

Southwest Florida Astronomical Society

SWFAS



The Eyepiece October 2012

A MESSAGE FROM THE PRESIDENT

Welcome to Fall! We are starting to ramp up with public events.

Bruce is working with a Cub Scout group that will be out at CRP on Saturday October 13th in conjunction with our star party.

On Sunday October 14th, we have Ding Darling Days out on Sanibel at the refuge. Solar observing, handouts etc. I am looking for help for this event.

On Friday October 19th, we have a large Cub Scout gathering at Camp Miles at SR31/74 in Charlotte County. Tony and I will be there for sure, but we are expecting hundreds, so the more scopes the better.

For our annual Telescope Renaissance night in November, we are going to add some observing for those who come out.

The CPC-800 is available for those interested. It has a large rolling case now that may not fit in some cars. I was able to get it into the back seat of a 4 door Ford Focus, with the tripod in the trunk. We also have the Meade 8" StarFinder on a GEM available too!

CRP Star Party Schedule for 2012: October 13th, November 10th, and December 15th. Please contact Bruce Dissette if you have any questions.

Our program for this meeting is Dr. Theo Koupelis from Edison State College about Spectroscopy.

Upcoming Meetings: November 1st – Telescope Renaissance Night/Public Observing and December 6th – Tom Field – "You Can Almost Touch the Stars!" Spectroscopy for Amateurs.

Moon: Last Quarter 8th, New 16th, 1st Quarter 22th, Full 29th

Planets: Mars is low in the west at sunset, rapidly approaching Antares. Saturn is now starting to go behind the sun and won't be well placed for observation for several months. Jupiter is getting high in Taurus around 2:00 am. Venus is still shining bright in the morning sky. By the end of the month, Mercury will reach greatest elongation east of the sun and will be in the western sky after sunset. On the 22nd, we have the Orionid meteor shower. Uranus and Neptune are still well placed for observing in the evening sky.

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October Meeting

Our October monthly meeting will be held on Thursday October 4th at 7:30 pm at Calusa Nature Center Planetarium. Our program for this meeting is Dr. Theo Koupelis from Edison State College about Spectroscopy.

Upcoming Meetings

We have a talk on Spectroscopy "You Can Almost Touch the Stars!" by Tom Field covering amateur spectroscopy equipment scheduled for December. The talk will be a remote presentation.

CRP Star Party Schedule

Upcoming star parties are October 13th, November 10th, and December 15th. Please contact Bruce Dissette if you have any questions.

Weird Planets

News flash: The Milky Way galaxy just got a little weirder.

Back in 2011 astronomers were amazed when NASA's Kepler spacecraft discovered a planet orbiting a double star system. Such a world, they realized, would have double sunsets and sunrises just like the fictional planet Tatooine in the movie Star Wars. Yet this planet was real.

Now Kepler has discovered a whole system of planets orbiting a double star. The star system, known as Kepler-47, is located 4,900 light-years from Earth in the constellation Cygnus. Two stars orbit one another at the center of the system: One is similar to the sun in size, but only 84% as bright. The second star is smaller, only one-third the size of the sun and less than 1% as bright. Kepler found two planets orbiting this mismatched pair.

The inner planet, Kepler-47b, closely circles the pair of stars, completing each orbit in less than 50 days. Astronomers think it is a sweltering world, where the destruction of methane in its super-heated atmosphere might lead to a thick global haze. Kepler-47b is about three times the size of Earth.

The outer planet, Kepler-47c, orbits every 303 days. This puts it in the system's habitable zone, a band of orbits that are "just right" for liquid water to exist on the surface of a planet. But does this planet even have a surface? Possibly not. The astronomers think it is a gas giant slightly larger than Neptune.



The discovery of planets orbiting double stars means that planetary systems are even weirder and more abundant than previously thought.

This diagram compares our own solar system to Kepler-47, a double-star system containing two planets, one orbiting in the so-called "habitable zone." Credit: NASA/JPL-Caltech/T. Pyle

"Many stars are part of multiple-star systems where two or more stars orbit one another. The question always has been - do they have planets and planetary

systems?" says William Borucki, Kepler mission principal investigator. "This Kepler discovery proves that they do."

Our own sun is a single, isolated star, with a relatively simple gravitational field that rules the motions of the planets orbiting it.

