, coming out of that experience, I think you'll find that the club feels much more like your club than it did before.

So, check our website calendar for some upcoming Outreach events, shoot an email to Andy to let her know which you'd like to attend (Outreach@ocastronomers.org), grab your telescope and head on out for a great evening sharing your love of the night sky!

AstroSpace Update

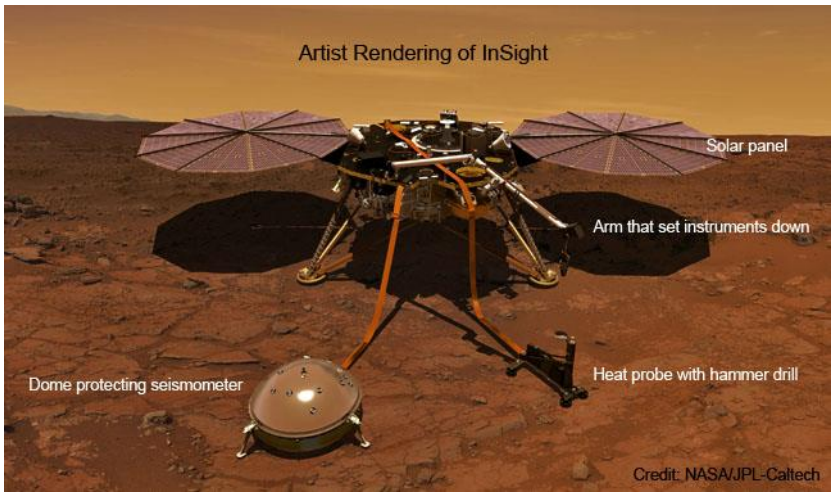
March 2019
Gathered by Don Lynn from NASA and other sources



Asteroid Sampled – Hayabusa2 (Japanese spacecraft) has touched down on its target asteroid Ryugu and completed a procedure to fire a bullet into the body and collect the debris blown off. This makes Ryugu a literal target. This and further samples are scheduled to be returned to Earth in December 2020. One further sample will be taken from inside a fresh impact crater to find out what the inside of the asteroid is made of. Material on the surface has been subjected to millions of years of space weathering caused by radiation and micrometeorite impacts and so won't chemically be the same as the interior. How will the spacecraft controllers find a fresh impact? They will make it by firing a huge bullet that is expected to make a crater 2 yards across.

Martian Air Pressure – InSight landed on Mars in November and since has been sending weather reports back to Earth. Among its instruments is the most precise atmospheric pressure sensor ever sent to Mars. As expected, the pressure changes daily with air temperature, rising with lower temperature. But unexpectedly the pressure has extra peaks at about 7 am and 7 pm local Martian time. Gives the theorists something to keep them busy trying to explain. You may ask why there is a pressure sensor on a mission to measure marsquakes. The ground actually moves ever so slightly with changes in air pressure, and those movements have to be subtracted from what the seismometer measures in order to be very sensitive to marsquakes.

More About InSight – InSight is in the process of hammering its heat flow probe into the Martian soil. In order to get below temperature changes from the surface, it needs to be pounded 10-16 feet deep. It will measure the heat flowing from the core of the planet and measure how well the soil conducts heat. As of my writing this, the hammering has hit a rock about half a meter (20 inches) below the surface. Controllers are taking a couple of weeks to determine the next moves. The probe has already pounded past one rock. The location of hammering the probe was chosen because it was rock-free, at least as far as could be seen from above.



Tails of the Hyades – Open star clusters form most of their stars during the initial collapsing of a gas cloud into stars. Then over hundreds of millions of years, gravitational disturbances force stars to wander off, and eventually the cluster is too spread out to distinguish. A new study was made of the Hyades open cluster, using data from Gaia, which very precisely measured positions and motions of more than a billion stars. The study found about 500 stars that were moving away from the Hyades, and so were part of that cluster in the past. They are concentrated in 2 tails of stars, one in front and one behind (relative to the cluster motion). The tails extend up to 650 light-years from the cluster. This is the dissipation of an open cluster caught in action. This is the first time such tails have been found about an open cluster, though they are often seen about galaxies or globular clusters.

