

YOUNG ASTRONOMERS NEWSLETTER

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STUDY + LEARN = POWER

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COMET CRASH IN AUSTRALIA

Approximately 800,000 years ago, a rock 100 to 160 feet across crashed down in Western Tasmania, Australia. As it slammed into the Earth, temperatures exceeded 3,100°F, melting rock and creating **glass sphericals**, as well as a quarter-mile wide hole known as the Darwin Crater.

Scientists have now found organics (cellulose and proteins) trapped inside tiny pockets in the glass sphericals.

If some of the organics were launched off Earth, they could have traveled through space to seed other bodies - a theory suggesting that in a similar event, life did not originate on Earth, but traveled here from elsewhere in the universe.

NASA'S ROVER CHALLENGE

NASA's new **Human Exploration Rover Challenge** is an engineering design challenge to students worldwide in the next phase of human space exploration. It is a more complex follow-on to the **Great Moonbuggy Race**.

The competition is open to high school and college students and challenges them to create a vehicle designed to travel the simulated surface of another world. Registration closes Jan. 10 for international teams and Feb. 7 for U.S. teams. See:

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

(and) <http://www.nasa.gov/education>

EUROPA SURFACE MATERIAL

A new analysis of data from the *Galileo* mission has revealed clay-type minerals at the surface of Jupiter's moon Europa that appear to have been delivered by a spectacular collision with an asteroid or comet. This is the first time such minerals have been detected on Europa's surface. The types of space rocks that deliver such minerals typically also often carry organic materials - important building blocks for life that are often found in comets and primitive asteroids.

Many scientists believe Europa is the best location in our solar system to find existing life. It has a subsurface ocean in contact with rock, an icy surface that mixes with the ocean below, salts on the surface. Scientists have also long thought there must be organic materials at Europa, too, though they have yet to detect them directly.

KIROBO'S CHRISTMAS

The world's first robot astronaut has begun chatting to the Japanese commander of the International Space Station, in what was being billed as the first conversation of its kind. **Kirobo**, the pint-sized android equipped with artificial intelligence and capable of learning how to respond appropriately to humans, said he expected a visit from a certain man bearing gifts. "What will you ask for from Santa Claus, Kirobo?" asked the Japanese astronaut. "I want a toy rocket... let's ask Santa Claus."

The unscripted conversation, in Japanese, is part of a longer-term project to see how a robot can act as a companion for isolated people, and to see if it can develop conversational skills

MILKY WAY'S ARMS

British astronomers say that a study of massive stars has confirmed the Milky Way galaxy has four spiral arms, ending debate sparked by telescope images suggesting our galaxy had only two arms. The shape of our galaxy cannot be observed directly from Earth because we are on the inside looking out, they say, but observation of its stars and their distances from us can help deduce its shape.

SUNSPOTS

Sunspots are huge, dark, irregularly shaped, and temporary areas of intense magnetism that expand and contract as they move. The diameters of sunspots are frequently on the order of 50,000 miles and their intense magnetism usually reaches about 3,000 Gauss.

By contrast, refrigerator magnets average about 5 Gauss, the Sun averages about 1.0 Gauss, and the Earth averages about .50 Gauss." Most of the Sun's surface is covered by convection cells--roiling and boiling gases that bring heat up to the Sun's surface from the furnace in its core by convection. It is only because of the relative "coolness" of sunspots that they appear black.

RADIO BURSTS

First discovered in 2007, "fast radio bursts" continue to defy explanation. These cosmic chirps last for only a thousandth of a second. The characteristics of the radio pulses suggested that they came from galaxies billions of light-years away.

However, new work points to a much closer origin - flaring stars within our own galaxy. Only six have been discovered to date, all of them in archival data. Each was detected only once, making follow-up studies difficult.

GAIA TELESCOPE

The European Space Agency launched an advanced telescope designed to detect a billion stars and provide the most detailed map yet of the Milky Way and our place in it. The **Gaia telescope** is the most sophisticated space telescope ever built by Europe, and aims at building an "astronomical census" of a billion stars, or around one percent of all the stars in the Milky Way.

By repeating the observations as many as 70 times, **Gaia** can help astronomers calculate the distance, speed, direction and motion of the stars and build a 3-D map of our area of the galaxy.

UNUSUAL GALAXY

W49A might be one of the best-kept secrets in our galaxy. This star-forming region shines 100 times brighter than the Orion nebula, but is so obscured by dust that very little visible or infrared light escapes. But the Smithsonian's Submillimeter Array (SMA) has peered through the dusty fog to provide the first clear view of this stellar nursery and revealed an active site of star formation being fed by three big streamers of in-falling gas. See: <http://images.nrao.edu/82>

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**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> ****

NASA's WISE mission has released a new and improved atlas and catalog brimming with data on three quarters of a billion objects detected during two full scans of the sky. One new feature of the enhanced WISE images is the ability to search for nearby stars, especially cooler ones that only show up in infrared light.