But, as Borucki points out, not all stars are single. Astronomers estimate that more than half of the stars in the galaxy have companions. There are double, triple and even quadruple star systems. Any planets in such systems would have to navigate a complex gravitational field, tugged in multiple directions by multiple stars. In fact, for many years, astronomers doubted that planets could even form in such an environment. Kepler-47 erases those doubts—and poses a conundrum: "These planets are very difficult to form using the currently accepted paradigm," says Laughlin. "Theorists, myself included, will be going back to the drawing board to improve our understanding of how planets are assembled in the dusty gaseous disks that surround many young stars."

The Kepler spacecraft is on a mission to find Earth-like planets that might support life. Says Borucki: "In our search for habitable worlds, we have just found more opportunities for life to exist."

Author: Dr. Tony Phillips | Production editor: Dr. Tony Phillips | Credit: Science@NASA

FULL STORY: http://science.nasa.gov/science-news/science-at-nasa/2012/12sep_weirdplanets/

Holy Galaxify Batman! Galaxy Zoo Allows Users to Put Their Name in Big Lights

If you're going to put your name in lights, you might as well go big; REALLY big. And with millions of galaxies



forming all sorts of shapes including letters, numbers and punctuation, GalaxyZoo has created a way for you to do just that.

More than 250,000 people, sorting through about a million images, have taken part in the Galaxy Zoo project since its launch in 2007. "Their findings have ranged from the scientifically exciting to the weird and wonderful," says the Galaxy Zoo team. And among the weird, the Zooites – that's what project volunteers call themselves – have found an alphabet of galaxies.

The new "font," available for anyone to use, is a way to thank all the Zooites for their hard work. But now a new challenge awaits.

The Galaxy Zoo now has more than 250,000 new images of galaxies, most of which have never been seen by humans.... and the GZ team really wants them to be seen by humans!

But first, the reward: Galaxy Zoo team member Dr. Steven Bamford created the website at <http://www.mygalaxies.co.uk> allowing users to create a message in stars. (Ed – Also try <http://writing.galaxyzoo.org/>)

"We'd like to thank all those that have taken part in Galaxy Zoo in the past five years. Humans are better than computers at pattern recognition tasks like this, and we couldn't have got so far without everyone's help," says principal investigator Dr. Chris Lintott. "Now we've got a new challenge, and we'd like to encourage volunteers old and new to get involved. You don't have to be an expert — in fact we've found not being an expert tends to make you better at this task. There are too many images for us to inspect ourselves, but by asking hundreds of thousands of people to help us we can find out what's lurking in the data."

New images available at the Galaxy Zoo website come from large surveys with NASA's Hubble Space Telescope as well as ground-based imagery from the Sloan Digital Sky Survey.

"The two sources of data work together perfectly: the new images from Sloan give us our most detailed view of the local universe, while the survey from the Hubble telescope allows us to look deeper into the universe's past than ever before," says Galaxy Zoo team member Kevin Schawinski.

Team members are quick to point out, however, that the quirky nature of the galactic alphabet is not the focus of Galaxy Zoo. Finding unusual galaxies that resemble animals and letters help scientists learn about galaxy interactions as well as the formation and evolution of the biggest structures in the Universe.

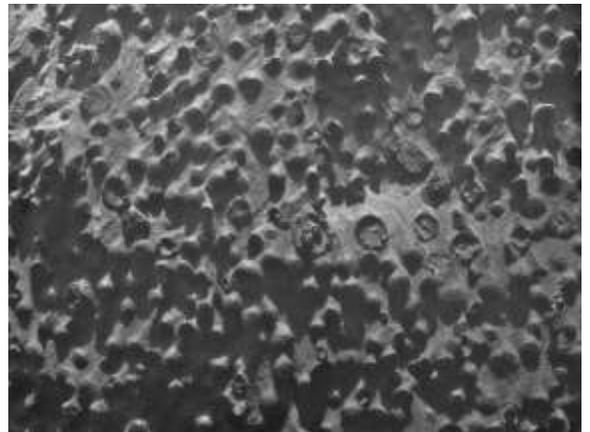
- *by John Williams, www.universetoday.com/97293/holy-galaxy-batman-galaxy-zoo-allows-users-to-put-their-name-in-big-lights/*

NASA Mars Rover Opportunity Reveals Geological Mystery

NASA's long-lived rover Opportunity has returned an image of the Martian surface that is puzzling researchers.

