THE YOUNG ASTRONOMERS NEWSLETTER

Volume 23 Number 12 | *STUDY + LEARN = POWER + SUCCESS* | November 2015

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This is the last "hard copy" issue of The Young Astronomers Newsletter. All readers are urged to access future issues on the FAS website (http:www.FAS37.org). I have had the pleasure and honor to have been able to provide the newsletter monthly for 23 years. Future issues will be available thanks to the very capable Bob Patsiga. - *Art Gormley*

"EDGE-ON" GALAXIES

A study of **spiral galaxies** seen edge-on has revealed that halos of cosmic rays and magnetic fields above and below the galaxies' disks are much more common than previously thought. Edge-on galaxies, when seen with the naked eye, -- look like a line in the sky. **Spiral galaxies**, like our own Milky Way, have the vast majority of their stars, gas, and dust in a flat, rotating disk with spiral arms. Most of the light and radio waves seen with telescopes come from objects in that disk

COALSACK NEBULA

The **Coalsack Nebula** is a huge, dusky object in the constellation of **Crux**. It forms a conspicuous silhouette against the bright, starry band of the Milky Way and has been known to people in the southern hemisphere for as long as man has existed. Like other dark nebulae, it is actually an interstellar cloud of dust so thick that it prevents most of the background starlight from reaching observers.

CERES A DARTBOARD?

A new set of high-velocity impact experiments suggests that the dwarf planet Ceres may be something of a cosmic dartboard: Projectiles that slam into it tend to stick. The experiments, performed using the Vertical Gun Range at NASA's Ames Research Center, suggest that when asteroids and other impactors hit Ceres, much of the impact material remains on the surface instead of bouncing off in space.

SATURN'S ICY MOON ENCELADUS

The **Cassini** spacecraft has begun returning its best-ever views of the northern extremes of Saturn's icy, ocean-bearing moon **Enceladus**. The spacecraft obtained the images during its October 14 flyby, passing 1,142 miles above the Moon's surface.

Mission controllers say the spacecraft will continue transmitting images and other data from the encounter for the next several days.

See: **http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA19660.** An online tool-for all three final Enceladus flybys is available at:
http://solarsystem.nasa.gov/finalflybys

CHINA'S SPACE LAB PLAN

In less than a year, China is expected to launch the Tiangong 2 small space station laboratory. With its long flights and complex tasks, the Tiangong program has taken China's human spaceflight program to new lengths, but it's really designed to prove the technologies required for the Chinese Space Station program.

LUNAR "GAS STATION" ?

Launching humans to Mars may not require a full tank of gas: A new MIT study suggests that a Martian mission may lighten its launch load considerably by refueling on the moon.

Previous studies have suggested that lunar soil and water ice in certain craters of the moon may be mined and converted to fuel. Assuming that such technologies are established at the time of a mission to Mars.

SOLAR WAVES

Two teams of researchers have independently discovered a new solar phenomenon: large-scale waves in the Sun's atmosphere accompanied by energetic particle emissions rich in helium-3. Helium-3 is a light variety of the inert gas helium. The huge waves may contribute significantly to accelerate the particles into space. The ***STEREO A*** and ***ACE*** spacecraft made it possible to simultaneously observe the Sun from two different directions. In the near future, no such opportunity will arise again.

NEW EDUCATIONAL INITIATIVES

The White House used its "Astronomy Night" to unveil some space-related educational initiatives. NASA will work with students and "citizen scientists" to identify objects to observe with the James Webb Space Telescope after its 2018 launch.

A separate competition will award $20,000 in prizes for videos promoting the Asteroid Grand Challenge of identifying potentially hazardous asteroids. NASA Space Grant universities will also support a competition for high school students to design **cubesats**, with the winning spacecraft given funds for development and launch opportunities through NASA's **Cubesat Launch Initiative**.

"KLINGONS" ?

