Conserve™ The Energy

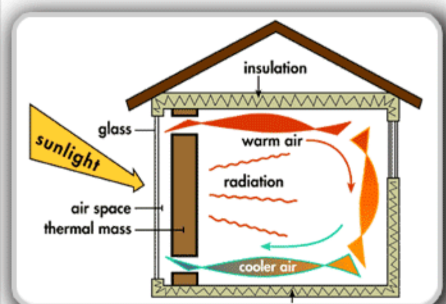
April - 2019 | Astronomy Special | Issue : 30

Nanotechnology

Why ???

We the people on the earth are gifted with wonderful energy sources by the nature, which has made our routine much more smother & easier... However, this gift of the nature is ' limited '. What we have done is, with the growth of science & technology, we have started using it extremely, because of which the energy resources are going to finish in near future. Hence, let us take the pledge to conserve the energy - save the energy!!!

Tips of the Month



Take advantage of solar gain

Take advantage of solar gain in the winter to keep your house warm (keep curtains open in the daytime to maximize direct light entering the house).

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Article - 1 : Long-duration space missions have lasting effects on spinal muscles

Astronauts who spend several months on the International Space Station have significant reductions in the size and density of paraspinal muscles of the trunk after returning to Earth. Some changes in muscle composition are still present up to four years after long-duration spaceflight, according to the new research of Massachusetts Institute of Technology and colleagues. They write, "Spaceflight-induced changes in paraspinal muscle morphology may contribute to back pain commonly reported in astronauts." The researchers analyzed computed tomography (CT) scans of the lumbar (lower) spine in 17 astronauts and cosmonauts who flew missions on the International Space Station. Scans obtained before and after missions were analyzed to determine changes in the size and composition of the paraspinal muscles. Average time in space was six months. Running up and down the spine, the paraspinal muscles play a key role in spinal movement and posture. Previous studies have found reduced paraspinal muscle mass after prolonged time in space, suggesting that muscle atrophy may occur without the resistance provided by gravity. The CT scans showed reductions in the size of paraspinal muscles after spaceflight. For individual muscles, muscle size decreased by 4.6 to 8.8 percent. In follow-up scans performed one year later, size returned at least to normal for all muscles.

Changes in muscle size and composition varied between individuals. For some muscles, changes in size were at least partly related to the amount and type of exercise the astronauts performed while in zero gravity: either resistance exercise or cycling. In-flight exercise did not seem to affect changes in muscle density. Previous studies of astronauts have linked spaceflight to muscle atrophy, especially of the muscles that maintain posture and stability while upright on Earth in normal gravity. Many astronauts experience low back pain during and immediately after space missions, and they appear to be at increased risk of spinal disc herniation. The new study is the first to measure changes in the size and density of individual paraspinal muscles. The results show that muscle size returns to normal upon Earth recovery, but that some changes in muscle composition -- particularly increased fatty infiltration -- may persist for at least a few years.

Some of the paraspinal muscle changes seem to be affected by exercise, suggesting possible approaches to preventing the adverse effects of prolonged spaceflight on spinal health and functioning.

**Source: https://www.sciencedaily.com/releases/2019/01/190109170647.htm*

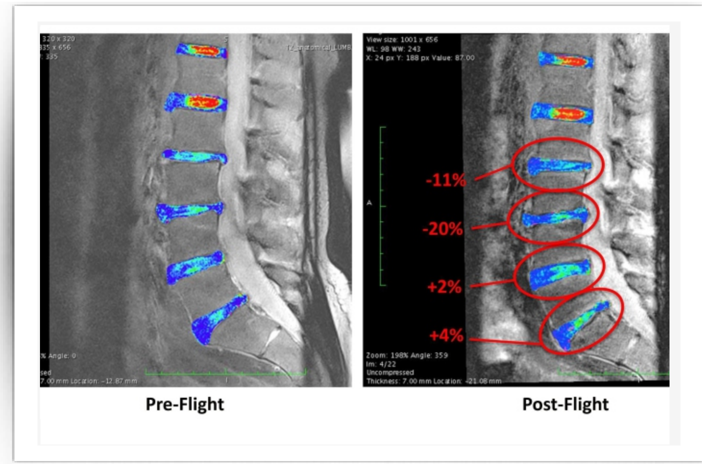

**Image Source: https://www.nasa.gov/mission_pages/station/research/experiments/856.html*

Article - 2 : Astronomers map 'light echoes' of newly discovered black hole

A team of astronomers led by, the Neil Gehrels Prize Postdoctoral Fellow in the University of Maryland's Department of Astronomy, has charted the environment surrounding a relatively small, "stellar mass" black hole that is 10 times the mass of the sun. The observations provide the clearest picture to date of how these small black holes consume matter and emit energy. Using NASA's Neutron star Interior Composition Explorer (NICER) payload aboard the International Space Station, the team detected X-ray light from the recently discovered black hole, called MAXI J1820+070 (J1820 for short), as it consumed material from a companion star. Waves of X-rays formed "light echoes" that reflected off the swirling gas near the black hole and revealed changes in the environment's size and shape.