Spherical objects concentrated at an outcrop Opportunity reached last week differ in several ways from iron-rich spherules nicknamed "blueberries" the rover found at its landing site in early 2004 and at many other locations to date.

Opportunity is investigating an outcrop called Kirkwood in the Cape York segment of the western rim of Endeavour Crater. The spheres measure as much as one-eighth of an inch in diameter. The analysis is still preliminary, but it indicates that these spheres do not have the high iron content of Martian blueberries.



"This is one of the most extraordinary pictures from the whole mission," said Opportunity's principal investigator, Steve Squyres. "Kirkwood is chock full of a dense accumulation of these small spherical objects. Of course, we immediately thought of the blueberries, but this is something different. We never have seen such a dense accumulation of spherules in a rock outcrop on Mars."

The Martian blueberries found elsewhere by Opportunity are concretions formed by action of mineral-laden water inside rocks, evidence of a wet environment on early Mars. Concretions result when minerals precipitate out of water to become hard masses inside sedimentary rocks. Many of the Kirkwood spheres are broken and eroded by the wind. Where wind has partially etched them away, a concentric structure is evident.

"They seem to be crunchy on the outside and softer in the middle," Squyres said. "They are different in concentration. They are different in structure. They are different in composition. They are different in distribution. So, we have a wonderful geological puzzle in front of us. We have multiple working hypotheses, and we have no favorite hypothesis at this time. It's going to take a while to work this out, so the thing to do now is keep an open mind and let the rocks do the talking."

The rover's energy levels are favorable for the investigations. Spring equinox comes this month to Mars' southern hemisphere, so the amount of sunshine for solar power will continue increasing for months.

"The rover is in very good health considering its 8-1/2 years of hard work on the surface of Mars," said Mars Exploration Rover Project Manager John Callas. "Energy production levels are comparable to what they were a full Martian year ago, and we are looking forward to productive spring and summer seasons of exploration."

NASA launched the Mars rovers Spirit and Opportunity in the summer of 2003, and both completed their prime missions in April 2004. They continued extended missions for years. Spirit finished communicating with Earth in March 2010. The rovers have made important discoveries about wet environments on ancient Mars that may have been favorable for supporting microbial life.

- *The full version of this story is at*

www.jpl.nasa.gov/news/news.php?release=2012-290&cid=release_2012-290

Mars Rover Panorama

Full 360° panoramic interactive moving view of Mars as you've never experienced before, taken by Opportunity Rover and converted into an interactive panorama.

Put your cursor on the scene and left click to move to picture anywhere you want with your mouse.

<http://www.panoramas.dk/mars/greeley-haven.html>

Curiosity Finds Evidence of Ancient Water Flow

NASA's Curiosity Mars rover, slowly nearing its initial science destination where multiple types of terrain come together, has found outcrops of conglomerate rocks made up of eroded gravels that scientists believe were transported across the floor of Gale Crater by a "vigorous" flow of ankle-to-hip-deep water in the distant past.

It's the first observation of its kind on Mars, showing that an alluvial fan photographed from orbit was, as suspected, formed due to the action of flowing water that entered the crater through a 100-foot-deep, 2,000-foot-wide channel dubbed Peace Vallis that cuts through the crater rim and then fans out across a gentle 1° slope toward Curiosity's landing site.

"This rock is made up of rounded gravels in a matrix that's very sand rich," Rebecca Williams of the Planetary Science Institute told reporters. "And these attributes are consistent with a common sedimentary rock type called a conglomerate. Over time,

erosion is working on that rock face and liberating some of the gravels and they're falling down and accumulating in a pile at the base of that outcrop."

Geologists are interested in such gravels, she said, because "they tell you that those particles had been subjected to a sediment transport process, either by water or wind."

"And so typically, you start off with a very angular rock fragment and as it's transported, it's bouncing along, interacting with other grains and the surface, and that wears away the edges until you have a very smooth surface. The key components of these gravels are the rounded shape and also the size. These are too large to be transported by wind. The consensus of the science team is these are water transported gravels in a vigorous stream."

Bill Dietrich, a co-investigator, said the gravel size and the distance the rocks were transported indicates the flow "might have been from ankle-to-hip deep and maybe moving a few feet a second." Summarizing the findings, Dietrich said "This is the first time we're actually seeing water-transported gravel on Mars. This is a transition from speculation about the size of streambed material to direct observation of it."