Unusual Nova – Astronomers studying a nova in the Andromeda Galaxy have found a huge shell of material surrounding the nova. This particular star has been going nova about every year, more frequently than any other known nova. The shell must have been ejected by the previous nova eruptions. Its size (almost 400 light-years across) suggests that it must have been erupting regularly for millions of years. A nova occurs when a very close companion star dumps gas onto a white dwarf star until the gas undergoes a nuclear explosion. Theory has it that repeated novas will eventually push the white dwarf's mass past the critical mass that causes a supernova, which will obliterate the star.

Milky Way Mass – New data from the Gaia and Hubble space telescopes has given extremely precise positions and motions in 3 dimensions for the globular clusters orbiting our Milky Way galaxy. From this scientists have calculated the total mass (both ordinary and dark matter) of the galaxy. That mass has been difficult to determine because it requires measuring motions of objects outside the galaxy but close enough to be orbiting it. The extent of our galaxy's halo of stars and its halo of dark matter are not well known, consequently past galaxy mass measurements have varied greatly. The scientists believe that they have accounted for all mass out to 1 million light-years from the center of the Milky Way. Probably this new measurement is the closest yet to the right value. The result is 1.5 trillion solar masses.

Geocorona Measured – The Earth is surrounded by an extremely thin cloud of hydrogen, known as the geocorona. It is a result of water vapor in the upper atmosphere being broken into its hydrogen and oxygen, and the light hydrogen then escaping into space. Scientists who wanted to know the size of the geocorona studied archived ultraviolet observations from the SOHO solar space telescope. Occasionally the Earth and its geocorona pass through the telescope's field of view. The geocorona was found to extend as much as 390,000 miles from Earth. The Moon's orbit actually lies within it. Interestingly, the geocorona was discovered in ultraviolet observations made by equipment placed on the Moon by Apollo 16 astronauts. Little did they realize that the observations were being made inside the geocorona. Results from the new study show that sunlight pushes the geocorona closer to Earth on the daylight side, and that the cloud is extremely thin (about 3 atoms per cubic inch at the Moon's distance). However, that is enough to somewhat interfere with any ultraviolet observations that astronomers might want to make from future installations on the Moon.

Huge Stellar Flare – Astronomers using the James Clerk Maxwell Telescope in Hawaii have discovered flares from a still-forming young star that are 10 billion times more powerful than flares from our Sun. Apparently material is still falling into this star as it forms, but in bursts, not steadily, in order to cause such flares. Astronomers believe that the star is spinning faster than the disk of material feeding it, resulting in a twisting of the star's magnetic field until it snaps and reconnects. This change to the field forces big chunks of material to fall into the star, making the huge flares. The Maxwell Telescope operates in the submillimeter wave-length range, that portion of the light spectrum between long infrared and short radio wavelengths. This is the first time such flares have been seen in submillimeter wavelengths, though similar events have been observed in X-rays, radio, and infrared. The star is in the Orion Nebula about 1500 light-years away.

Oldest White Dwarf Found – A volunteer citizen scientist has discovered the oldest known white dwarf star, and it has been found to have a ring of dust (possibly double ring) about it. When white dwarf stars form, their nuclear reactions stop, and they then just slowly cool off. Since this is the coolest known white dwarf, it must be the oldest. Whatever is feeding material into the ring about it must therefore have been acting for billions of years. Theory has it that such rings about white dwarfs dissipate in less than 100 million years unless something is replenishing the ring material. The best theory is that collisions in an asteroid belt about the star are producing such material. The citizen science project was looking through WISE infrared data to find brown dwarfs (and Planet 9), but it also stumbled on this cool white dwarf. The project, called "Backyard Worlds: Planet 9", in its first 2 years has found more than 1000 brown dwarf candidates, but has not found Planet 9.

Super-Puffs – There are half a dozen known super-puffs, exoplanets about the size of Neptune but with a lot less mass, and therefore less density. They must consist mostly of gas and be fairly warm (because they are close to their star) to have this density. A problem with this is that the temperature required by the density should have already boiled away the atmosphere. A new paper suggests a solution: if outflows in the atmosphere constantly circulate dust, that dust could prevent the atmosphere from boiling away. These super-puffs also have another mystery: they have no spectral lines. Dust would explain that too.