SETI astronomers are turning their radio telescopes towards an unusual star, just in case. **SETI** is monitoring a star, **KIC 8462852**, that was previously seen to have unusual and dramatic dips in brightness that could not be explained by orbiting planets.

Some have speculated the dips could be caused by "**megastructures**" built by an alien intelligence there, but a more widely accepted explanation is that the star has a large swarm of comets orbiting it. "So history suggests we're going to find an explanation for this that doesn't involve Klingons, if you will," said SETI Institute astronomer Seth Shostak.

SCIWORKS – For information and Planetarium schedules, call 767-6730

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The Sky Tonight? **http://www.skymaps.com/downloads.html** *and also*
http://amazing-space.stsci.edu/tonights_sky/
and **http://hubblesite.org/explore_astronomy/tonights.sky**
* * * * *Astronomy Picture of The Day* - **http://apod.nasa.gov/apod/astropix.html** * * * *

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BRIGHT SPOTS ON CERES -- The brightest spots on the dwarf planet **Ceres** gleam with mystery in new views delivered by the Dawn spacecraft. See: **http://www.jpl.nasa.gov/spaceimages/details.php?id=pia19890** and **http://www.jpl.nasa.gov/spaceimages/details.php?id=pia19891**

PUZZLES

FIND THE WORD

A	T	E	M	O	C	L	O	U	D	AFRICA	FLYBY
Y	T	S	R	I	F	H	E	E	O	BLACK	FORTH
B	A	F	R	I	C	A	N	V	Z	BURST	GLEAM
Y	R	B	M	A	K	S	S	E	E	CLOUD	HOLES
L	A	R	E	O	E	C	T	M	N	COMET	HOURS
F	L	T	T	S	B	S	A	M	R	DENSE	LARGE
O	O	A	E	U	R	E	A	L	N	DOZEN	METER
R	S	L	R	U	L	E	J	A	B	EVENT	SOLAR
T	O	S	O	G	T	N	E	V	E	FABRIC	STEAM
H	T	H	E	S	E	D	E	L	B	FIRST	THESE

SCRAMBLED ASTRONOMY

METEOR SHOWERS

SIPICSD __ __ __ __ __ __ __

BIOSTOD __ __ __ __ __ __ __

DIYCSGN __ __ __ __ __ __ __

RILSDY __ __ __ __ __ __

DISURS __ __ __ __ __ __

(Answers below)

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The four-page YOUNG ASTRONOMERS NEWSLETTER is on the Internet at:
http://www.fas37.org *(FAS)* *and* http://204.200.153.100/pwood/sfair/yan.html *(The Summit School)*

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* * * * * * INTERNET SITES * * * * * *

Archive *SMART-1* Moon images - **http://www.esa.int/spaceinimages/Missions/SMART-1/(offset)/0/(sortBy)/rating**
New **Sharon** images - **https://mail.google.com/mail/u/0/?tab=wm#inbox/150287b4d930d864?projector=1**
67-P image - **http://www.spacedaily.com/reports/Rosettas_First_Peek_at_the_Comets_Dark_Side_999.html**

SITE OF THE MONTH

Hubble's Astronomy PrintShop - **http://hubblesite.org/gallery/printshop/**

* * * * * * MOON IN NOVEMBER * * * * * *

Full: 25th; First Qt.: 19th; Last Qt.: 3rd; New: 11th

Last Quarter: 11/3 **New Moon**: 11/11 **First Quarter**: 11/19 **Full Moon**: 11/25

Apogee: 11/3 9:15 AM 252,543 mi. (406,400 km)
Perigee: 10:26 9:05 AM 222,759 mi. (358,472 km)

****** The November Full Moon was called the Frosty Moon, Beaver Moon and and Hunter's Moon.

****** Best nights for observing: 10/4 – 10/20

* * * * * * PLANETS IN NOVEMBER * * * * * *

Spectacular pairings and gatherings all month before sunrise

JUPITER, **VENUS**, **MARS** and the bright star **REGULUS** are in a line within 17° in the eastern sky. **MERCURY** rises in the East below the three other planets on the 8th. MERCURY and JUPITER are the closest on the 17th at 0.4° apart. VENUS and JUPITER form their second 2015 close pairing on 10/25 and 10/26. **SATURN** is low in the SW evening sky.

