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YOUNG ASTRONOMERS NEWSLETTER

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ESA'S GAIA SPACECRAFT DISCOVERS ASTEROIDS WITH ODDLY TILTED ORBITS

The European Space Agency's Gaia spacecraft's main mission is to plot the location and motion of the stars in the Milky Way galaxy. But last December, it spotted three new asteroids with odd orbits. The plane of their orbits is tilted by 15 degrees, or more, relative to the main asteroid belt and the rest of the Solar System. The discovery was recently confirmed by the French, ground-based Haute Provence Observatory.

Now, astronomers are scratching their heads as to how or why these asteroids came to follow the out-of-kilter pathway. Since most observations are conducted along the Solar System plane, this discovery is likely to spur further out-of-plane studies. Possibly many more bodies are out there waiting to be discovered. [Space.com, May 5, 2019].

EARTH'S GOLD, SILVER AND PLATINUM CAME FROM A NEUTRON STAR COLLISION

The gold on your finger or in your other jewelry likely originated when two neutron stars came together in a massive collision that occurred millions of years before our solar system formed.

Professor Imre Bartos of the University if Florida and colleague Szabolc Marka of Columbia University have analyzed the isotopic content of an ancient meteorite and performed computer simulation of the nuclear decay steps that led to its final elemental make-up.

Nucleosynthesis in stars can be thought of as occurring in two environments: nuclear fusion during a star's lifetime or neutron capture during a supernova of a star or collision of two neutron stars. A maturing star can form new elements by fusing atoms in its core. Thus, hydrogen fuses to make helium, helium can fuse to make carbon, carbon can fuse to make higher elements, and so on to form higher and higher elements that we see on the Periodic Table. But the element build-up stops at the element iron. Fusion of iron is not energetically favorable, so the fusion steps stop when the iron in a star's core builds up to a high level. The cessation of fusion within a star makes it unstable and it undergoes a collapse and rebound explosion that we call a supernova. During
the supernova, clouds of neutrons fly around and merge to form new elements – elements higher up than iron in the periodic table. (This can happen when a neutron – think of it as a plus and minus together-loses a negative beta particle. This leaves behind a positive proton that creates a new atom one unit up in the Periodic Table.) That's one way we get gold, silver and platinum, and so on.

The other way involves a rare collision of two neutron stars. These super-dense bodies consist of essentially pure neutrons which merge with atoms by a rapid process to produce the higher elements. However, the distribution of the higher elements is different than that obtained from a supernova. Bartos and Marka have determined that the distribution of gold, platinum, plutonium, etc. that we find on Earth corresponds to the neutron merger pathway rather than from supernovae. Furthermore, they have calculated that this event happened about 100 million years before the formation of the solar system and at a distance of 1000 light-years.

So, now when you look at the gold ring on your finger, you can let your imagination picture its ancient and violent origin. [Livescience.com; May 6, 2019].

NEW CANADIAN RADIO TELESCOPE DETECTS MANY FAST RADIO BURSTS

Fast radio bursts (FRB) have puzzled astronomers since the time they were discovered in 2007. They consist of a very brief pulse in radio frequencies that lasts for only a few milliseconds. Even though their signals are very weak (think of a signal that's a thousand times weaker than a cell phone signal from the Moon) the signal at its origin is calculated to be hugely energetic and at distances measured in millions or billions of light years away.

The 2007 signal was actually detected and archived in 2001 at the Parkes Observatory in New South Wales, Australia. Since then, the observatory actually detected a "live" burst in 2015. Dozens have been detected since then.

A new radio telescope observatory has been set up near Penticton, British Columbia which utilizes a series of linear, parabolic cylinders. It is referred to as CHIME for Canadian Hydrogen Intensity Mapping Experiment. It makes use of Earth's rotation to scan the sky.

Shortly after being turned on in the summer of 2018, the observatory detected a fleeting FRB signal that lasted two-thousandths of a second. And since then, it has observed hundreds of FRB pulses, which contrasts with only a few dozen that were detected previously by radio telescopes located around the world.

Now, as for the source of these signals, some astronomers propose that they come from pulsars (spinning neutron stars) or from magnetars (neutron stars with huge magnetic fields). A more fantastic idea is that they are sent by extraterrestrial intelligent beings. We wait for more information from the CHIME. [SkyNews (Canada), May/June 2019].

