

**SOLAR FLARES**

Two successive “three-ribbon” solar flares were observed on July 6th. Flares with two ribbons are typical of these immensely powerful eruptions that can send storms of charged particles and high-energy radiation toward Earth at nearly the speed of light.

**KAPTEYN'S STAR'S PLANET**

An international team of astronomers reports the discovery of two new planets orbiting the very old **Kapteyn's Star**. One planet orbits the star at the right distance to allow liquid water to exist on its surface. **Kapteyn's Star** is the second fastest-moving star in the sky and with a third of the mass of the Sun.

**COLLISION OF GALAXIES**

Astronomers have observed a series of violent collisions involving at least four clusters of galaxies. The complex region is triggering a host of phenomena that scientists still are working to understand. The large, oddly-shaped red feature at the center probably is a region where shocks caused by the collisions are accelerating particles that then interact with magnetic fields and emit the radio waves. See:

[https://public.nrao.edu/images/non-gallery/2014/d-Finley/06-01/MACSJ0717\\_nrao.jpg](https://public.nrao.edu/images/non-gallery/2014/d-Finley/06-01/MACSJ0717_nrao.jpg)

**ONE HEAVY PLANET!**

Astronomers have discovered that rocky planet **Kepler-10c** weighs 17 times as much as Earth and is more than twice as large in size. It had previously measured as 2.3 times larger than Earth, but its mass was not known until now.

It was thought worlds such as this could not possibly exist. The enormous gravitational force of such a massive body would accrete a gas envelope during formation, ballooning the planet to a gas giant the size of Neptune or even Jupiter. However, this planet is thought to be composed primarily of rock.

**KEPLER 56 SYSTEM**

Astronomers announced that the planets **Kepler-56b** and **Kepler-56c** will be swallowed by their star in 130 million and 155 million years, respectively. The star **Kepler-56** is becoming a red giant star and will expand outward. Not only will the star grow larger, but its tides will get stronger, dragging its planets inward to their eventual doom.

The only survivor in the system will be **Kepler-56d**, a gas giant planet.

**EARTH'S MOON "THEIA"**

A new series of measurements of lunar and Earth samples provide increasing evidence that the Moon formed from the collision of Earth with another large, planet-sized body around 4.5 billion years ago. It has been given the name **Theia**.

The differences are small and difficult to detect, but they are there. This means that we can now be reasonably sure that the collision took place and also that it gives us an idea of the geo-chemistry of **Theia**.

**BUBBLES**

Massive stars end their lives with a bang, exploding as spectacular supernovas and releasing huge amounts of mass and energy into space. The explosions sweep up any surrounding material, creating bubble remnants that expand into interstellar space.

At the heart of bubbles are **small, dense neutron stars or black holes**, the remains of what once shone brightly as a star. See:

<http://inspirehep.net/record/1191387/plots?ln=en>

**EARTH-SIZE EXOPLANETS**

According to a new study, one in six stars has an Earth-sized planet in an orbit of 85 days or less. And, **Kepler spacecraft** astronomers find about 17% Earth-sized planets are in orbits closer than Mercury.

Since the Milky Way has about 100 billion stars, there are at least 17 billion Earth-sized worlds out there!

**"BEAST ASTEROID" CLOSE CALL**

On June 8th, the so-called **Beast asteroid** missed Earth by about 777,000 miles. There was no chance the asteroid would hit Earth, scientists said, but at 777,000 miles away it's a relatively close call. The asteroid was about 10 to 20 times larger than the one that injured 1,000 people last year in Russia.

**MESSIER 51**

After 12 days observing time, the **Chandra X-ray Observatory** has revealed a spiral galaxy similar to the Milky Way glittering with hundreds of X-ray points of light. **Messier 51** (M51) or **NGC 5194** goes by the "**Whirlpool Galaxy**."

Like the Milky Way, the Whirlpool is a spiral galaxy with spectacular arms of stars and dust in a perspective that we can never get of our own spiral galactic home.

See: <http://messier.seds.org/m/m051.html>

**UNIVERSE IN THE CLASSROOM**

In this second of a special three-part edition of "The Universe in the Classroom" students can learn how our understanding of cosmology has evolved as our ability to collect and interpret data has improved. The new edition is at: <http://astrosociety.org/publications/universe-in-the-classroom/>

**POPIGAI CRATER**

Researchers precisely dated rocks from the Popigai crater in remote Siberia to the **Eocene epoch mass extinction** that occurred 33.7 million years ago.