Crew Dragon Test Flight – SpaceX made a test flight, without crew, of their spacecraft the Crew Dragon, reaching and docking with the International Space Station. A few days later, it returned to Earth, soft-landing in the Atlantic under 4 huge parachutes. The Crew Dragon needs to pass one more test, that of its emergency escape rocket system, before it will be ready for a flight with people aboard. That flight could happen as soon as July. Boeing, like SpaceX, is under support from NASA to produce a spacecraft to take people into space, and hopes to also make a flight with crew this year. American astronauts have not launched in American spacecraft since July 2011 when the Space Shuttle made its last flight. The USA has been buying rides into space on Russian rockets.

Moon Lander Launched – More than a decade ago Google and the X Prize Foundation announced a competition to win $30 million for the first privately sponsored space mission to land on the Moon and perform certain acts including sending pictures back. The deadline was eventually extended to March 2018. Though dozens of groups entered, no one finished on time. This February 21, a team from the competition launched their Moon lander named Beresheet, built by SpaceIL (a nonprofit organization in Israel), even though there is no longer a prize. It launched aboard a SpaceX rocket that also carried 2 communications satellites. This is the first Moon lander launched from the USA since 1972 (Apollo 17). Landing is scheduled for about April 11 and the craft is designed to operate a few days on the surface.

LOFAR – The first data release has been made from LOFAR (low frequency radiotelescope array). Though it covers only 2% of the sky scheduled for survey, it has discovered 300,000 new radio sources, many of them radio galaxies and quasars. Comparison with optical sky surveys shows that about 70% of the radio sources are objects already known in visible light. An interesting finding is that all of the fairly massive galaxies have jets near their cores, which can be seen in low frequency radio. Also found was that not only interacting galaxies, but isolated ones too are emitting radio, though less powerfully. LOFAR consists of 50 locations, each with an array of typically 2000 antennas, connected to a supercomputer by fiber optics. They are spread out all over Europe, though the biggest concentration lies in the Netherlands.

Instant AstroSpace Updates

Remember in February when it was reported here that the most distant member of the Solar System, a trans-Neptunian object (TNO) nicknamed Farout, had been discovered at about 120 AU (where 1 AU is the Earth's distance from the Sun)? Well, that record lasted only a couple of months, being replaced by a newer TNO discovery nicknamed (of course) **FarFarOut** at about 140 AU, about 19 hours away at the speed of light.

A study of the images of Pluto and its moon Charon from the New Horizons spacecraft has shown that there are **too few small impact craters**, compared with the numbers of larger ones, meaning that there are too few small bodies that might collide in this area of the Solar System, as compared to larger bodies. Past work with the moons of Jupiter and Saturn agree with this shortage.

Astronomers have been using the NASA Deep Space Network, normally used for radio communication with distant spacecraft, instead as a radiotelescope array to observe **magnetars** (rapidly rotating neutron stars with astoundingly strong magnetic fields). Only a couple dozen of these objects are known, and are not well understood.

Bonus AstroSpace Update

From the unpublished March Issue

Opportunity Lost – On February 13, NASA declared Mars rover Opportunity lost. It had not responded since last June, in spite of hundreds of attempts to raise it by radio. The massive dust storm of last May and June had reduced the sunlight to the point the rover's solar panels could not charge its batteries, and so Opportunity's computer shut the rover down. There was hope that after the storm passed the returning sunlight would return the rover to operation, but apparently the temperature dropped too low during the power outage, ruining some vital part. Opportunity landed in January 2004 and operated for 14 3/8 years, while its mission was designed for 90 Martian days (about 92 Earth days). The rover took over 200,000 pictures and traveled 28 miles (721 feet on its best day), all records. If Curiosity, the only remaining operating Mars rover, manages to run 8 more years, it could break those longevity and distance records. Opportunity's achievements include finding several pieces of evidence of past flowing water. NASA plans to send another rover to Mars in 2020, which is designed to search for signs of ancient life.