* * * * * * METEOR SHOWERS * * * * * *

NAME	DATES	BEST NIGHT	PER HOUR	WHERE TO LOOK
ORIONIDS	10/4 – 11/14	10/21	20	Low in the NW.

After meteor showers were known to be produced by comets, astronomer A. S. Herschel first predicted the Orionids.

DRACONIDS 10/6 – 10/10 10/8 evening 5? High in the northwest above Lyra in DRACO. Usually, this meteor shower offers no more than a handful of slow meteors per hour, even at its peak. The waning crescent moon this year is sure to provide a dark sky for the Draconids during the peak evening hours. Also, watch out if the Dragon awakes! This shower has been known to rain down hundreds or even thousands of meteors in an hour. ** October has eight minor showers - one in daylight.

LOOK FOR: **>>>>> BIG DIPPER** – By the end of October only three stars in the handle will still be visible, but the nearby **LITTLE DIPPER** stays with us year round. **>>>>>** In the southwest, bright **ANTARES** in Scorpius will be gone by month's end. **>>>>>** The showplace of the southern skies – the **LAGOON NEBULA**. It's looking like steam rising from the spout of the **Sagittarius Teapot**.

BLACK HOLES

Nearly all black holes come in one of two sizes: **stellar mass black holes** that weigh up to a few dozen times the mass of our Sun or **supermassive black holes** ranging from a million to several billion times the Sun's mass. Astronomers believe that medium-sized black holes exist, though only about a half-dozen candidates have been considered.

But now new evidence for an **intermediate-mass black hole** about 5,000 times the mass of the Sun has been found. NASA plans to launch a new X-ray telescope, the Neutron Star Interior Composition Explorer (NSICE), to explore several candidates.

"COMET 67P"

Rosetta scientists now say that two fully fledged, separately formed comets collided at low speed in the early Solar System to give rise to the distinctive 'rubber duck' shape of **Comet 67P/Churyumov-Gerasimenko**. The origin of the comet's double-lobed form has been a key question since *Rosetta* first revealed its surprising shape.

A NEBULA'S MANY NAMES

One nebula may have had more names bestowed upon it over the ages than any other object of its kind. Although officially known as **Messier 17**, its nicknames include: **Omega Nebula**, **Swan Nebula**, **Checkmark Nebula**, **Horseshoe Nebula** and **the Lobster Nebula**

See: **http://www.eurekalert.org/multimedia/pub/99603.php**

THE VEIL NEBULA

NASA's *Hubble Space Telescope* has unveiled in stunning detail a small section of the expanding remains of a massive star that exploded about 8,000 years ago. Called the **Veil Nebula**, the debris is one of the best-known supernova remnants, deriving its name from its delicate, draped filamentary structures. The entire nebula is 110 light-years across, covering six full Moons on the sky as seen from Earth, and resides about 2,100 light-years away in the constellation **Cygnus**, the Swan.

The *Hubble* pictures of a small area roughly two light-years across, cover only a tiny fraction of the nebula's vast structure. See: **http://www.space.com/30645-veil-nebula-hubble-space-telescope-video.html**

EXTRA-MASSIVE BLACK HOLE

The central supermassive black hole of a recently discovered galaxy is much more massive than it should be compared to the mass of the galaxy around it. The galaxy, **SAGE0536AGN**, contains an active galactic nucleus (AGN), an incredibly bright object resulting from the accretion of gas by the central supermassive black hole. The gas is accelerated to high velocities due to the black hole's immense gravitational field, causing this gas to emit light.