Popigai crater is one of the 10 biggest impact craters on Earth. In 2012, Russian scientists claimed the crater harbors a gigantic industrial diamond deposit. See: <http://www.livescience.com/45126-biggest-impact-crater-earth-countdown.html>

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**SCIWORKS – For information and planetarium schedules call 767-6730**

**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> \*\*\***

**STEM KIDWIND** --- After school over more than two months, 168 students and their teachers from seven San Diego-area school districts learned about design and engineering as they built small wind turbines. By the end of the project they had developed an understanding of aerodynamics and energy conversion. **KidWind**, first developed in 2002, is now an international project that has trained more than 7,000 teachers and impacted more than 500,000 students, who have built over 50,000 experimental wind turbines.

**PUZZLES**

<b>Find The Word</b>			<b>Scrambled Astronomy</b>		
T H E S E R E C R N	ALLOW	KEPLER	<b>ANIMALS</b>		
S H L S E T D A R E	APART	MESSIER	FIGAFER	_____	_____
A W R P H A T S E V	BEAST	NEVER	RHEA	_____	_____
E B E E T L K B I E	BLACK	SEVEN	SHERO	_____	_____
B E I E E E U Y S R	BUBBLE	SPEED	LOAF	_____	_____
K A D D P B G N S S	CERES	THEIA	DAZILR	_____	_____
C P L L B R N E E T	DATED	THESE	<i>(Answers below)</i>		
A A E L E O J V M O	DELTA	THREE			
L R E N O N A E I R	ENERGY	VESTA			
B T E M R W N S L M	KEEPER	WAVES			

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

Saturn's dancing **auroral** lights: <http://www.spxdaily.com/images-ig/saturn-northern-uv-auroras-ig.jpg>  
Serpens Cloud - <http://scitechdaily.com/images/Spitzer-Views-Star-Forming-Region-Serpens-Cloud-Core.jpg>  
Video - First *IRIS* solar flare - <https://www.youtube.com/watch?v=SuAja09e51U>  
Circinus molecular cloud - <http://news360.com/article/241437649>  
NGC 1566 sparkles - <http://www.nasa.gov/sites/default/files/potw1422a.jpg>

**SITE OF THE MONTH**

Solar image sites - [http://www.swpc.noaa.gov/solar\\_sites.html](http://www.swpc.noaa.gov/solar_sites.html) (A real "keeper" for Solar observing.)

**\*\*\*\*\* MOON IN JULY \*\*\*\*\***

**First Quarter:** 7/5    **Full Moon:** 7/12    **Last Quarter:** 7/19    **New Moon:** 7/26  
**Apogee:** 7/27 10:28 PM 252,630 mi. (406568 km)    **Perigee:** 7/13 3:28 AM 222/611 mi. (358258 km)  
\*\* The **July Full Moon** was called the **Thunder Moon**, **Buck Moon**, and **Hay Moon**.  
\*\* **Best observing nights:** 7/1 – 7/5; 7/18 – 7/31

**\*\*\*\*\* PLANETS IN JULY \*\*\*\*\***

**VENUS** is in the ENE all month rising about two hours before the Sun.  
**MARS** in the western sky sets about three hours after sunset.    **SATURN** is in the SW after sunset.  
**JUPITER**, in the WNW, sets in evening twilight on the 3rd and is at *superior conjunction* on the 24<sup>th</sup>.  
**MERCURY** hangs close to Venus all month and only 9° apart on the 16th.

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

<u>NAME</u>	<u>DATES</u>	<u>BEST NIGHT</u>	<u>PER HOUR</u>	<u>WHERE TO LOOK</u>
<b>DELTA AQUARIDS</b>	7/12 – 8/23	7/28 – 7/29	20	East but some Aquarids can appear anywhere in the sky. The meteors are produced by debris from comets <i>Marsden</i> and <i>Kracht</i> . Other showers in July include 1 southern, and 6 classed as minor/weak. You can also see sporadics from a dark sky area.

**LOOK FOR:** It's Milky Way Season! >>>> **THE MILKY WAY** is 45° above the horizon in the eastern sky as twilight darkens. By morning twilight, it passes overhead. >>>> **The SUMMER TRIANGLE** rising in the east. >>>> **CERES** and **VESTA** very close to each other just above the Moon and Mars on the 4th and 5th. >>>> **SATURN'S RINGS** tipped 21° during July. >>>> **THE MOON** is most distant on the 27th for 2014.