Newly Discovered Comet Could Outshine the Moon in 2013

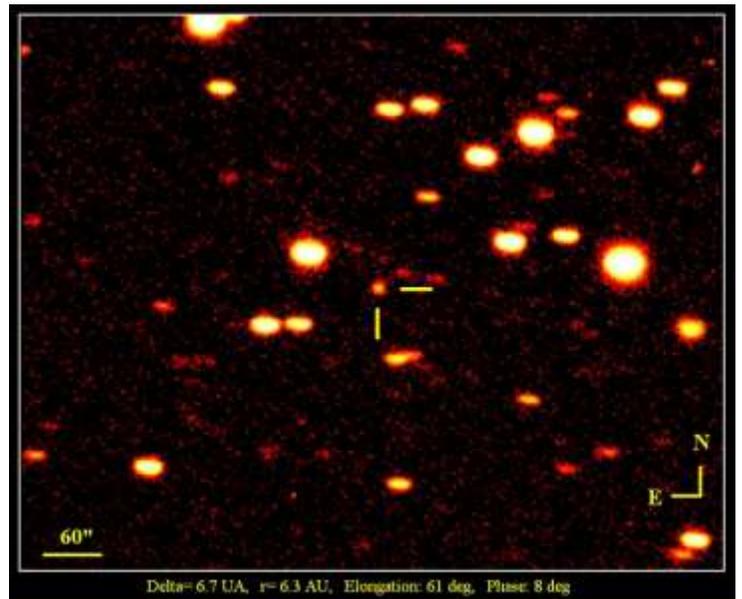
Caption: Comet C/2012 S1 (ISON) photographed near Mayhill, NM on Sept. 22, 2012, by Ernesto Guido, Giovanni Sostero and Nick Howes.

A comet headed towards the Sun has the potential to be bright enough to be visible in the daytime skies of the northern hemisphere in 2013. The possibility of the stellar display was recently announced by two Russian astronomers.

Officially known as C/2012 S1 (ISON), the comet was discovered by Artyom Novichonok and Vitaly Nevsky. The duo spotted it in images taken with a reflecting telescope at the International Scientific Optical Network (ISON) in Kislovodsk in southern Russia. The comet is barely distinguishable from stars in the constellation of Cancer right now, but is likely to brighten a lot as it approaches the Sun.

According to a Minor Planet Center report, on November 28, 2013, the comet will be at its perihelion, passing just 1.2 million kilometers from the surface of the Sun. If it survives the trip, the comet would then travel towards Earth. A month later, it will pass by our planet at a distance of about 63 million kilometers and be visible to the naked eye throughout January. According to some estimates, the comet could have a long tail and be brighter than the Moon.

This scenario is far from certain, however. Comets' behavior is difficult to predict, and C/2012 S1 is just as likely to fizzle out as become a global spectacle. Right now, the comet is near Jupiter, and is expected to rapidly brighten in August next year. Whether it will disintegrate or blaze across the sky remains to be seen.



One point of intense speculation among media and astronomers is the similarity between this new comet and the Great Comet of 1680, an object that left a brilliant streak across the sky during that year. The two comets may be fragments of a single object that broke apart in the distant past.

- <http://rt.com/news/ison-comet-sun-glazer-192/>

The Rich Colors of a Cosmic Seagull



This new image from ESO's La Silla Observatory in Chile shows part of a stellar nursery nicknamed the Seagull Nebula. This cloud of gas, formally called Sharpless 2-292, seems to form the head of the seagull and glows brightly due to the energetic radiation from a very hot young star lurking at its heart.

Nebulae are among the most visually impressive objects in the night sky. They are interstellar clouds of dust, molecules, hydrogen, helium and other ionized gases where new stars are being born. Although they come in different shapes and colors many share a common characteristic: when observed for the first time, their odd and evocative shapes trigger astronomers' imaginations and lead to curious names. This dramatic region of star formation, which has acquired the nickname of the Seagull Nebula, is no exception.

This new image from the Wide Field Imager on the MPG/ESO 2.2-metre telescope shows the head part of the Seagull Nebula. It is just one part of the larger nebula known more formally as IC 2177, which spreads its wings with a span of over 100 light-years and resembles a seagull in flight. This cloud of gas and dust is located about 3700 light-years away from Earth. The entire bird shows up best in wide-field images.