NICER has allowed to measure light echoes closer to a stellar-mass black hole than ever. "Previously, these light echoes off the inner accretion disk were only seen in super massive black holes, which are millions to billions of solar masses and undergo changes slowly. Stellar black holes like J1820 have much lower masses and evolve much faster, so we can see changes play out on human time scales." J1820 is located about 10,000 light-years from Earth, in the direction of the constellation Leo. The black hole's companion star was identified in a survey by the European Space Agency's (ESA) Gaia mission, which allowed researchers to estimate its distance from Earth. Astronomers were unaware of the black hole's presence until March 11, 2018, when an outburst was spotted by the Japanese Aerospace and Exploration Agency's Monitor of All-sky X-ray Image (MAXI), also aboard the space station. In just a few days, J1820 went from a totally unknown black hole to one of the brightest sources in the X-ray sky. NICER moved quickly to capture this dramatic transition and continues to follow the fading tail of the eruption.

A black hole can siphon gas from a nearby companion star and into a ring of material called an accretion disk. Gravitational and magnetic forces heat the disk to millions of degrees Celsius, making it hot enough to produce X-rays at the inner parts of the disk, near the black hole. Outbursts occur when instability in the disk causes a flood of gas to suddenly rush inward toward the black hole, like a gaseous avalanche. Astronomers do not yet understand what causes these disk instabilities. According to Einstein's theory of relativity, time runs slower in strong gravitational fields and at high velocities. When the iron atoms closest to the black hole are bombarded by light from the core of the corona, the wavelengths of the X-rays they emit get stretched because time is moving slower for them than for the observer. These observations give scientists new insights into how material funnels into a black hole and how energy is released in this process.

**Source: https://www.sciencedaily.com/releases/2019/01/190109142634.htm*

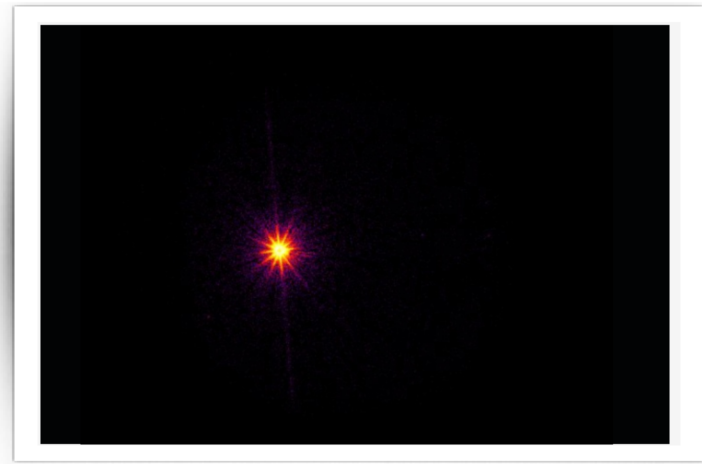

**Image Source: https://www.sciencedaily.com/releases/2019/01/190109142634.htm*

Article - 3 : Saturn hasn't always had rings

One of the last acts of NASA's Cassini spacecraft before its death plunge into Saturn's hydrogen and helium atmosphere was to coast between the planet and its rings and let them tug it around, essentially acting as a gravity probe. Precise measurements of Cassini's final trajectory have now allowed scientists to make the first accurate estimate of the amount of material in the planet's rings, weighing them based on the strength of their gravitational pull. That estimate -- about 40 percent of the mass of Saturn's moon Mimas, which itself is 2,000 times smaller than Earth's moon -tells them that the rings are relatively recent, having originated less than 100 million years ago and perhaps as recently as 10 million years ago. Their young age puts to rest a long-running argument among planetary scientists. Some thought that the rings formed along with the planet 4.5 billion years ago from icy debris remaining in orbit after the formation of the solar system. Others thought the rings were very young and that Saturn had, at some point, captured an object from the Kuiper belt or a comet and gradually reduced it to orbiting rubble.

The new mass estimate is based on a measurement of how much the flight path of Cassini was deflected by the gravity of the rings when the spacecraft flew between the planet and the rings on its final set of orbits in September 2017. Initially, however, the deflection did not match predictions based on models of the planet and rings. Only when the team accounted for very deep flowing winds in atmosphere on Saturn -- something impossible to observe from space -- did the measurements make sense, allowing them to calculate the mass of the rings. "The discovery of deeply rotating layers is a surprising revelation about the internal structure of the planet,"

Earlier estimates of the mass of Saturn's rings -- between one-half and one-third the mass of Mimas -- came from studying the density waves that travel around the rocky, icy rings. These waves are caused by the planet's 62 satellites, including Mimas, which creates the so-called Cassini division between the two largest rings, A and B. Mimas is smooth and round, 246 kilometers in diameter. It has a big impact crater that makes it resemble the Death Star from the Star Wars movies.