See: <http://wise2.ipac.caltech.edu/docs/release/allwise/>

Puzzles

Find The Word

N R M K Y A A T A W	AREAS	EVENT
H E C A C T R S O F	ATLAS	FOUND
U T R L L A S R O N	BLACK	GLASS
M A A A H A L U R I	BURST	HUMAN
A R S C L D N B D W	CARRY	NIGHT
N C H G N D T P E R	CHART	OCEAN
A R E V O R H L R A	CRASH	ORDER
E Y R R A C G A H D	CRATER	PLACE
C A R E A S I C O N	DARWIN	RADIO
O I D A R T N E V E	DUSTY	WORLD

Scrambled Astronomy:

AROUND THE HOUSE

AFNREUC	___	___	___	___	___	___
SELCA	___	___	___	___	___	___
SEELA	___	___	___	___	___	___
EBLAT	___	___	___	___	___	___
LOCKK	___	___	___	___	___	___

(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 *****

How to read a Star Chart – <http://www.Astronomy.com/starchart>

Most distant objects - http://en.wikipedia.org/wiki/List_of_the_most_distant_astronomical_objects

SITE OF THE MONTH

Explore the sky - <http://www.seasky.org/celestial-objects/celestial-objects.html>

***** JANUARY MOON *****

New Moon: 1/1 **First Quarter:** 1/7 **Full Moon:** 1/15 **Last Quarter:** 1/24 **New Moon:** 1/30
Perigee: 1/1 3:59 PM 221,781 mi. (356922 km) ** The January Full Moon was called the **Wolf Moon**.
Apogee: 1/15 8:53 PM 252,607 mi. (406531 km) ** **Best observing nights:** 1/1 – 1/8, 1/24 – 1/31
Perigee: 1/30 4:59 AM 221,879 mi. (357079 km)

***** PLANETS IN JANUARY *****

NEPTUNE is 25° high, in the SW after twilight in early January and near Mercury in late January. **URANUS** is half-high in the ENE in the evening sky and sets before midnight. **VENUS** is in the western sky after sunset and passes 5° north of the Sun on the 11th (*inferior conjunction*). By the 17th, it is in the southwest morning sky. **MARS** is above the eastern horizon after 1 AM. **JUPITER** rises in the east during evening twilight. **MERCURY** appears in the western sky after the 15th in the western sky, and after midnight. **SATURN** is in the SE as twilight begins.

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

<u>NAME</u>	<u>DATES</u>	<u>BEST NIGHT</u>	<u>PER HOUR</u>	<u>WHERE TO LOOK</u>
QUADRANTIDS	12/28 -1/12	1/3	60 - 120	Northeast near Bootes. This shower peaks in the pre-dawn hours but puts on a good show all night. The sky will be dark with the New Moon is on the 1st. Although the shower source is near Bootes, the original constellation in this area was Quadrans Muralis which is no longer used. Also, there is no known comet associated with this stream. January has twelve weak/minor showers.

LOOK FOR: >>>>> **VENUS** – it puts on a show this month. It is in the WSW and is a crescent that grows dimmer, thinner, and lower each night until the 7th when it will be directly above the Sun. Then from the 9th to the 12th it is above the horizon at BOTH SUNRISE AND SUNSET. On the 10th at midday, block the Sun and you'll see Venus just above the Sun. On the 28th and 29th, use the Moon to find Venus in the daytime.

BUT DO NOT EVER LOOK DIRECTLY AT THE SUN.

THREE EARLY GALAXIES

Astronomers have discovered a far-flung trio of primitive galaxies nestled inside an enormous blob of primordial gas nearly 13 billion light-years from Earth. These galaxies appear poised to merge into a single massive galaxy and eventually evolve into something like the Milky Way.

Areas of such furious star formation should be brimming with heavy elements such as carbon, silicon, and oxygen. These elements are forged in the nuclear furnaces of massive, short-lived stars like those bursting into life inside the three galaxies.

At the end of their relatively brief lives, these stars explode as supernovas, seeding the intergalactic medium with a fine dust of heavy elements. The absence of a signal from heavy elements that is the most exciting result

HUGE GRB

Gamma-ray bursts (GRBs) are violent bursts of gamma radiation associated with exploding massive stars. For the first time ever, researchers have observed an unusually powerful gamma-ray burst in the relatively nearby universe, a monster gamma-ray burst.