The Seagull Nebula lies just on the border between the constellations of Monoceros and Canis Major and is close to Sirius, the brightest star in the night sky. The nebula lies more than four hundred times further away than the famous star.

The complex of gas and dust that forms the head of the seagull glows brightly in the sky due to the strong ultraviolet radiation coming mostly from one brilliant young star — HD 53367 — that can be spotted in the center of the image and could be taken to be the seagull's eye.

The radiation from the young stars causes the surrounding hydrogen gas to glow with a rich red color and become an HII region. Light from the hot blue-white stars is also scattered off the tiny dust particles in the nebula to create a contrasting blue haze in some parts of the picture.

Although a small bright clump in the Seagull Nebula complex was observed for the first time by the German-British astronomer Sir William Herschel back in 1785, the part shown here had to await photographic discovery about a century later.

- <http://www.eso.org/public/news/eso1237/>

Sizing Up a New Measuring Ruler for the Solar System

The sun still shines as bright, but according to the International Astronomical Union (IAU), its precise distance from us has just changed.

At a recent meeting of the IAU in Beijing, China, members unanimously voted to redefine the astronomical unit, or AU, which has long served as the fundamental unit of distance between objects in the solar system. According to the voters, the official definition of the AU is now exactly 149,597,870,700 meters, and the unit should be written "au".

Historically, calculating the astronomical unit was based on the average distance between Earth and the sun, or 149,597,870,691 meters. An amendment in 1976 complicated things by also tying the unit to the sun's mass.

Although the recent decision doesn't alter the value by much, it simplifies things and should improve the accuracy of distance measurements over time.

For the past 36 years the AU has been calculated using the Gaussian gravitational constant, a figure that depends on the mass of the sun. But astronomers know that the sun is constantly losing mass as it radiates energy, which technically changes the value of the AU over time.

Defining the unit as a set number fixes this problem and brings it in line with the effects of general relativity.

In addition, the meter itself is defined as the distance travelled by light in a vacuum in 1/299,792,458th of a second. The speed of light is fixed in all reference frames and is unaffected by the changing mass of the sun, so giving the astronomical unit a set value in meters means that it will no longer waver.

- by Jacob Aron, www.newscientist.com/article/dn22276-sizing-up-a-new-measuring-ruler-for-the-solar-system.html

The Meter and the New Definition of the AU

The original definition of the meter in the late 18th century was 10,000,000 meters as measured on a line of longitude from the equator to the pole. This definition was chosen because it closely matched the definition of the nautical mile then in use. The nautical mile was defined as equal to one minute (of arc) of latitude. By this definition, there are 5400 or 60x90 nautical miles between the equator and the pole. The French designers of the metric system attempted to keep the idea of tying measurement to the size of the Earth from the nautical mile concept while switching to a decimal system of accounting. So they divided the right angle from the Earth's equator to the Earth's pole into 100 "grads" and they divided each of those 100 grads into 100 sub-units each of which is a kilometer by our modern reckoning. All of this means that 54 nautical miles would have been exactly 100 kilometers. And though both have been re-defined over the years, it's still very nearly correct.

The definition of the meter in terms of the size of the Earth was replaced by the concept of the "prototype meter bar" - essentially a single meter stick preserved in a vault in Sevres, France against which all other meter bars would be compared. This definition was unsatisfactory in the long term since the prototype meter might be lost or destroyed. Even so, this definition lasted into the 20th century. It was replaced for a few

decades by a definition in terms of a wavelength of light generated by a particular atomic transition of Krypton. This definition could be used by anyone anywhere to generate secondary "meter bars" and it was considered a major improvement. But nearly thirty years ago, the meter was re-defined in a way that should be safe from change for a very long time. The meter is now defined to be that length such that the distance travelled by light in a vacuum is exactly 299,792,458 meters in one second. So, assuming you have a good definition of a second and assuming you have an apparatus for observing the speed of light, you can create a meter standard from this value for the speed of light. It's important to recognize that there are no "decimals", no extra digits, after the "458" in the speed of light. It ends there. To put it another way, those experiments which used to be seen as refinements in the measurement of the exact speed of light have become instead refinements in the exact length of one meter.