WATER CYCLE THEORY MAY EXPLAIN THE LOSS OF WATER FROM MARS

Planetary scientists generally agree that billions of years ago, Mars was a very wet planet with oceans, lakes and rivers. But over the ensuing time, nearly all liquid water was lost, and what remains is regions of water ice trapped in subsurface geologic layers as well as incorporated with sold carbon dioxide at the planet's poles.

Collaborating scientists from the Moscow Institute of Physics and Technology and the Max Planck Institute for Solar System Research in Germany have used computer simulations as a basis to propose a process taking place on the Martian surface and atmosphere, which results in a net loss of water.

Driving the process is the fact that the Mars orbit is more elliptical than Earth's and also the orbit takes 2 years to complete. When Mars is closest to the Sun (perihelion) it is summertime at the planet's southern hemisphere. This gives an extra boost to the summer warmup which causes water vapor to rise up into the upper atmosphere which is colder. Spectral studies show the water content of the upper atmosphere goes through a max/min 2-year cycle which coincides with the planet's orbit.

At these high altitudes, the Sun's rays can degrade some of the water to hydrogen and oxygen. The gases, especially the lighter hydrogen, are then lost to space. The undecomposed water can be absorbed by high-level dust particles and carried back down to the surface where it accumulates again at the poles. But due to the decomposition of some water by solar radiation, we have a net loss of water from the planet. [EarthSky, May 21, 2019; LiveScience.com, May 13, 2019].

NASA'S INSIGHT MARS LANDER PROBE IS STILL STUCK

The heat flow probe on NASA's InSight Mars lander remains stuck at a depth of about one foot (30 centimeters). This has been the situation since February when the digging probe, called "mole" stalled in its digging efforts. Various ideas have been put forward as to what is causing the lack of progress. The most reasonable one proposes that the digger is losing friction with the walls of the hole. It needs a certain amount of friction in order to gain enough leverage in its hammering thrusts. More test runs are in progress. [Science News, May 15, 2019].

BIRTHDAYS IN JUNE:

George Ellery Hale (Amer.), b. June 29, 1868, d. Feb. 21, 1938. Founded the Yerkes Observatory, Palomar Observatory and Mount Wilson Observatory. Hired Harlow Shapley and Edwin Hubble.

Fred Hoyle (Brit.) b. June 24, 1915, d. Aug. 20, 2001. Astrophysicist. One of the earliest to explain nucleosynthesis, the synthesis of the elements in the cores of stars. Also did popular science writing and science fiction writing.

Allan R. Sandage (Amer.): b. June 18, 1926; d. Nov. 13, 2010. Astronomer who worked at the Mount Wilson Observatory (later at Palomar) and collaborated with Edwin Hubble to measure the redshifts of distant stars and galaxies. He revised the Hubble constant downward from 250 to 75. The latter value is more in line with what is accepted today.

Giovanni Cassini (Ital.), b. June 8, 1625, d. Sept. 14, 1712. Studied Saturn and discovered separations in the rings.

Charles Messier (French), b. June 26, 1730, d. April 12, 1817. Studied the nebulae and created his list of Messier Objects.

Lyman Spitzer (Amer.) b. June 26, 1914; d. Mar. 31, 1997. Theoretical physicist who did research on star formation. Proposed the idea of telescopes operating in space.

MOON PHASES IN JUNE: New: Monday the 3rd; First Qtr.: Monday the 10th; Full: Monday the 17th; Last Qtr.: Tuesday the 25th.

THE PLANETS IN JUNE: Just after sunset, gaze to the west-northwest to find **Mars** and **Mercury.** Binoculars will help to pick out the planets in the glow of twilight. Mercury edges a bit higher as Mars sags, so that on the evening of the 18th the two inner planets appear super close with a separation of only 18 arc minutes of angle. On the other side of the sky, we see **Jupiter** rising in the east around 9 p.m. and it remains visible all night long at magnitude -2.6 providing astronomers with good views for study. The giant planet is followed by **Saturn** which rises in the east around 10 to 11 p.m. in the region of Sagittarius. It is best observed in the wee hours of the night. **Venus** is difficult to see now because it is very close in line with the rising Sun. It is hard to find it in the east in the Sun's glare. It will disappear in July and pass on the far side of the Sun in August.

SUMMER SOLSTICE: The Earth's northern hemisphere has its maximum tilt toward the Sun on the 21st. We recognize the summer solstice as the first day of summer. However, people in the southern hemisphere, which is tilted away from the Sun, like in Australia, are looking at the first day of winter.