Astronomers never see the original star itself - it is far too dim to be seen from their distance in the universe. But when the star dies, they can see the exploding star as a supernova and there may be a very short burst.

Although GRBs are extremely bright and can be seen across the entire universe, they cannot be seen from telescopes from Earth because the atmosphere absorbs the gamma radiation - astronomers use space telescopes.

YOUNGEST X-RAY BINARY

Chandra X-ray Observatory data has revealed faint remnants of a supernova explosion and helped researchers determine that **Circinus X-1** (an X-ray binary) is the youngest of this class of astronomical objects found to date.

X-ray binaries are star systems made up of two parts: a compact stellar remnant -- either a neutron star or a black hole; and a companion star -- a normal star like our Sun. As they orbit one another, the neutron star or black hole pulls in gas from the companion star. This heats the gas to millions of degrees, producing intense X-ray radiation and making these star systems some of the brightest X-ray sources in the sky.

A HUNGRY BLACK HOLE

A small yet voracious black hole located in the **Pinwheel Galaxy** is forcing astronomers to reevaluate what they know about the already mysterious objects. Based on the amount of gas and dust the black hole consumes, researchers expected to uncover a messy situation. See: <http://www.sci-news.com/astronomy/science-ulx1-black-hole-messier101-01582.html>

KEPLER

NASA's crippled *Kepler Space Telescope* has been successfully revived and may get a new mission searching the skies. It would have new opportunities to observe star clusters, young and old stars, active galaxies and supernovae.

During testing of the new procedure, light collected from a distant star field produced an image quality within five percent of the primary mission's image parameters.

STRANGE GEMINIDS

Astronomers have long been puzzled by the Geminid meteor shower - fast, bright, and reliable, never fail to show up, and called the finest meteors of the year by many.

But where do they come from? That is the puzzle. There is no comet that matches the orbit of the Geminid debris stream but the orbit is occupied by an object called "**3200 Phaethon**" that looks remarkably like a rocky asteroid. It swoops by the Sun every 1.4 years, much like a comet would, but it never sprouts a dusty tail.

When a group of astronomers observed **3200 Phaethon** when it passed by the Sun, it doubled in brightness and looked as if sunlight were shining through a cloud of dust around the asteroid. The observers began to suspect **3200 Phaethon** was something new -- a "**rock comet**", an asteroid that comes very close to the Sun--so close that solar heating scorches dusty debris right off its rocky surface.

SATURN'S HEXAGON

The *Cassini* spacecraft has obtained the highest-resolution movie yet of a unique six-sided jet stream, known as The Hexagon, around Saturn's north pole

This is the first movie to show a complete view of the top of Saturn down to about 70 degrees latitude. Spanning about 20,000 miles across, the hexagon is a wavy jet stream of 200-mph winds with a massive, rotating storm at the center. There is no weather feature exactly, consistently like this anywhere else in the solar system. See: <http://go.usa.gov/Wtrk>

GRAVITY

A new issue of *The Universe in the Classroom* is now available at: <http://m1e.net/c?115666567-8lRpv1l8w0Xw%4060324674-2xaKzMZfildHs>

In the fall of 2013, peoples' imagination was captured by the movie *Gravity*. Though many of the plot elements were unrealistic, overall the movie accurately portrayed the role of gravity, and showing how people and objects move in space.

The misconception arises when we ask about the role gravity plays. The movie gives educators a marvelous opportunity to help learners of all ages better understand how gravity works.

In this edition, learn about the starring role of gravity in the real life of astronauts and their work in space.

EXOPLANETS' WATER

Astronomers say they've found faint signatures of water in the atmospheres of five distant planets.

Although the probable existence of atmospheric water has been detected previously on a few exoplanets orbiting stars beyond our solar system, the new study is the first to conclusively measure and compare the profiles and intensities of these signatures on multiple worlds. The five planets are hot Jupiters, massive worlds that orbit close to their host stars.

COMET LOVEJOY

A team of astronomers captured an image of the intricate flow of the **Comet Lovejoy's** (C/2013 R1) complex, wiggling streams in the comet's tail. Comet Lovejoy was discovered in September. See:

<http://www.naoj.org/Topics/2013/12/05/fig1e.png>

MEN ON MARS ?

Bas Lansdorp, the founder of Mars One colony project, believes that in about a decade from now a colony of people from the Earth will appear on Mars. Experts confirm that with the current technologies this is quite possible. Lansdorp is expecting that the first unmanned mission to pave the way to the Red Planet will leave in 2016, followed by a first rover in 2018. The first colonists will come to Mars in 2023, he says. According to Lansdorp's calculations, it will cost about \$6 billion to get the first four people on Mars and \$4 billion for every crew that follows.

