

# THE YOUNG ASTRONOMERS NEWSLETTER

Volume 23 Number 3

STUDY + LEARN = POWER

February 2015

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## SOLAR FLARES

Though scientists do not completely understand what triggers solar flares, Stanford solar physicists have designed an automated analysis that could someday provide advance warning to protect power grids and communication satellites.

Solar flares can release energy equivalent to many atomic bombs, cutting out satellite communications and damaging power grids on Earth. The flares arise from twisted magnetic fields all over the Sun's surface.

## CHONDRULES

Meteors that crashed to Earth have long been regarded as relics of the early solar system. Studded with **chondrules**, -- tiny, glassy, spherical grains scientists thought were the "kernels" of terrestrial planets: As the solar system grew, they collided with bits of gas and dust to form larger early planets. But researchers have now found that the **chondrules** may have only been byproducts of a violent and messy planetary process.

## TWO MORE PLANETS?

Researchers report that there could be at least two unknown planets beyond Pluto and probably more. Last year a dwarf planet (**2012 VP113**) was discovered in the **Oort cloud**, just beyond our solar system. The discoverers consider that its orbit is influenced by the possible presence of a "super-Earth" up to ten times larger than Earth.

## HUYGENS

Ten years ago, the *Huygens* probe accomplished humanity's first landing on a moon in the outer solar system. *Huygens* not only survived the descent and landing, but transmitted data for more than an hour on the frigid surface of **Titan** until its batteries were drained. (See page 2 – Internet Sites.)

## THE "NGTS"

A group of European scientists have formed a "ground-breaking" space research project that will study small, rocky planets orbiting other stars, and discover new planets. Their **Next-Generation Transit Survey** at the Paranal Observatory in Chile has a suite of highly sensitive telescopes that will reach a level of accuracy never before attained under observatory conditions

## NUSTAR DISCOVERY

Astronomers have found a pulsating, dead star beaming with the energy of about 10 million Suns. It is the brightest **pulsar** (a dense stellar remnant left over from a supernova explosion) ever recorded. The surprising find is helping astronomers better understand mysterious sources of blinding X-rays called **Ultraluminous X-ray Sources** (ULXs).

Until now, they were thought to be black holes but the new data shows that at least the one ULX in the **M82** galaxy is actually a pulsar. The puny, dead star is radiating so fiercely likely due to the neutron pulling matter from companion stars, heating it up and causing the X-ray glows.

## EXOPLANET STUDY

A study by astrophysicists at the University of Toronto suggests that exoplanets are more likely to have liquid water and be more habitable than we thought. The study suggests that as exoplanets rotate around their stars, they spin at such a speed as to exhibit a day-night cycle similar to Earth. Theoretical arguments suggest that many exoplanets should be able to maintain an atmosphere as massive as that of Earth.

## NEW HORIZONS

The *New Horizons* spacecraft is entering the first of several approach phases that culminate July 14 with the first close-up flyby of Pluto inside the orbits of the five known moons. See: [www.nasa.gov/newhorizons](http://www.nasa.gov/newhorizons)

## NEOWISE

NASA's **Near-Earth Object Wide-field Survey Explorer** (NEOWISE) spacecraft discovered 40 **near-Earth objects** (NEOs) since it was re-started December 2013. Eight have been classified as **potentially hazardous asteroids** (PHAs) based on their size and how close their orbits could come to Earth's orbit.

## A HUGE MAP OF THE UNIVERSE

An international team of scientists have plans for an experiment of truly astronomical proportions -- the biggest map of the Universe ever made. The experiment will combine signals from the **SKA** -- a collection of thousands of radio receivers and dishes spread across two sites in South Africa and Western Australia. It will have a total collecting area equivalent to 15 football fields and will produce more data in one day than several times the daily traffic of the entire internet. A second phase, due in the late 2020s, will be ten times larger.