## CREATING MATTER FROM LIGHT

College London physicists have discovered how to create matter from light - a feat thought impossible when the idea was first theorized 80 years ago. They suggested that it should be possible to turn light into matter by colliding two particles of light (photons), to create an electron and a positron.

A 'photon-photon collider' would convert light directly into matter using technology that is already available and, would be a new type of high-energy physics experiment.

This experiment would recreate a process that was important in the first 100 seconds of the universe and that is also seen in gamma ray bursts, which are the biggest explosions in the universe and one of physics' greatest unsolved mysteries.

## BLACK HOLE THEORIES

In new *NEOWISE* results, researchers found evidence that something other than a doughnut structure may, in some circumstances, determine whether a black hole is visible or hidden. The team has not yet determined what this may be, but the results suggest the unified, or doughnut, model does not have all the answers.

Every galaxy has a massive black hole at its heart. The new study focuses on the "feeding" ones, called active, supermassive black holes, or active galactic nuclei. These black holes gorge on surrounding gas material that fuels their growth. See

: <http://neo.jpl.nasa.gov/programs/neowise.html>

## MAGNETOTAILS

Astronomers used the Hubble Space Telescope to capture new images of the dancing *auroral* lights at Saturn's north pole. The images provide a detailed look at the stormy glow that is an ongoing mystery in planetary science. These new images add new insight by capturing moments when Saturn's magnetic field is affected by bursts of particles from the Sun.

Saturn has a long, comet-like magnetic tail - a **magnetotail** (as do Mercury, Jupiter, Uranus, Neptune and Earth). This **magnetotail** is present around planets that have a magnetic field, caused by a rotating core of magnetic elements.

It appears that when bursts of particles from the Sun hit Saturn, the planet's magnetotail collapses and later reconfigures itself, an event that is reflected in the dynamics of its *aurorae*. See:

<http://www.spxdaily.com/images-lg/saturn-northern-uv-auroras-lg.jpg>

## MARS

The largest fresh meteor-impact crater ever firmly documented with before-and-after images has been discovered on the Red Planet

The crater spans half the length of a football field and first appeared in March 2012. The impact that created it likely was preceded by an explosion in the Martian sky caused by intense friction between an incoming asteroid and the planet's atmosphere.

## REVIVING A SATELLITE

NASA has signed an agreement with Skycorp, Inc. of Los Gatos, California to attempt to contact, and possibly command and control, NASA's *International Sun-Earth Explorer-3* (ISEE-3) spacecraft. Launched in 1978 to study the constant flow of solar wind streaming toward Earth, ISEE-3 successfully completed its prime mission in 1981.

With remaining fuel and functioning instruments, it then was redirected to observe two comets. Following the completion of that mission, the spacecraft continued in orbit around the Sun. It is now making its closest approach to Earth in more than 30 years.

## CHELYABINSK METEORITE

The Chelyabinsk meteorite that exploded on February 15, 2013, in Russia was part of a large asteroid and came off it as a result of an impact 250 million years ago. The scientists studied the chemical composition of the meteorite's fragments and found out that they contain jade - a mineral formed under high pressure and temperature.

The meteorite was 680 inches in diameter and 10,000 tons. The asteroid, from which the meteorite came off, was at least 7,500 inches in diameter.

## EXPLOSIONS

**Supernovae-stellar explosions** are incredibly energetic, dynamic events. The problem is finding one and being able to promptly point a world-class telescope at it. The **intermediate Palomar Transient Factory** (iPTF) operated by Caltech scans the sky constantly in search of dramatic astrophysical events. In 2013, it caught such a star in the act of exploding.

See: [http://www.ptf.caltech.edu/news/ptf\\_13astflashspectra](http://www.ptf.caltech.edu/news/ptf_13astflashspectra)

## EXOPLANET ATMOSPHERES

Scientists working with data from the *Cassini* mission have developed a new way to understand the atmospheres of exoplanets by using Saturn's smog-enshrouded moon Titan as a stand-in. The new technique shows the dramatic influence that hazy skies could have on our ability to learn about these alien worlds orbiting distant stars.

## OLDEST GALAXIES

The structures and star populations of massive galaxies appear to change as they age, but much about how these galaxies formed and evolved remains mysterious.

Many of the oldest and most massive galaxies reside in clusters, enormous structures where numerous galaxies are found concentrated together. Galaxy clusters in the early universe are thought to be key to understanding the lifecycles of old galaxies, but to date astronomers have located only a handful of these rare, distant structures.

Today the largest and oldest galaxies are found in clusters, but there is a mystery about when and why these giant galaxies stopped forming new stars and became dormant, or quiescent.