Curiosity Gravimeter – Mars rover Curiosity has accelerometers on it to allow precise navigation. Scientists figured out that they could use the accelerometer data instead as a gravimeter, measuring the gravitational pull of the mountain under the rover. The mountain is less dense than it should be if the theory of the mountain's formation is correct. It had been thought that sometime after Gale Crater formed from an impact, it filled with water and sediment all the way to the crater rim. Then over billions of years the softer parts of the sediment eroded by wind, leaving the mountain. However the weight of a crater completely full of sediment would have crushed the rock to greater density than the rover measured. So it appears the crater could not have filled more than half way. Now the theorists have to tell us how the mountain grew to about the height of the crater rim without crushing the rock to greater density.

Mars Lander – The InSight spacecraft has finished testing and adjusting its seismometer, previously set on the Martian ground with its robotic arm, and has placed a protective dome over it to prevent disturbances from wind and extreme temperature changes. The InSight drill has been placed on the ground about a yard from the seismometer. It will hammer a heat sensing probe as much as 16 feet into the soil to measure heat conductivity of the soil and heat flowing out of the planet, which will, along with seismometer data, help characterize the interior of the planet. The hammering and calibration is expected to take about 40 days. When this is complete, InSight will never again move any of its parts, such as its arm, in order not to disturb the seismometer. Even the radio antenna and weather station are designed to work without moving parts.

Venusian Cloud Streaks – Researchers have found a pair of streaks that persist in the clouds of Venus, using infrared data from the Japanese Venus orbiter Akatsuki. Computer simulations of that planet's atmosphere show why these streaks are there. Polar jet streams converge at the location of the streaks, which forces downflow, which creates the cloudy streaks.

Sub-Saturn Found – The OGLE survey looks for gravitational lensing events caused by stars and planets passing in front of more distant stars. OGLE just found another sub-Saturn exoplanet, that is, one more massive than Neptune, but less so than Saturn. At least 30 sub-Saturns have been found by gravitational lensing. Unfortunately for the theorists, the core-accretion theory of how gas giant and ice giant planets form says we should not have found so many. It is particularly disturbing that the newly found OGLE planet is beyond the snow line (the distance from its star beyond which starlight is too weak to melt ice), where theory says sub-Saturns should not form. So the theorists are going to have to modify or replace their theories for how gas giants form.

Small Kuiper Belt Object Found – The OASES project has been using small telescopes for the past year to monitor hundreds of stars, hoping to see outer Solar System objects pass in front. They have spotted an object in the Kuiper Belt with a diameter somewhere in the range of 1-2 km. Such an object is far too small for any telescope to see. Theorists tell us that there ought to be lots of objects there smaller than telescopes are seeing, so now we may have found a way to detect them.

Titan Rain – Even though the Cassini mission at Saturn has ended, its data continues to feed research. Study of images taken of Saturn's moon Titan in June 2016 show in the northern hemisphere what appears to be a reflection from wet ground, presumably because methane rain just fell there. Rain has been expected in the north, since south Titan had its methane rainy season about half a Saturn year ago. The reflection was rough rather than looking like pools, because the surface there is probably pebbly.

Saturn Day Measured – There are no permanent markings on Saturn to time the planet's rotation, and attempts since Voyager (1980) to measure the rotation by the motion of the magnetic field have yielded varying results. Apparently the Saturnian magnetic field is too symmetric about the rotational axis for this to work. The planet's internal mass distribution was found recently to make waves in the rings, though this effect had been predicted theoretically as long ago as 1982. Results of the new study of ring waves (from Cassini data) say Saturn's day (one rotation) is 10 hours 33 minutes 38 seconds, several minutes faster than previous measurements.

Jupiter Cloud Cycle – Scientists studying long term infrared observations of Jupiter have found a recurring cycle of 6-7 years in the clouds near the planet's equator. In visible light, this cycle results in a darkening of the bright white near-equatorial clouds for 12-18 months roughly every 7 years. The darkening is caused by a dissipation of ammonia clouds, which are bright white, allowing us to see lower, darker cloud decks. The scientists expect the next visible-light darkening this year, and in fact it may have already started. The Juno spacecraft, currently in Jovian orbit, will monitor this.

