

YOUNG ASTRONOMERS NEWSLETTER

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STUDY + LEARN = POWER

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ASTEROID USE

The potential colonization of asteroids is one of the most promising areas of space exploration - even more so than mining them for resources, Russian scientists say. Asteroids are often easier to access because they sometimes pass very close to Earth and are typically easier to reach than the Moon.

Planetary Resources, a US based company, announced last year that it aims to develop a robotic asteroid mining industry. Another US-based firm, Deep Space Industries, said that they also hope to start a private development of asteroid mineral riches and manufacture products in space.

NEW GRB INSIGHT

In April, a blast of light from a dying star in a distant galaxy became the focus of astronomers around the world. The explosion, - a gamma-ray burst designated **GRB 130427A**, tops the charts as one of the brightest that has ever been seen.

A trio of NASA satellites working with ground-based robotic telescopes has captured never-before-seen details that challenge current theoretical understandings of how gamma-ray bursts work. See:

<http://go.nasa.gov/17R2cf3>

PHOBOS

New research suggests that Mars' moon, **Phobos**, is likely an errant asteroid trapped by the planet's gravitational pull. Astronomers matched the chemical makeup of Phobos' surface to a meteorite that struck Canada, concluding that the Martian moon likely started out as an asteroid that drifted too close to the red planet.

Asteroids are a popular explanation because Mars sits at the edge of the solar system's asteroid field. Some scientists say that a captured asteroid would likely have an orbit that is highly elliptical, or that the moons formed from debris ejected from a meteorite impact.

TWO OF A KIND

Spiral galaxy **NGC 6984** played host to the explosion of supernova **SN 2012im** in 2012. Now, a nearby star has exploded, forming supernova **SN 2013ek**. The explosions were so close that the two events are thought to be linked in some unknown way. The chance of two completely independent supernovae so close together exploding within one year of one another is a very unlikely event. See: <http://www.spxdaily.com/images-lg/ngc-6984-supernova-lg.jpg>

A NEW BABY

Combined observations from *Spitzer* and ALMA in Chile have revealed the throes of stellar birth as never before seen in the well-studied object known as HH 46/47. **Herbig-Haro (HH)** objects form when jets shot out by newborn stars collide with surrounding material, producing small, bright, nebulous regions.

The *Spitzer* observations show twin supersonic jets emanating from the central star that blast away surrounding gas and set it alight into two bubbly lobes.

See: <http://www.eso.org/public/archives/images/screen/eso1336c.jpg>

MARS MAVEN MISSION

NASA's *MAVEN* probe was launched November 18th on a mission to find out why Mars' atmosphere is too cold and thin to support water. *MAVEN* will study the atmosphere for clues on how the Sun may have influenced gas to escape from the planet billions of years ago. See: <http://www.nasa.gov/maven>

SPOTS ON THE SUN

A "sunspot" is seen as a dark spot on the Sun's "surface" and given a rating based on its area. Over a period of about 11 years, sunspot activity will usually go from a low to high and then back to low. 2008 - 2009 was apparently the low phase and the high phase is 2013.

The monthly low points and highs seem to occur in waves about 5-7 months apart. The 2013 highs have peaked in May and November.

SUNSPOT LOWS - 2007 THRU 2011

2008: no spots in August, - 272 days no spots

2009: 259 days no spots

2010: 43 days no spots

2011: 1 day no spots

MONTHLY SUNSPOT HIGHS - 2011 thru 2013

2011: ran from 65 to 208, - 10 months 100+

2012: ran from 83 to 169, - 10 months 109+

2013: ran from 117 to 272 (Nov), - 11 months 117+

LADEE

On November 20, NASA's *LADEE* spacecraft entered its planned orbit around the Moon's equator allowing the small probe to make frequent passes from lunar day to lunar night. This will provide a full scope of the changes and processes occurring within the Moon's atmosphere. See: <http://www.nasa.gov/ladee>

EARLY MARS CRUST

Based on an analysis of a 4.4 billion-year-old Martian meteorite that was unearthed by Bedouin tribesmen in the Sahara desert, a Florida State University scientist has uncovered what may be the first recognized example of ancient Martian crust.

High concentrations of trace metals such as iridium, an element that indicates meteoritic bombardment, showed that this meteorite came from the elusive cratered area of Mars' southern highlands. The team dated special crystals within the meteorite (zircons) at an astounding 4.4 billion years old.

M15

The *Hubble Space Telescope* has captured the "best ever" image of the globular cluster **Messier 15**, one of the oldest globular clusters known. It is in **Pegasus** in the center of the Milky Way with over 100,000 stars, and may hide a rare type of black hole. See:

<http://www.spacetelescope.org/images/heic1321a/>

EARLIEST GALAXY FOUND

Colleagues at several institutions have identified the earliest galaxy ever detected. The finding suggests that the infant universe may harbor a larger number of intense star-forming galaxies than believed possible.