## NGC 3590

**NGC 3590** is a small open cluster of stars loosely bound together by gravity in the constellation of **Carina** (The Keel) - the largest single segment of the Milky Way's minor spiral arm that can be seen from Earth.

A new image was created by combining images taken in the visible and infrared parts of the spectrum, and a special filter that collected light coming from glowing hydrogen.

See: <http://www.sci-news.com/astronomy/science-ngc3590-image-star-cluster-01935.html>

## STAR NURSERY

On May 24th, the NASA *Black Brant IX* sounding rocket was launched into deep space where floating between the stars, lies an abundance of atoms -- carbon, oxygen, hydrogen -- that over millions of years will grow into new stars and new planets.

It will look at the ultraviolet light from a bright star - light that is blocked by the atmosphere and can't be seen from the ground.

As this light travels toward Earth, it bumps into the interstellar atoms and molecules along the way, each of which can block certain wavelengths of light. Scientists know which wavelengths are blocked by what, so by measuring what light is missing, they can map out the atoms and molecules that are present.

## NGC 5474

The term "dwarf galaxy" may sound diminutive, but don't let that fool you — **NGC 5474** contains several billion stars compared to the Milky Way with its hundreds of billions of stars. The **Messier 101 Group** and our own **Local Group** reside within the **Virgo Supercluster**, making **NGC 5474** something of a neighbor in galactic terms.

See: <http://scitechdaily.com/images/New-Hubble-Image-of-Dwarf-Galaxy-NGC-5474.jpg>

## SUNSPOT FINDINGS

Sunspots, first seen by Galileo more than 400 years ago as dark blemishes on the Sun, are still one of the greatest mysteries of astronomy

New multi-wavelength observations, both with a telescope and the *IRIS* spacecraft have produced new and intriguing images of high-speed plasma flows and eruptions extending from the Sun's surface to the outermost layer of the solar atmosphere, the **corona**.

These leading-edge observations show that sunspots are far more complex and dynamic than previously believed. See: <http://www.bbso.njit.edu/>

## THE SWIFT SATELLITE

Every two years NASA reviews the scientific performance of its astronomical satellites in order to decide whether they should continue in operation and what their funding level should be.

This month NASA has released its most recent report which ranks the *Swift GRB Mission* top out of the nine satellites - even though almost all of the others were launched more recently than Swift.

## SUPER-EARTHS

New discoveries of many "super-Earth planets" orbiting very close to Sun-like stars make Earth's solar system look a little lonely without any super-Earth cousins. When astronomers began discovering hundreds of extrasolar planets orbiting other stars they found up to 50 percent of stars similar to the Sun have hot super-Earths-planets. (*Check "super-earths" on the web for more info.*)

## TZO

Scientists have detected the first **Thorne-Zytkow objects** (TZOs). It is a hybrid of red supergiant and neutron stars that superficially resembles normal red supergiants, such as **Betelgeuse** in Orion, and may have been formed during a supernova explosion. TZOs differ in that their distinct chemical signatures result from unique activity in their stellar interiors.

## WOLF-RAYET STARS

Our Sun may seem pretty impressive: 330,000 times as massive as Earth, it accounts for 99.86 percent of the Solar System's total mass. It generates about 400 trillion trillion watts of power per second; and has a surface temperature of about 10,000 degrees Celsius. Yet for a star, it's a lightweight.

The real cosmic behemoths are Wolf-Rayet stars, which are more than 20 times as massive as the Sun and at least five times as hot. Because these stars are relatively rare and often obscured, scientists don't know much about how they form, live and die.

But this is changing, thanks to a new sky survey scientists have direct confirmation that a Wolf-Rayet star in the Bootes constellation died in a violent explosion known as a **Type IIb supernova**.

## CLEAN SPACE

ESA's **Clean Space** initiative is seeking to transform our understanding of how large, dead objects behave in space and is exploring why derelict satellites can tumble in unpredictable ways.

Down on the ground, death equals stillness – but not in space. Derelict satellites can tumble in unpredictable ways and ESA's team is tasked with developing a method to determine the cause and possible effects

## BLACK HOLE STUDY

A new study of supermassive black holes at the centers of galaxies has found that magnetic fields play an impressive role in the systems' dynamics. In dozens of black holes, the magnetic field strength matched the force produced by the black holes' powerful gravitational pull.

jets of gas that shoot away from a black hole produce a radio emission that can be used to measure the magnetic field strength near the black hole itself.

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