EVIDENCE OF WATER ON MARS

New findings from MRO, the Mars orbiter, provide the strongest evidence yet that liquid water flows intermittently on present- day Mars. Mysterious streaks are signatures of hydrated minerals and are seen to ebb and flow over time. They darken and flow down steep slopes during warm seasons and fade in cooler seasons. The discovery is the latest of many breakthroughs by NASA's Mars missions.

NEW PLUTO IMAGES

The newest high-resolution images of **Pluto** from *New Horizons* are both dazzling and mystifying, revealing a multitude of previously unseen topographic and compositional details.

One image that shows an area near the line that separates day from night, captures a vast rippling landscape of strange, aligned linear ridges.

And the "snakeskin" image of Pluto's surface is another tantalizing piece in the highest-resolution color views yet in detailed spectral maps and other high-resolution images.

See: **http://pluto.jhuapl.edu/News-Center/News-Article.php?page=20150924**

SEARCH FOR LIFE

Astronomers have created a way to compare and rank exoplanets to help prioritize which of the thousands discovered warrant close inspection in the search for life beyond Earth.

The Kepler Space Telescope has enabled astronomers to detect thousands of exoplanets, - far more than can be investigated one by one. The James Webb Space Telescope, set for launch in 2018, will be the first able to actually measure the atmospheric composition of a rocky, possibly Earthlike planet far off in space, and so vastly enhance the search for life

A MOON MOSAIC

The pockmarked landscape captured in an image from ESA's *SMART-1* mission is a mosaic of the surface of the Moon. Some of the many craters scattered across the lunar surface are clearly visible as records of the multitude of impacts that have plagued it. The lunar north pole is at the center. See:

http://www.spxdaily.com/images-lg/esa-smart-1-lunar-north-pole-composite-desk-lg.jpg

THE DINOSAUR EXTICTIONS

Berkeley geologists have uncovered compelling evidence that an asteroid impact on Earth 66 million years ago accelerated the eruptions of volcanoes in India for hundreds of thousands of years, and that together these planet-wide catastrophes caused the extinction of many land and marine animals, including the dinosaurs. The new evidence with the most accurate dates yet for the volcanic eruptions before and after the impact show that the **Deccan Traps lava flows**, which at the time were erupting at a slower pace, doubled in output within 50,000 years of the asteroid or comet impact that is thought to have initiated the last mass extinction on Earth.

Both the impact and the volcanism would have blanketed the planet with dust and noxious fumes, drastically changing the climate and sending many species to an early grave.

51 PEGASI b

October 6th marked the 20th anniversary of the first discovery of a planet orbiting a Sun-like, or "normal," star beyond our solar system. The planet, called **51 Pegasi b**, belongs to a class of planets now known as **exoplanets**. Since that momentous discovery, thousands more exoplanets have been found.

See: **http://planetquest.jpl.nasa.gov/page/20-years**

WATER FROM ASTEROIDS

Water reserves found on the Moon are the result of asteroids acting as "delivery vehicles" and not of falling comets as was previously thought. Using computer simulation, scientists have discovered that a large asteroid can deliver more water to the lunar surface than the cumulative fall of comets over a billion year period.

A "SUPER" GALAXY CLUSTER

Galaxy clusters are huge conglomerations of galaxies, hot gas, and dark matter and are the largest structures in the Universe held together by gravity. They tend to be poor at producing new stars and generally have one giant galaxy in their middle that forms stars at a rate significantly slower than most galaxies - including our Milky Way. The central galaxy contains a supermassive black hole roughly a thousand times more massive than the one at the center of our galaxy.

New data provide more details on how the galaxy cluster **SPT-CLJ2344-4243** challenges this trend. The cluster has shattered multiple records in the past: In 2012, scientists announced that it featured the highest rate of cooling hot gas and star formation ever seen in the center of a galaxy cluster, and is the most powerful producer of X-rays of all known clusters. The rate at which hot gas is cooling in the center of the cluster is also the largest ever observed.