SCIWORKS - planetarium schedules and Information, call 767-6730

The Sky Tonight? <http://www.skymaps.com/downloads.html>
<http://www.skymaps.com/downloads.html>
http://amazing-space.stsci.edu/tonights_sky/

*** Astronomy Picture of The Day - <http://apod.nasa.gov/apod/astropix.html> ***

CUBESATS

11 small *Cubesat* research satellites from nine universities, a NASA center and a high school were launched into space November 19th. *Cubesat* research addresses science, exploration, technology development, education or space missions. See: http://go.nasa.gov/CubeSat_initiative.

December 21st - first day of Winter - December Solstice

Puzzles

Find The Word

S M A L L D E S A B	BASED	MINING
R I W H E T P J Q H	BLAST	NEVER
A N S T S O T E U R	DATED	NOTED
T I O O T T H R E E	EVENT	QUEEN
S N H S C N E E E V	FIELD	SMALL
M G E A E E S H N E	GAMMA	STARS
E A P V S N E T N N	GHOST	TENSE
S M A R E B L A S T	IMPACT	THERE
I M E T A L S R J R	MAVEN	THESE
D A T E D L E I F R	METALS	THREE

Scrambled Astronomy:

ANIMALS IN THE SKY

SIARE	___	___	___	___	___
UPSUL	___	___	___	___	___
ESLUP	___	___	___	___	___
CADOR	___	___	___	___	___
ARUTSU	___	___	___	___	___

(Answers on page 4)

The **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)

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

Cassini view of Saturn's rings - <http://www.jpl.nasa.gov/spaceimages/details.php?id=PIA17474>

Halloween leftovers- scientists have released a trio of stellar ghosts.

All three spooky structures, called planetary nebulas, are in fact material ejected from dying stars:

- Exposed Cranium Nebula - <http://www.spitzer.caltech.edu/images/5687-sig13-013-Exposed-Cranium-Nebula>
- Ghost of Jupiter Nebula - <http://www.nasa.gov/content/ghost-of-jupiter-nebula/#.Un0zUHC-ol8>
- Little Dumbbell Nebula - <http://www.spitzer.caltech.edu/images/5686-sig13-015-Little-Dumbbell-Nebula>

SITE OF THE MONTH

Science news site - http://www.sciencedaily.com/news/space_time/

***** MOON IN DECEMBER *****

New Moon: 12/2 First Quarter: 12/9 Full Moon: 12/17 Last Quarter: 12/25

Perigee: 12/4 5:16 AM 223,733 mi. (360063 km) **Apogee:** 12/19 6:50 PM 252,433 mi. (406267 km)

** The December Full Moon was called the **Cold Moon** and **Long Night Moon**.

** **Best observing nights:** 12/1 – 12/9, 12/22- 12/31

***** PLANETS IN DECEMBER *****

NEPTUNE is in the S and can be seen with a telescope as a blue-gray disk between the horizon and overhead.

VENUS is in the SW sky at dusk and sets about 1+ hours after the Sun. **MARS** rises in the E after midnight.

JUPITER rises in the ENE after sunset and sets after dawn in the SW. **MERCURY** appears low in the ESE before sunrise and is behind the Sun on the 29th (*superior conjunction*). **SATURN** rises in the SE 1.9 hours before sunrise and earlier each day. **URANUS** is at the lower left of the Moon by mid-month.

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

<u>NAME</u>	<u>DATES</u>	<u>BEST NIGHTS</u>	<u>PER HOUR</u>	<u>WHERE TO LOOK</u>
GEMINIDS	12/4 – 12/17	12/13 - 12/14	120	Halfway up in the western sky
before dawn. Bright moonlight will wash out many meteors but this is still one of the best showers of the year.				
URSIDS	12/17 – 12/24	12/22	10	North - Ursids have a variety of colors.
December has nine minor/weak showers. In a dark site, meteors will appear almost every night during the month.				

LOOK FOR: >>>> **Venus** on December 6th – it will at its brightest. >>>> **Mars** - with a telescope. You can see the North Polar cap now. >>>> **Cassiopeia** – the big "W" overhead. In mythology, she was an Ethiopian queen. This constellation is visible all year.

EARLY UNIVERSE

- o The *Hubble*, *Spitzer* and *Chandra* space telescopes are teaming up to look deeper into the universe than ever before. With a boost from natural "**gravitational lenses**" found in space, they should be able to uncover populations of galaxies that existed when the universe was only a few hundred million years old and have not been seen before now. They are as much as 100 times fainter than what these three great observatories typically can see. See: <http://hubblesite.org/news/2013/44>
- o University of Texas astronomers have discovered and measured the distance to the most distant galaxy ever found.