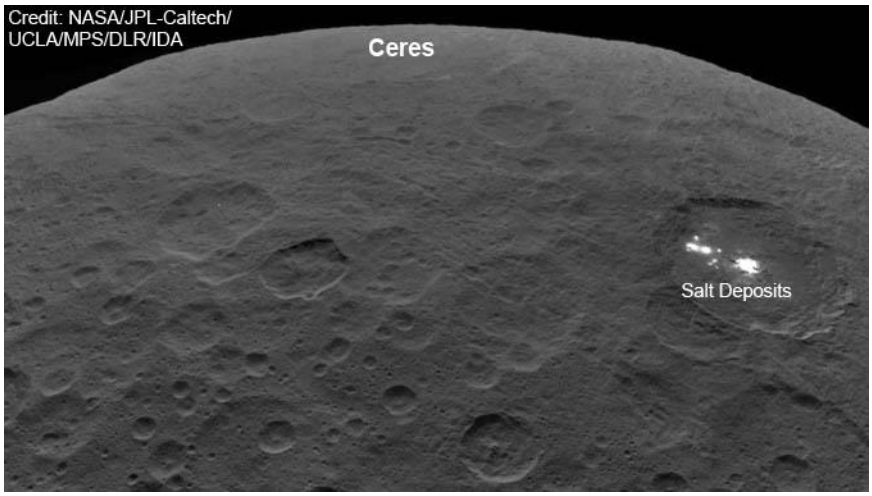
More Impacts – A new study of the ages and sizes of meteor craters on both the Moon and Earth shows that the rate of impacts rose about 300 million years ago. Since then, the rate of impacts has been about 2.6 times the rate during the previous hundreds of millions of years. Lunar crater ages were measured by how fast the surface temperature changes at sundown, which depends on how long that surface has been pulverized by tiny meteorite impacts. The increase may have been the result of a collision in the asteroid belt, but this is just one possibility. The study showed no change in the distribution of sizes of meteorites impacting as far back in time as could be measured.

Possibly Oldest Earth Rock – Where would you look to find the oldest rock on Earth? Weather and plate tectonics do a pretty good job of getting rid of old rocks here on Earth. So some scientists looked through rocks brought back from the Moon by Apollo astronauts. They found one rock that analysis shows is extremely likely to have come from Earth. Since we have found dozens of meteorites that fell to Earth and match the composition of Moon rocks, it looks likely that rocks get blasted the other direction when large meteorites crater Earth. In fact, it probably happened more often billions of years ago, because the Moon orbited the Earth more closely, and so would sweep up more of Earth's debris. Analysis shows (from the pressure and temperature required to form its minerals) the newly found rock formed about 12 miles below Earth's surface 4-4.1 billion years ago, and so may be older than anything else we have found that formed on our planet. It was partially melted by an impact event on the Moon about 3.9 billion years ago, which buried it under lunar soil. It was later excavated by an impact about 26 million years ago, and then an astronaut picked it up in 1971.

Planet-Forming Disk – A young star in Orion (V883) is undergoing an outburst. This is causing icy objects in the planet-forming disk surrounding the star to sublimate, unleashing various chemicals that were trapped in ice. This affords a great opportunity to observe what those chemicals are, adding to our knowledge of how planets form. Astronomers are using ALMA (radiotelescope array in Chile) to do just that. What they are finding is chemicals similar to those found in comets in our Solar System. This includes methanol, acetaldehyde, acetone, methyl formate, and acetonitrile. The distribution of the 1st two of those chemicals was mapped to be a ring twice the size of Neptune's orbit. Beyond that, those chemicals were undetectable because they were still frozen inside ice, and probably not seen inside the ring due to obscuring dust.

Iron Planet Found – Astronomers have discovered a pair of super-Earth sized exoplanets orbiting a star in Cygnus. One of the pair has a density similar to Earth, but the other is more than twice as dense. The discoverers think that the only way this could happen is if the very dense one suffered a collision with some other planet sometime in the past, which blasted off most of the rocky crust and mantle, leaving little more than a dense iron core. This is the 1st evidence that any exoplanet has survived a catastrophic collision.