## DUST IN THE OCEAN

Scientists plumbing the depths of the ocean have made a surprise finding that could change the way we understand supernovae. They have analyzed extraterrestrial dust thought to be from supernovae that has settled on ocean floors to determine the amount of heavy elements created by the massive explosions. They found there is much less of the heavy elements such as plutonium and uranium than expected.

## DUST IN SPACE

The **Large Binocular Telescope Interferometer** has completed its first study of dust in the "habitable one" around a star. Dust is a natural byproduct of the planet-formation process, but too much of it can block our view of planets. The LBTI will obtain the best infrared images yet of dust permeating a star's habitable zone, the region around the star where water could pool on a planet.

## LIFE

Aliens, UFOs, little green men: life that did not start on Earth has yet to be found, but a number of scientists speculate that extraterrestrial life does exist. Some have even attempted to estimate the number of civilizations in our galaxy. Scientists have also identified places in the Solar System such as Jupiter's moon Europa that have the potential to support life.

**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/](http://amazing-space.stsci.edu/tonights_sky/)  
 and [http://hubblesite.org/explore\\_astronomy/tonights.sky](http://hubblesite.org/explore_astronomy/tonights.sky)  
 \*\*\* **Astronomy Picture of The Day** - <http://apod.nasa.gov/apod/astropix.html> \*\*\*  
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**A STRANGE, FLICKERING WHITE “BLOTCH” FOUND ON THE DWARF PLANET CERES** by the DAWN spacecraft has scientists scratching their heads. New images show areas of light and dark indicating surface features like craters. But at the moment, none of the specific features can be resolved. **Ceres** is the largest object in the asteroid belt and is classified as an asteroid and simultaneously as a dwarf planet. Ceres is also the smallest known dwarf planet in the solar system. See: <http://www.space.com/28310-dwarf-planet-ceres-photos-dawn-spacecraft.html>

**Puzzles**

<b>FIND THE WORD</b>				<b>SCRAMBLED ASTRONOMY</b>			
R F L A R E P O R T	ABOUT			<b>PEOPLE IN THE SKY</b>			
R E V E N T C E I S	CENTER		RSTOCPU	_____	_____	_____	_____
H X T R E E T M E A	CERES						
M T E N A N E R B E	CRATER	MERGE	RACREH	_____	_____	_____	_____
E M R N E S E O E L	EARTH	OCEAN					
R E T A R C U S Y Y	ENTER	PHASE	SWINT	_____	_____	_____	_____
G S A X E T A R P D	EVENT	PLACES	TEXAS				
E S T I G H T T S U	FLARE	REPORT	TIGHT	NRTHEU	_____	_____	_____
F R E L P E K K I T	KEPLER	STUDY	TIMES				
S E C A L P O O W S	LEAST	SWOOP	WISPY	IADINN	_____	_____	_____

(Answers below)

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** \*\*\*\*\*

NGC 6535 in “The Serpent” -- <http://www.spxdaily.com/images-lg/ngc-6535-globular-cluster-lg.jpg>  
 Huygens landing on Titan - 10 most important results - <http://sci.esa.int/huygens-titan-science-highlights/>  
 ROSETTA COMETWATCH - <http://blogs.esa.int/rosetta/>  
 Approaching Titan - <http://scitechdaily.com/new-jpl-video-approaching-titan-billion-times-closer/>  
**SITE OF THE MONTH**  
 The West Virginia Space Grant Consortium (NASA) - <http://www.wvspacegrant.org/>

\*\*\*\*\* **MOON IN FEBRUARY** \*\*\*\*\*

**Full Moon:** 2/3 **Last Quarter:** 2/11 **New Moon:** 2/18 **First Quarter:** 2/25  
**Apogee:** 2/6 1:13 AM 252,365 mi. (406,143 km) **Perigee:** 2/19 2:22 AM 221,833 mi. (357,006 km)  
 \*\* February’s Full Moon was called the SNOW Moon and HUNGRY Moon –  
 - “it was a lean time for both man and beast.” \*\* Best observing nights: 2/11 – 2/25

\*\*\*\*\* **PLANETS IN FEBRUARY** \*\*\*\*\*

**JUPITER**, on February 6th, will be opposite the Sun as seen from Earth and at its closest approach. Its face will be fully illuminated by the Sun. It and is the best opportunity to see details and four moons with telescopes and binoculars. **VENUS** and **MARS**, in the western evening sky, will be within 0.5° of each other on the 22nd – a rare event (*conjunction*). **MERCURY** and **SATURN** are low in the early eastern morning sky at month’s end.