The galaxy is seen as it was at a time just 700 million years after the Big Bang. , this galaxy is the farthest and earliest whose distance can be definitively confirmed with follow-up observations from the Keck I telescope,

RUSSIAN METEOROID

A team of NASA and international scientists have gathered a detailed understanding of the effects on Earth from a small meteoroid impact. The unprecedented data obtained as the result of the airburst of a meteoroid over the Russian city of Chelyabinsk in February has revolutionized scientists' understanding of this natural phenomenon.

Because of the extreme heat, many pieces of the meteor vaporized before reaching Earth. Scientists believe that between 9,000 to 13,000 pounds of meteorites fell to the ground with one fragment weighing approximately 1,400 pounds.

BOOMERANG NEBULA

Astronomers used a radio telescope array in Chile to study a cosmic curiosity known as the **Boomerang Nebula**, the coldest object in the universe.

The Boomerang, a **pre-planetary nebula** is nearing the end stage of its life. Its temperature is one degree Kelvin -- minus 458 degrees Fahrenheit, See:

http://www.nasa.gov/multimedia/imagegallery/image_feature_405.html

ASTEROIDS

Russian scientists in the Crimea discovered another potentially hazardous 250-mile wide asteroid that is headed to a dangerous Earth pass-by in 2032. They also discovered a potentially dangerous asteroid estimated to pass Earth in 2065 at a distance of only 4.350 miles.

NASA's near-Earth object program lists 1435 known Potentially Hazardous Asteroids. Eleven have been discovered in the last 60 days, including the latest finds.

GROWTH OF GALAXIES

Galaxies outlive trees by billions of years, making their growth impossible to see, but astronomers can read the rings in a galaxy's disk to unravel its past. Using data from *WISE* and *GALEX* scientists have acquired more evidence for the "inside-out" theory of galaxy growth, showing that bursts of star formation in central regions were followed one to two billion years later by star birth in the outer fringes.

Initially, a rapid star-forming period formed the mass at the center of these galaxies, followed later by a star-forming phase in the outer regions. Eventually, the galaxies stop making stars and become stable.

CASSINI IMAGES OF TITAN

With the Sun now shining down over Saturn's moon Titan, a little luck with the weather, and trajectories that put the *Cassini* spacecraft into optimal viewing positions, it has obtained new pictures of the liquid methane and ethane seas and lakes that reside near Titan's north pole.

The images reveal new clues about how the lakes formed and Titan's Earth-like "hydrologic" cycle that involves hydrocarbons rather than water. See:

<http://www.spxdaily.com/images-lg/vims-titan-3-ir-wavelengths-lg.jpg>

MILKY WAY'S BLACK HOLE

Researchers using NASA's *Chandra X-ray Observatory* have found evidence that the normally dim region very close to the supermassive black hole at the center of the Milky Way Galaxy flared up with at least two luminous outbursts in the past few hundred years. This discovery comes from a new study of rapid variations in the X-ray emission from gas clouds surrounding the supermassive black hole.

KEPLER 87b

Not only is **Kepler-78b** a mystery world, it is the first known Earth-sized planet with an Earth-like density. **Kepler-78b** is about 20 percent larger with a diameter of 9,200 miles, and weighs almost twice as much. As a result it has similar density which suggests an Earth-like composition of iron and rock.

Kepler-78b is a member of a new class of planets which orbit their stars with periods of less than 12 hours. They're also small but Kepler-78b is the first and only planet in the new class to have its mass measured.

SMITH CLOUD

The **Smith Cloud**, a gigantic streamer of hydrogen gas is on a collision course with the Milky Way Galaxy. Astronomers have discovered a magnetic field deep in the cloud's interior, which may protect it during its meteoric plunge into the galaxy's disk.

This discovery could help explain how so-called high velocity clouds remain mostly intact during their mergers with the disks of galaxies where they would provide fresh fuel for a new generation of stars. The origin of the Smith Cloud's field remains a mystery.

ASTEROID WITH TAILS

New *Hubble Space Telescope* images reveal a "never-before-seen" set of six comet-like tails radiating from a body in the asteroid belt. The asteroid (P/2013 P5) was discovered as an unusually fuzzy-looking object on September 10th but when *Hubble* returned on the 23rd, the asteroid's appearance had totally changed - it looked as if the entire structure had swung around.

One interpretation is that its rotation rate has been increased to where dust is falling off and escaping into space where the pressure of sunlight sweeps out the fingerlike tails.

INDIA'S MARS MISSION

India has launched its first mission to Mars and aims to become the only Asian nation to reach the Red Planet. India has never before attempted inter-planetary travel, and more than half of all missions to Mars have ended in failure, including China's in 2011 and Japan's in 2003.