Cryovolcano (Almost) Explained – The Dawn spacecraft more than 3 years ago found salt deposits on the asteroid Ceres that are likely the result of geologically recent water/ice volcano (cryovolcanic) activity. Ceres is too small to have retained enough heat since its formation to melt ice for such activity. It was suggested that an impacting asteroid heated up Ceres to cause the volcanic activity. But the age of the crater in which the activity took place was old enough (20 million years) that Ceres should have cooled off from the impact before the volcanic activity. A new study concluded that material found in the crust of Ceres is acting to insulate heat almost enough to make the impact-causes-volcanic-activity theory work. More study is needed to eliminate that "almost".



Dark Energy May Be Growing – A new study of distant quasars in both visible light and X-rays claims that scientists can now determine the absolute brightness of many quasars. This would allow distance measurements to be calculated from apparent brightnesses. They then applied their brightness formula to 1600 quasars and analyzed the expansion of the Universe at various distances, and concluded that dark energy has increased in strength over billions of years. Yet similar analysis using the brightness of Type Ia supernovas does not show the dark energy change. More work is needed to solve where this discrepancy arises.

Black Hole Outburst – A year ago a stellar-mass black hole, soon dubbed MAXI J1820+070, suddenly started consuming material from its close companion star, becoming the brightest X-ray source in the sky. The X-rays are emitted by both the accretion disk (where infalling material orbits before making it into the black hole) and an even hotter corona surrounding the disk. The disk and corona of this black hole are too small to be resolved by any current technology, but the emissions from the disk and corona can be distinguished by their different energies. In addition, X-rays are reflecting off material farther out from the black hole, arriving later than X-rays that take a direct path to us. Two X-ray instruments mounted on the International Space Station have been monitoring the situation for the past year. Analysis of the data shows that the corona shrunk during the outburst from about 100 miles across to about 10 miles. One structure that fits the data is that the corona is located at the base of a pair of jets, whose activity varies with the amount of material falling in. The details of how material falls into black holes and produces X-rays are not well known, so study of such events will help solve this.

Huge Data Release – Pan-STARRS is a 1.8-meter telescope with a 1.4 billion pixel camera, which has been in full operation for 4 years. It shoots the entire sky available from Maui about 15 times per year (3 repeats in 5 colors). Computer processing finds anything that moves or changes from the baseline survey, such as asteroids, variable stars, and supernovas. The Pan-STARRS team just made its second data release. It consists of 1.6 billion megabytes. It contains a catalog of 3 billion sources, a composite picture of all the sky available there, and all the individual images. It is the largest astronomical data release ever made. The release can be accessed by anyone, even amateurs.

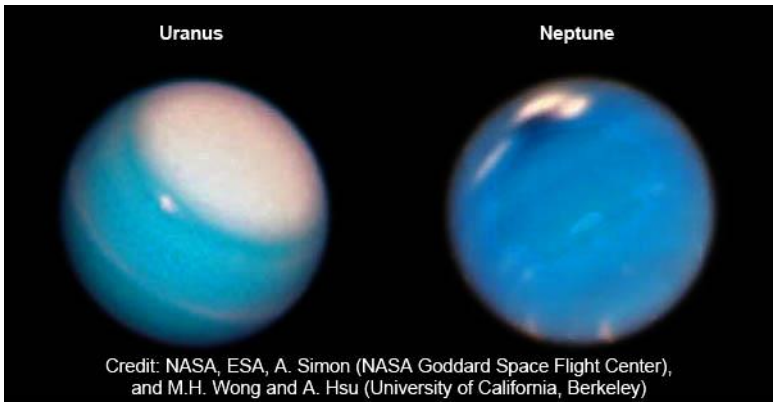
Warped Galaxy Map – A team of astronomers, using both visible light and infrared archived observations, mapped out in 3 dimensions over 1300 Cepheid variable stars within the Milky Way to try to define the shape of the galaxy's arms. Instead they found the map did a better job of defining the warps in our galaxy's disk. Causes of galaxy warpage are thought to include gravitational pull of passing satellite galaxies, magnetic fields, interstellar winds, and misalignment with the galaxy's halo. Computer modeling showed that it would take multiple pushes on the Milky Way to attain the newly measured shape. Limits on how dim of Cepheids can be seen allowed only about 2/3 of the Milky Way to be mapped. Eventually the astronomers hope to extend their map to the whole galaxy.