\*\*\*\*\* **METEOR SHOWERS** \*\*\*\*\*

<u>NAME</u>	<u>DATES</u>	<u>BEST (PRE-DAWN)</u>	<u>PER HOUR</u>	<u>WHERE TO LOOK</u>
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There are two minor showers this month. Both, the **Alpha Centaurids** and the **Theta Centaurids** produce less than five meteors per hour on their peak dates February 8 and 10. There are a few sporadics all month long.  
**LOOK FOR:** >>>> **CASSIOPEIA** (The Queen) - the big “W” in the NW sky that is visible throughout the year. The bright star at the upper right is **CAPH**, the best example of a pulsating variable star that is twenty times brighter than our Sun. >>>> **THE MILKY WAY** - This hazy band of faint light is our galaxy and circles the sky from the northwest to the southeast. It is at its brightest and best seen away from city lights.

## USING SMALL TELESCOPES

A new project at Ohio State University is doing something radically different: using small telescopes to study a growing portion of the nearby universe all at once. While many joint projects use powerful telescopes to target individual objects in the distant universe, the researchers have detected 89 bright supernovae and hundreds of other bright local objects, two extremely rare sightings of what happens when a black hole captures a portion of a nearby star, and many M dwarf flares

Ohio State researchers are about to launch a series of spin-off projects, each geared to serve the growing interests of amateurs and professional astronomers

## TO CAPTURE AN ASTEROID

In 2013, NASA announced the planning of a robotic mission to snag an asteroid and haul it into lunar orbit for study. Scientists and engineers had been working out the feasibility and published a report suggesting that a spacecraft using solar-electric propulsion could reach and capture a 8.5-ton near-Earth asteroid by putting an enormous bag around it and then hauling it into high lunar orbit. And, they added, all of this could be done by around 2025 for a total cost of about \$2.6 billion.

## EXOPLANETS

Researchers say that astronomers could soon be able to find rocky planets stretched out by the gravity of the stars they orbit. Since the first discovery in 1993, more than 1800 planets have been found in orbit around stars other than our Sun.

These 'exoplanets' are very diverse, with some gaseous like Jupiter and some mostly rocky like Earth. The worlds orbit their stars at very different distances, from less than a million km to nearly 100 billion km.

## DAWN UPDATE

NASA's *Dawn* spacecraft is closing in on **Ceres**, a Texas-sized dwarf planet never before visited by a spacecraft. *Dawn* was launched in 2007 and is scheduled to enter **Ceres** orbit in March. *Dawn* had explored the protoplanet **Vesta** for 14 months capturing detailed images and data. **Ceres**, with an average diameter of 590 miles is the largest body in the asteroid belt between Mars and Jupiter.

## KEPLER REACHES 1000

NASA's *Kepler* spacecraft has discovered its 1,000th alien planet with eight newly confirmed exoplanets, bringing the mission's current alien world tally to 1,004.

*Kepler* has found more than half of all known exoplanets to date, and the numbers will keep rolling in: The space telescope has also spotted 3,200 additional planet candidates, and about 90 percent of them should end up being confirmed, scientists say.

## ALIEN PLANETS

New research suggests planets similar to Earth are much more common across the galaxy than previously thought. Scientists found that five planets in their study with diameters smaller than 1.6 times that of Earth showed a tight relationship between mass and size.