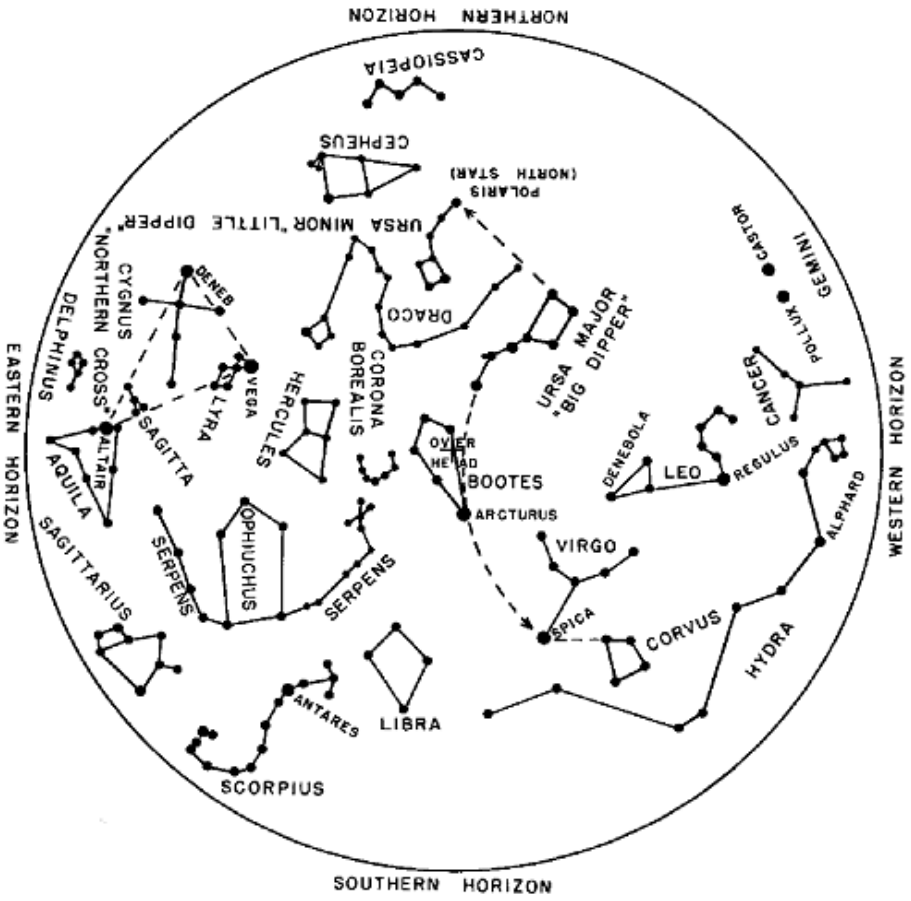
THE FORSYTH ASTRONOMICAL SOCIETY meets the second Wednesday of the month at Kaleideum North (formerly SciWorks) at 7:30 p.m. Visitors are welcome. For club activities and special events, see the FAS web site at www.fas37.org. You can also get information about FAS at the Kaleideum North front desk: 336-767-6730 ext.1000. The June meeting will be on the 12th.

There will be an observation session on Saturday, June 8 at Kaleideum North starting at sunset. The public is invited. Check the FAS website if there is some doubt about the weather. Readers may want to look ahead to July: The club will have public observation on Saturday, July 4 at Pilot Mountain State Park (at upper parking lot). See the astronomical features in the sky as you can also see multiple fireworks display in the distant valley communities.

See the summer sky chart on page 4. Have a great summer. Bob Patsiga, editor

THE SUMMER SKY

In the summer, if we are in an ideal location, we can see the Milky Way band extend from the southern horizon to the northern horizon. On the southern horizon, we see the fish-hook tail of Scorpius the scorpion and just above the tail, we see Sagitarius The Archer. In the region between Sagitarius and the tail of Scorpius, we are looking toward the center of the Milky Way. A lot of dust and gas blocks out the visible light from the center of our galaxy. The main star in Scorpius is Antares (mag. 1, 600 LY). Antares is a red supergiant star, about 200 times the size of our sun.
High over head, we see the Summer Triangle with the three stars: Deneb (mag 1, 3,000 LY) in the tail of Cygnus the Swan; Vega (mag 0, 25 LY) in Lyra the Harp and Altair (mag 1, 17 LY) in Aquila the Eagle. Sagitarius has the asterism name: The Teapot. Looking north, the Big Dipper (Ursa Major) is lined up vertically (handle up and bowl down) a little off to the west of the North Star. Look for more numerous "shooting stars" (meteorites) in the summer, especially look for the Perseids in mid August.



THE NIGHT SKY IN JUNE