This whole issue is closely related to the recent redefinition of the astronomical unit approved by the IAU. Like the meter, the astronomical unit is no longer defined in terms of a physical "artifact". For the meter, that artifact used to be a metal bar, for the original definition of the meter, the artifact was the Earth itself. The original "artifact" used to define the astronomical unit was the average distance of the Earth from the Sun. In the first two centuries of modern astronomy, this was a practical measuring unit because distances within the Solar System relative to each other were known with greater accuracy than the absolute distances. An astronomer could provide the distance to a comet to, let's say, four significant digits, but the distance in kilometers was only good to three significant digits. But today, this definition is no longer useful since we have reached a level where the variations in the Earth's orbit are large enough to measure and large enough to render the old definition ambiguous. Rather than having a pseudo-unit of measurement that varies based on improvements in observations, the astronomical unit is now a fixed unit defined as a simple integer multiple of the meter. It is likely that it will never change again.

When subordinate units like the astronomical unit are re-defined, the re-definitions won't be adopted by working professionals unless they make as little difference as possible to previously published work. That's why the meter was not re-defined as a distance that would make the speed of light exactly 300,000,000 meters per second. Similarly the AU was re-defined with enough digits to be effectively indistinguishable from previous definitions. So you can still say that the "au" is the "average distance" of the Earth from the Sun. This would not be a false statement in any important context.

- *Frank@ReedNavigation.com*



Chimney Rock Ancient Moon Observatory: New National Monument

President Obama named a new national monument on Friday September 21: Chimney Rock in southwestern Colorado. With two sandstone spires soaring from a mesa, not only is Chimney Rock a spectacular place; it also provides a fascinating glimpse into the ancient people who lived in that region more than

1,000 years ago.

The moon usually rises south of the stone towers at Chimney Rock, but every 18 or 19 years, the moon rises directly between the two huge pillars. This feature seems to have been especially important to a society known as the ancestral Pueblo people. They built their largest building — what archaeologists call their "great house" — to have a perfect view of this astronomical wonder.

Archaeologist Steve Lekson says that this great house is actually still standing at Chimney Rock, and it is a remarkable sight. "The location is just stunning," he says. "And then they architecturally positioned themselves on that ridge out near those two huge pillars to make that thing really impressive."

Chimney Rock Archeological Area official web site - <http://www.chimneyrockco.org/>
- <http://www.npr.org/2012/09/21/161583836/chimney-rock-becomes-newest-national-monument>

Astronomy Photographer of the Year

From the BBC . . . stunning photographs from their annual competition for astronomy photography! Enjoy the five-minute show. . .

- <http://www.bbc.co.uk/news/science-environment-19637073>



Doing Science with a Spacecraft's Signal

By David Doody

Mariner 2 to Venus, the first interplanetary flight, was launched August 27 fifty years ago. This was a time when scientists were first learning that Venus might not harbor jungles under its thick atmosphere after all. A Russian scientist had discovered that atmosphere during the rare Venus transit of 1761, because of the effects of sunlight from behind.

Mariner 2 proved interplanetary flight was possible, and our ability to take close-up images of other planets would be richly rewarding in scientific return. But it also meant we could use the spacecraft itself as a "light" source, planting it behind an object of our choosing and making direct measurements.

Mariner 4 did the first occultation experiment of this sort when it passed behind Mars as seen from Earth in July 1965. But, instead of visible light from the Sun, this occultation experiment used the spacecraft's approximately 2-GHz radio signal.

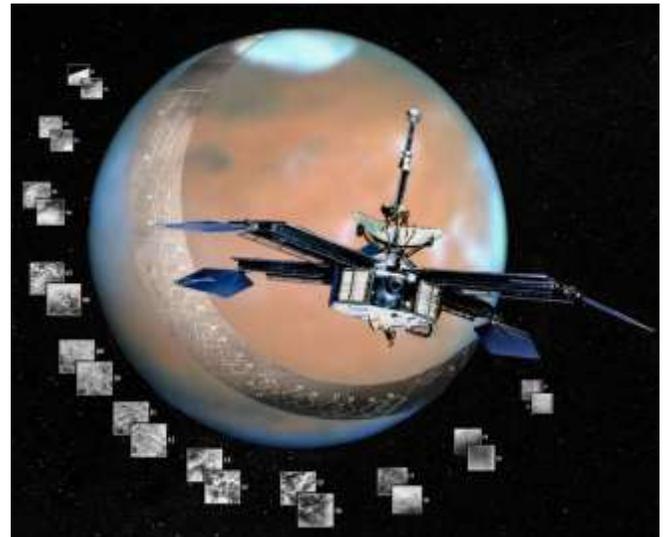
The Mariner 4 experiment revealed Mars' thin atmosphere. Since then, successful radio science occultation experiments have been conducted at every planet and many large moons. And another one is on schedule to investigate Pluto and its companion Charon, when the New Horizons spacecraft flies by in July 2015. Also, during that flyby, a different kind of radio science occultation experiment will investigate the gravitational field.