Andromeda Collision – You have probably heard that the Andromeda galaxy (M31) is heading toward us and is going to collide with our Milky Way galaxy in a few billion years. Also you have probably heard different time estimates for that collision. That is because the relative motion of Andromeda is very difficult to measure in the right-left and up-down dimensions, even though we have a very accurate number for forward-back motion, because that can be measured by redshift. The recent release of data from the Gaia spacecraft includes extremely accurate motions in all 3 dimensions for over a billion, stars including scads of them in M31. A team of astronomers used the GAIA data and distinguished what part of more than 1000 Andromeda stars' motions is rotation and what part is motion of the galaxy as a whole. They also did the same for the Triangulum galaxy (M33). Then they computer simulated what the current galaxy motions and gravity is going to do for billions of years in advance. Their result is that Andromeda and the Milky Way will merge about 4.5 billion years from now. Because of the just measured sideways motion of Andromeda of about 30 miles per second, it will be a glancing blow, not head-on. Also determined from this study is that M33 is making its first approach to M31, contrary to earlier theories that had it orbiting. This may mean that the Local Group of galaxies (of which the Milky Way, M31, and M33 are the heavyweight members) may have come together more recently than thought.

Instant AstroSpace Updates

What's **deeper than the Hubble Ultra-Deep Field** image? A reprocessing of that image using new noise-suppression techniques. It shows faint light around thousands of galaxies in the image, making some of them twice the size.

The Hubble Space Telescope monitors the **weather on Uranus and Neptune** every year. The latest findings: Neptune has developed another dark storm, the 4th since 1993, accompanied by methane ice bright clouds; Uranus has grown a bright north polar cap of clouds, and a narrow cloud band north of the equator.



Credit: NASA, ESA, A. Simon (NASA Goddard Space Flight Center), and M.H. Wong and A. Hsu (University of California, Berkeley)

The pair of tiny (smaller than a briefcase) **Mars Cube One** spacecraft, sent to the Red Planet alongside InSight, completed their mission of relaying data from InSight during its entry and landing. They continued to operate for about 5 and 6 weeks past that landing, demonstrating the viability of tiny spacecraft at planetary distances from us.

The **Refabricator**, a 3-D printer, is now in operation aboard the International Space Station. Unlike the previous Station 3-D printer, it can recycle its plastic fabrication material, and even use some kinds of plastic trash to build new parts and tools.

NASA has selected a new mission called **SPHEREx**, to launch in 2023, which will survey the entire sky in visible light and infrared, taking data in 96 color bands of 300 million galaxies and 100 million stars. It should find water and organic molecules in our galaxy, shed light on the inflation period early in the history of the Universe, and identify star and galaxy targets for study by other telescopes.

From the Editor

Ideas for Future articles

The newsletter would like to include articles from members and articles about subjects suggested by our members. We are looking for both ideas and writers to cover them. Anybody who would like to contribute an article or work with the editor to produce one may contact me at newsletter@ocastronomers.org .

To get this started, I will post some examples here and then add in ideas submitted to me from club members.

- The Making of a Personal Observatory
- Borrowing a Club Telescope – the process, the results – real life experiences by club members
- Articles about early history of the club
- "Your idea goes here"

April's Guest Speaker: Shelley Wright

New Ways to Search for Extraterrestrial Intelligence

Shelley Wright is an Associate Professor of Physics with the Center for Astrophysics & Space Sciences at UCSD. Her fields of study include galaxies and supermassive black holes. She specializes in building optical and infrared cameras and spectrographs for large telescopes. She is the Project Scientist for the first light instrument (ISIS) for the Thirty Meter Telescopes and Principal Investigator of a new Keck Observatory instrument. In addition to this, she has also been working in the SETI field for over dozen years

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