Both Venus and Earth are on the same line, indicating that alien worlds have similar compositions - they are liable to be made of iron, rock and other materials as Earth is.

## ORION'S RETURN

A new video recorded through windows in *Orion's* crew module during its return through Earth's atmosphere provides a taste of the intense conditions the spacecraft and its astronauts will endure when they return from Mars. See: <https://www.youtube.com/watch?v=MtWzuZ6WZ8E>

## VENUS

Venus was once covered in strange oceans of liquid carbon dioxide but now the surface is hot, dry and suffocated by a thick lower atmosphere of toxic gases. The planet has likely always been too hot to host water with an intolerable, ultra-dense atmosphere complete with clouds of corrosive sulfuric acid and high temperatures. Venus is often called Earth's twin since the two planets are very similar in size, mass, and distance from the Sun.

## STUDENT EXPERIMENTS IN SPACE

*SpaceX's* latest mission to the International Space Station carried scientific research conceived and designed by eighteen grade 5-14 students who are learning first-hand how to conduct research in space.

The **Student Spaceflight Experiments Program** (SSEP) teams prepared experiments to investigate a range of topics from a crystal growth study to how microgravity affects milk spoilage in experiments known as **Yankee Clipper**.

## HUGE BLACK HOLE FLARE

Astronomers using *Chandra* made the unexpected discovery of the largest X-ray flare ever detected from the supermassive black hole at the center of the Milky Way galaxy. The black hole, **Sagittarius A\***, or Sgr A\*, is estimated to contain about 4.5 million times the mass of the Sun. What's causing these giant flares is unknown.

See: <http://chandra.si.edu> and <http://www.nasa.gov/Chandra>

## ROSETTA AND PHILAE

Attempts to identify the *Rosetta* lander (**Philae**) in high-resolution OSIRIS images have reportedly not yet been successful. Rosetta orbits comet 67P/C-G at a distance of about 30 km and will continue until February 3rd before swooping down to just 6 km from the surface on February 14th.

This close flyby will allow instruments to take images and spectra of the surface with unprecedented resolution and to learn more about how the comet's characteristic coma and tail are created.

## ETA CARINAE

**Eta Carinae**, the most luminous and massive stellar system within 10,000 light-years of Earth, is known for its surprising behavior, erupting twice in the 19th century for reasons scientists still don't understand. It comprises two massive stars whose eccentric orbits bring them unusually close every 5.5 years.

Both produce powerful gaseous outflows (**stellar winds**), which enshroud the stars and stops efforts to directly measure their properties. The brighter, cooler primary star has about 90 times the mass of the Sun and outshines it by 5 million times. See:

[http://www.bbc.co.uk/science/space/universe/ke\\_y\\_places/eta\\_carina](http://www.bbc.co.uk/science/space/universe/ke_y_places/eta_carina)

## THE HORSEHEAD NEBULA

Orion's famous **Horsehead Nebula** makes a ghostly appearance but is almost unrecognizable in a new infrared view. In visible-light images, the nebula has a distinctively dark and dusty horse-shaped silhouette, but in infrared light, dust becomes transparent and the nebula appears as a wispy arc. See: <http://www.jpl.nasa.gov/spaceimages/details.php?id=pia18905>

### LDN 483

In a new ESO image, some of the stars appear to be missing but the gap in this glitteringly beautiful star field is a region of space clogged with gas and dust called **LDN 483 - Lynds Dark Nebula 483**. **LDN 483** is about 700 light-years away in the constellation of Serpens. The cloud contains enough dusty material to completely block the visible light from background stars.

See: <http://www.spxdaily.com/images-lg/dark-nebula-ldn-483-lg.jpg>

## BLACK HOLES

# The central regions of many glittering galaxies harbor cores of impenetrable darkness - black holes with masses equivalent to millions, or even billions, of Suns. Supermassive black holes and their host galaxies appear to develop together, or "co-evolve." As galaxies collide and merge, they grow more massive, as do their dark centers - the black holes.