The most recent radio science occultation experiment took place September 2, 2012, when the Cassini spacecraft carried its three transmitters behind Saturn. These three different frequencies are all kept precisely "in tune" with one another, based on a reference frequency sent from Earth. Compared to observations of the free space for calibration just before ingress to occultation, the experiment makes it possible to tease out a wide variety of components in Saturn's ionosphere and atmosphere.

Occultation experiments comprise only one of many categories of radio science experiments. Others include tests of General Relativity, studying the solar corona, mapping gravity fields, determining mass, and more. They all rely on NASA's Deep Space Network to capture the signals, which are then archived and studied.

Find out more about spacecraft science experiments in "Basics of Space Flight," a website and book by this author, <http://www2.jpl.nasa.gov/basics>. Kids can learn all about NASA's Deep Space Network by playing the "Uplink-Downlink" game at <http://spaceplace.nasa.gov/dsn-game>.

Caption: In this poster art of Mariner 4, you can see the parabolic reflector atop the spacecraft bus. Like the reflector inside a flashlight, it sends a beam of electromagnetic energy in a particular direction. Credit: NASA/JPL/Corby Waste.



Target Asteroids!

A new NASA outreach project will enlist the help of amateur astronomers to discover near-Earth objects (NEOs) and study their characteristics. NEOs are asteroids with orbits that occasionally bring them close to the Earth.

This new citizen science project called "Target Asteroids!" will support NASA's Origins Spectral Interpretation Resource Identification Security - Regolith Explorer (OSIRIS-REx) mission objectives to improve basic scientific understanding of NEOs. OSIRIS-REx is scheduled for launch in 2016 and will study material from an asteroid. Find out more and participate at <http://osiris-rex.lpl.arizona.edu/>



Wishing you clear skies and oodles of outreach,

Marni Berendsen, Jessica Santascoy, & Vivian White, The Night Sky Network Team
nightskyinfo@astrosociety.org

The NASA Night Sky Network is a nationwide coalition of nearly 400 amateur astronomy clubs. The NASA Night Sky Network is managed by The Astronomical Society of the Pacific.

SWFAS Minutes

September minutes will be published in a future newsletter.

Future Events

CALUSA NATURE CENTER PLNTRM	10-4-12	7:30 PM	MONTHLY MEETING
CALOOSAHATCHEE REGIONAL PARK	10-13-12	DUSK	STAR PARTY
JN "DING" DARLING NW REFUGE	10-14-12	7:30 PM	SOLAR OBSERVING/TABLE EVENT
CALUSA NATURE CENTER PLNTRM	11-1-12	7:30 PM	TELESCOPE RENAISSANCE NIGHT
CALOOSAHATCHEE REGIONAL PARK	11-10-12	DUSK	STAR PARTY

ENERGY WE ARE WASTING WITH LIGHT POLLUTION



EQUIVALENT TO 4.9 MILLIONS LITERS OF GAS, 37 MILLION KM FOR AN AVERAGE SUV, MEANING 104 TIMES THE EARTH-MOON DISTANCE.



THIS IS ALSO EQUIVALENT TO 9436 OF SUCH SUV TRAVELING FROM NY TO LA.



EQUIVALENTS OF 15 BILLION FLASHLIGHTS BURNING FOR 8 HOURS EVERY NIGHT.
41 TW-H (TERAWATT HOUR)



EQUIVALENT TO 5 NUCLEAR REACTORS



EQUIVALENT TO 27 SUPERTANKERS FULL OF OILS



EQUIVALENT TO 5.8 MILLIONS TONS OF COAL



EQUIVALENT TO 380 BILLIONS DOLLARS/300 BILLIONS EUROS

Southwest Florida Astronomical Society, Inc.
P.O. Box 100127
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www.theeyepiece.org