FIRST LIFE ON EARTH

How life began on planet Earth has always baffled humans. Now, research by Sankar Chatterjee, a scientist at Texas Tech, suggests it may have rained from the skies and he believes he has found the answer by connecting theories on chemical evolution with evidence related to our planet's early geology.

By studying three sites containing the world's oldest fossils, he believes the first single-celled organisms formed in hydrothermal crater basins.

GLOBULAR CLUSTER BLACK HOLES

Until recently, astronomers had assumed that the black holes did not occur in **globular clusters** which are some of the oldest and densest collections of stars in the universe.

When a team of Michigan State astronomers discovered black holes in a **globular cluster** last year (M22), they were not sure if it was a common occurrence. They now believe it was since another black hole has been found in a globular cluster, M62.

EARTH-LIKE PLANETS

US astronomers said as many as one in five Sun-like stars may have a planet the size of Earth, and the nearest could be in systems visible to the naked eye. Ten newly discovered planets are close to Earth-sized and in the habitable zone of their stars.

There are about two dozen planets that may be a suitable distance from their suns so that their oceans would not boil or freeze.

NEW-FOUND ASTEROIDS

Two surprisingly large **Near-Earth Asteroids** have just been discovered, plus a third which has gone undetected until now, even though it can pass close enough to the Earth to be classified as "potentially hazardous".

Not since 1983 has any **Near-Earth Asteroid** been found as large as the approximately 12-mile wide size of the two new large ones - there are only three other known near-Earth asteroids that are of comparable size or larger. None of the new three can come close enough to the Earth to represent a near-term threat to Earth.

SUN'S MAGNETIC FIELD FLIP

Every 11 years, the Sun undergoes a complete makeover when the polarity of its magnetic field - its magnetic north and south - flips. The internal mechanism that drives the shift is not entirely understood.

The Sun is usually at the peak of its activity during a magnetic field reversal with an increased number of sunspots and a surge in solar flares and mass ejections.

BLACK HOLE JETS

For the first time, astronomers have cracked the lid open on black hole jets - the little-understood, super-powerful streams of matter sometimes emitted from the centers of black holes. They have found that the high-speed jets contain heavy atoms - nickel and iron, that must be providing positive charged atoms.

Atoms with a positive charge are much heavier than the positrons astronomers thought might be responsible for the powerful jet streams. This means the jets can draw far more energy from the black hole than scientists previously believed.

SWARM MISSION

Europe's ESA has launched the *Swarm mission*, a trio of hi-tech satellites designed to explore Earth's magnetic field and help explain some of the weird things happening to our planet's magnetism. Scientists ask: "The magnetic pole is changing, and the magnetic field is changing too. Why?"

Earth's magnetism derives from superheated liquid iron and nickel, which swirl like a spinning dynamo in the outer core about 1,800 miles beneath the surface. Like a spinning dynamo, this subterranean metal ocean generates electrical currents and thus a magnetic field that is not constant.

The well-known gap between Earth's magnetic north pole and its geographical north is growing and the magnetic field has been weakening. Some experts wonder if this is a prelude to something really big: a reversal of magnetic polarity when N becomes S. Polarity switches occur around every 200,000 to 300,000 years, according to telltale magnetic signatures found in ancient sediments.

EARLY MILKY WAY

The Hubble Space Telescope has produced the first visual evidence of how the Milky Way assembled itself into the majestic pinwheel of stars we see today. Astronomers studied the evolution of 400 galaxies similar to the Milky Way and noted their appearance at various stages of development over 11 billion years. They found the Milky Way likely began as a faint, blue, low-mass object containing a lot of gas - the fuel for star birth.

They also found the Milky Way probably was a flat disk with a bulge in the middle, both of which grew simultaneously into the majestic spiral seen today. See:

<http://hubblesite.org/news/2013/45> (and)

<http://www.nasa.gov/hubble>

THE BIG RED SPOT

Jupiter's Great Red Spot is one of the solar system's most mysterious landmarks. Based on what scientists have understood, this massive storm - which is big enough to engulf the Earth two or three times over - should have disappeared centuries ago.

But now new studies suggest that it is like a whirlpool, or vortex. A model also predicts a radial flow, which sucks winds from the high-speed jet streams toward the vortex center enabling it to last longer.

MYSTERY OBJECT

Most stars do not form alone, but have many siblings created in a cluster at about the same time from a cloud of gas and dust. **NGC 3572**, in **Carina** (The Keel), is a cluster with many young stars that shine brightly and generate powerful stellar winds.

A strange feature is the tiny ring-like nebula located slightly above the center in an image. Astronomers still are uncertain about the origin of this curious feature. See:

<http://www.spxdaily.com/>

[images-lg/star-cluster-ngc-3572-lg.jpg](http://www.spxdaily.com/images-lg/star-cluster-ngc-3572-lg.jpg)

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