ROSETTA'S NEW MISSION

When Europe's *Rosetta* probe is roused from its deep space slumber in January, scientists are hoping it will wake up fit and ready for the final stage of its daring mission to land a spacecraft on a comet. There is little room for mistakes as the coming months involve a high-speed chase, a delicate dance around comet **67P/Churyumov-Gerasimenko**, and finally the precision drop of a lander onto its icy surface — set for November 11th.

The effort is different from NASA's *Deep Impact* probe that fired a projectile into comet **Tempel** in 2005, hurling a plume of matter into space for scientists to study. That mission was more of a sniper shot compared to the extended rendezvous the European Space Agency is planning for its spacecraft.

CHINA'S FLYBY OF TOUTATIS

China's flyby of asteroid **4179 Toutatis** shows that the gigantic space rock which once triggered a doomsday scare is essentially rubble. Their lunar probe **Chang'e-2** came within 770 yards of the asteroid's surface, returning images showing a rock shaped like a piece of ginger root (2.96 miles long by 1.21 miles wide. A crater at its large end shows evidence of an impact at some point in its history. **Toutatis** is one of the biggest "potentially hazardous asteroids," whose orbit can bring them close to Earth." See: <http://www.spxdaily.com/images-lg/china-change2-asteroid-toutatis-lg.jpg>

CHANG'E-3 ON THE MOON

The successful landing of China's Chang'e-3 spacecraft on the Moon is the first in a sequence of four robot lunar landings that China has officially announced and represents an important step forward for their space program. It's also the first object to safely land on the Moon in 36 years, breaking a mission drought that has gone longer than most analysts would have expected.

STARBURST GALAXY

Astronomers have captured never-before-seen details of the nearby starburst galaxy M82 — it is located above the bowl in the Big Dipper Ursa Major. The new data highlights streamers of material fleeing the disk of the galaxy as well as concentrations of dense molecular gas surrounding pockets of intense star formation.

M82 is a classic example of a starburst galaxy -- one that is producing new stars tens- to hundreds-of-times faster than our own Milky Way. See:

<http://www.spxdaily.com/images-lg/starburst-galaxy-m82-lg.jpg>

END OF THE UNIVERSE

Physicists have long predicted that the universe may one day collapse, and that everything will be compressed to a small hard ball. New calculations from physicists at the University of Southern Denmark now confirm this prediction - and they also conclude that the risk of a collapse is even greater than previously thought.

Sooner or later a radical shift in the forces of the universe will cause every little particle in it to become extremely heavy. Everything - every grain of sand on Earth, every planet in the solar system and every galaxy - will become millions of billions times heavier than it is now, and this will have disastrous consequences: The new weight will squeeze all material into a small, super hot and super heavy ball, and the universe as we know it will cease to exist.

EUROPA'S WATER VAPOR

The *Hubble Space Telescope* has discovered water vapor erupting from the frigid surface of Jupiter's moon **Europa**, with one or more plumes near its south pole. It is already thought to harbor a liquid ocean beneath its icy crust, making the moon one of the main targets in the search for habitable worlds away from Earth.

SUN'S POLARITY

Something big is about to happen on the Sun. According to measurements from NASA-supported observatories, the Sun's vast magnetic field is about to flip and we are no more than three to four months away from a complete field reversal.

The Sun's magnetic field changes polarity approximately every 11 years. It happens at the peak of each solar cycle as the sun's inner magnetic dynamo reorganizes itself. The coming reversal will mark the midpoint of Solar Cycle 24. Half of "solar max" will be behind us, with half yet to come.

HS STUDENTS' CUBESAT

Students at Thomas Jefferson High School for Science and Technology in Alexandria, Va., built **TJ3Sat** - a **Cubesat** that was launched into space in November. **TJ3Sat** is a class of research spacecraft called **nanosatellites**, which measure approximately four inches long, have a volume of about one quart and weigh about three pounds. **TJ3Sat** contains a voice synthesizer module that will take written phrases in the form of code and produce a phonetic voice reading on the satellite's downlink frequencies. It is the first NASA-sponsored cubesat developed by high school students.

METEORITE "REDISCOVERED"

A rare meteorite formed soon after the origin of the solar system sat unnoticed for more than a century in a private Dutch collection.

Estimated at 4.6 billion years old, the cosmic fragment was "rediscovered" by a Dutch amateur astronomer when he examined the collection. The meteorite is a very rare, carbon-rich type known as a **CM carbonaceous chondrite**.

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