New observations of this galaxy cluster at X-ray, ultraviolet, and optical wavelengths reveal narrow filaments from the center of the cluster where stars are forming. These massive cosmic threads of gas and dust, most of which had never been detected before, extend for 160,000 to 330,000 lights years. This is longer than the entire breadth of the Milky Way galaxy, making them the most extensive filaments ever seen in a galaxy cluster.

SUNSPOTS

Sunspots are planet-sized conglomerates of bundles of intense magnetic field lines on the surface of the Sun. They are known to cause explosions (solar flares) which can directly impact our technological infrastructure. What astrophysical mechanisms are responsible for the formation of sunspots and how do they drive explosive events are important questions in our quest to understand the Sun's activity and its magnetic effect on Earth.

On-going research reveals that subsurface motions in the Sun are the ultimate driving force of burst activity in the Sun's atmosphere. The solar interior serves as the reservoir of energy that gives birth to sunspots, which structure the magnetic field of the Sun's corona and determine how the Sun affects the Earth magnetically.

ANCIENT LAKES ON MARS

A new study has confirmed that Mars was once, billions of years ago, capable of storing water in lakes over an extended period of time. The team has determined that, long ago, water helped deposit sediment into Gale Crater where the rover landed more than three years ago. The sediment deposited as layers that formed the foundation for Mount Sharp, the mountain found in the middle of the crater today. See:

http://www.jpl.nasa.gov/spaceimages/details.php?id=pia19839

MYSTERY MOUNTAIN

*Dawn i*s seeking to learn more about the structure of **Ceres** including a four-mile high protrusion they have dubbed "Lonely Mountain". Scientists are having difficulty understanding what made that mountain and have been getting many suggestions from the public including "salt" and an "ice structure".

And the crater **Occator** contains bright spots whose origin still eludes scientists. They said: "Ceres continues to amaze, yet puzzle us."

BLUE SKIES ON PLUTO

Earth isn't the only planet with blue skies. Pluto has them, too. NASA's *New Horizons* spacecraft has just beamed back the first color images of Pluto's atmosphere, and they look a lot like home.

See: **http://spaceweather.com**

PLUTO AND IT'S MOONS

Pluto and its largest moon **Charon** dance around each other, making circles around their common center of mass in an empty space between them. Around the dancing couple are four small moons: **Styx** (just beyond Charon), then **Nix**, **Kerberos** and **Hydra**. These tiny moons also orbit around the system's center of mass. Their orbits line up like a miniature solar system with all four less than about 30 miles in their longest dimension. Each has a lumpy shape because, unlike **Pluto** and **Charon**, they aren't big enough for gravity to squish them into a ball.

See:**http://www.nasa.gov/feature/pluto-s-big-moon-charon-reveals-a-colorful-and-violent-history** *and* **http://blogs.nasa.gov/pluto/wp-content/uploads/sites/253/2015/10/nh-10-4blog-pluto_schem_1.png**

THE AU MIC PUZZLE

AU Microscopii, or **AU Mic**, is a young, nearby star surrounded by a large disc of dust. Studies of such debris discs can provide valuable clues about how planets, which form from these discs, are created. Astronomers have been searching **AU Mic's** disc for any signs of clumpy or warped features, as such signs might give away the location of possible planets. Then in 2014 something very unusual was discovered – five arch-like, or wave-like, structure unlike anything that has ever been observed before.

A LUNAR "GAS STATION" ?

Launching humans to Mars may not require a full tank of gas: A new MIT study suggests that a Martian mission may lighten its launch load considerably by refueling on the moon. Previous studies have suggested that lunar soil and water ice in certain craters of the Moon may be mined and converted to fuel.

"EDGE-ON" GALAXIES

A study of spiral galaxies seen edge-on has revealed that halos of cosmic rays and magnetic fields above and below the galaxies' disks are much more common than previously thought. Studying these halos with radio telescopes can give us valuable information about a wide range of phenomena, including the rate of star formation within the disk, and the galaxies' magnetic fields

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