# **MAPPING** - Scientists have observed a black hole that is about 8 million times the mass of the Sun. They used a method known as **reverberation mapping** which involves observing the light that is emitted as material spirals toward the black hole. At different distances from the center, the light interacts with nearby gases, which then re-emit that light. By analyzing this time difference and measuring how fast the material is moving around the center of the galaxy, scientists are able to determine the mass of this central black hole.

Current techniques for this method require some of the largest and overbooked telescopes in the world. They are working on a way to use smaller telescopes that have the abilities to observe different active galaxies.

Astrophysicists everywhere can then have the ability to do this science using smaller and less costly telescopes

## ANDROMEDA

A detailed study of the motions of different stellar populations in the **Andromeda Galaxy** (M31) has found striking differences from the Milky Way, suggesting a more violent history of mergers with smaller galaxies in Andromeda's recent past. The structure and internal motions of a spiral galaxy hold important keys to understanding a galaxy's formation history.

## "SMALL" STARS AND "MASSIVE" STARS

Astrophysicists have known that **small** stars (less than 9 times the mass of the Sun) live for a long period of time (about 10,000 million years) before burning out completely. **Massive** stars (more than 10 solar masses) have more active lives, ending in about 30 million years (at the most) and violently exploding as a supernova.

The remnant of the explosion can be a neutron star or a black hole, depending on the mass of the star. The density is so high that it is equivalent to concentrating a commercial aircraft into one grain of sand.

## ARP 299'S GALAXIES

A new high-energy X-ray image from NASA's **NuSTAR** has pinpointed a true monster of a two-galaxy smashup in **Arp 299**. Each of the galaxies has a supermassive black hole at its center. One black hole is actively gorging on gas while the other is either dormant or hidden under gas and dust. **NuSTAR** is the first telescope capable of pinpointing where high-energy X-rays are coming from in **Arp 299**.

## METEOR CRATER IN ANTARCTICA?

Researchers in remote East Antarctica think a just-discovered massive area of fractured ice could be a meteorite impact crater. The mile-wide crater is a circular scar with fractured, rumpled ice in an otherwise smooth area. Antarctica's cold, dry conditions preserve meteorites, and more than 20,000 have been discovered on its frozen surface.

See: <http://www.livescience.com/49372-mystery-antarctic-crater-could-be-house-sized-meteor-impact-video.html>

## SLOAN DIGITAL SKY SURVEY

# The **Sloan Digital Sky Survey** (SDSS) has issued its latest public data release. It contains measurements of the properties of nearly half a billion stars and galaxies, making it one of the largest and richest databases in the history of astronomy.

The SDSS has devoted most of its 2,000 nights of observing to measuring spectra: passing light from individual stars and galaxies through a fiber-optic spectrograph, which divides light into component wavelengths much like a prism separates light into the colors of the rainbow.

# The SDSS has a unique map of puzzling molecules in our galaxy that are responsible for unknown features in the light from stars. "**Diffuse Interstellar Bands**" have been a mystery ever since they were discovered in 1922 as unexpected lines created by something existing in the interstellar space between the stars and the Earth. .

See: <http://is.gd/dibmap>

## NICKEL AND GRB'S

Researchers from 19 countries using 13 telescopes reported that supernovas associated with Gamma-Ray Bursts emit greater quantities of nickel compared to those not linked to a GRB. GRBs are brief and intense flashes of gamma radiation that occur randomly in the heavens at a rate of approximately three per day. Since 2003 astrophysicists believe that at least a large part of these gamma ray outbreaks are linked to supernovas but not all supernovas emit gamma rays.

## R SCULPTORIS

A new *Hubble* image shows **R Sculptoris** and the region around this red giant star in the constellation of **Sculptor**. Recent observations have shown that the material surrounding **R Sculptoris** actually forms a spiral structure probably caused by a hidden companion star orbiting the star. See:

<http://www.spacetelescope.org/images/potw1501a/>

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