Source: https://www.sciencedaily.com/releases/2019/01/190117142159.htm

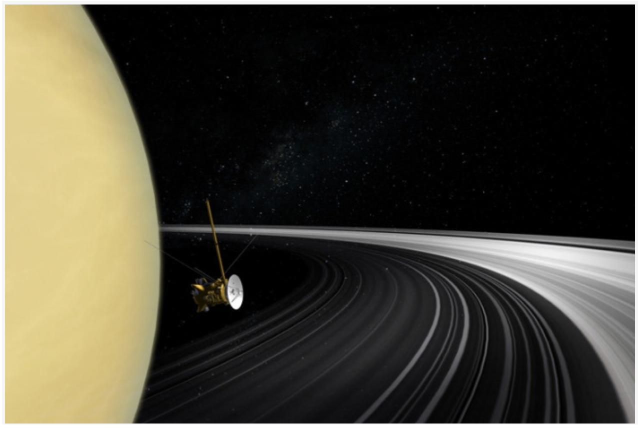

*Image Source: https://www.sciencedaily.com/releases/2019/01/190117142159.

Article - 4 : Space telescope detects water in a number of asteroids

Using the infrared satellite AKARI, a Japanese research team has detected the existence of water in the form of hydrated minerals in a number of asteroids for the first time. This discovery will contribute to our understanding of the distribution of water in our solar system, the evolution of asteroids, and the origin of water on Earth.

Our Earth is an aqua-planet, and is the only planet in our solar system where the presence of water on the planet surface has been confirmed. We are, however, not yet sure how our Earth acquired water. Recent studies have shown that other celestial bodies in our solar system have, or used to have, water in some form. Asteroids are considered to be one of the candidates that brought water to Earth. Note that the liquid water is not flowing on the surface of asteroids, but water is retained in asteroids as hydrated minerals, which were produced by chemical reactions of water and anhydrous rocks that occurred inside the asteroids, that is, aqueous alteration. Hydrated minerals are stable even above the sublimation temperature of water ice. Thus, by looking for hydrated minerals, we can investigate whether asteroids have water.

Infrared wavelengths contain characteristic spectral features of various substances, such as molecules, ice, and minerals, which cannot be observed at visible wavelengths. Therefore, it is indispensable to observe at infrared wavelengths for the study of solar system objects. Hydrated minerals exhibit diagnostic absorption features at around 2.7 micrometers. The absorption of water vapor and carbon dioxide in the terrestrial atmosphere prevents us from observing this wavelength with ground-based telescopes. It is absolutely necessary to make observations from outside of the atmosphere, that is, in space. However, observations with space-borne telescopes have been scarce; the Infrared Space Observatory (ISO), launched in 1995, did not have a sufficient sensitivity to make spectroscopy of faint asteroids and the Spitzer Space Telescope, launched in 2003, did not have coverage of this wavelength range. For this reason, it has not fully been understood how much water is contained in asteroids.

The observations detected absorption, which were attributed to hydrated minerals for 17 C-type asteroids. C-type asteroids, which appear dark at visible wavelengths, were believed to be rich in water and organic material, but the present observations with AKARI are the first to directly confirm the presence of hydrated minerals in these asteroids. The absorption strength detected at around 2.7 micrometers varies for each asteroid, and some show absorption features of other substances, such as water ice and ammonia-rich material at around 3.1 micrometers.

Source: https://www.sciencedaily.com/releases/2018/12/181218100407.htm

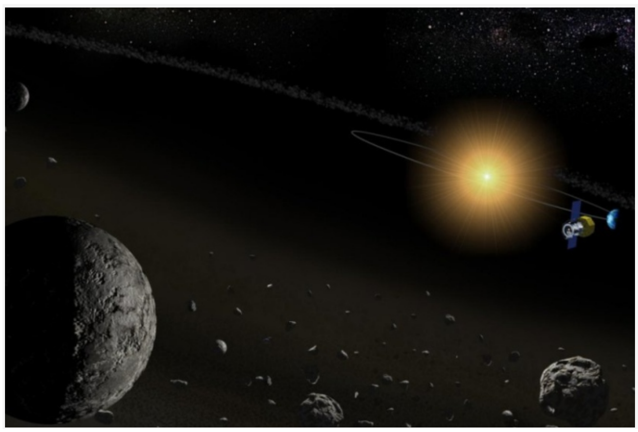

*Image Source: https://www.sciencedaily.com/releases/2018/12/181218100407.htm

Conserve the Energy,

Save our Climate!

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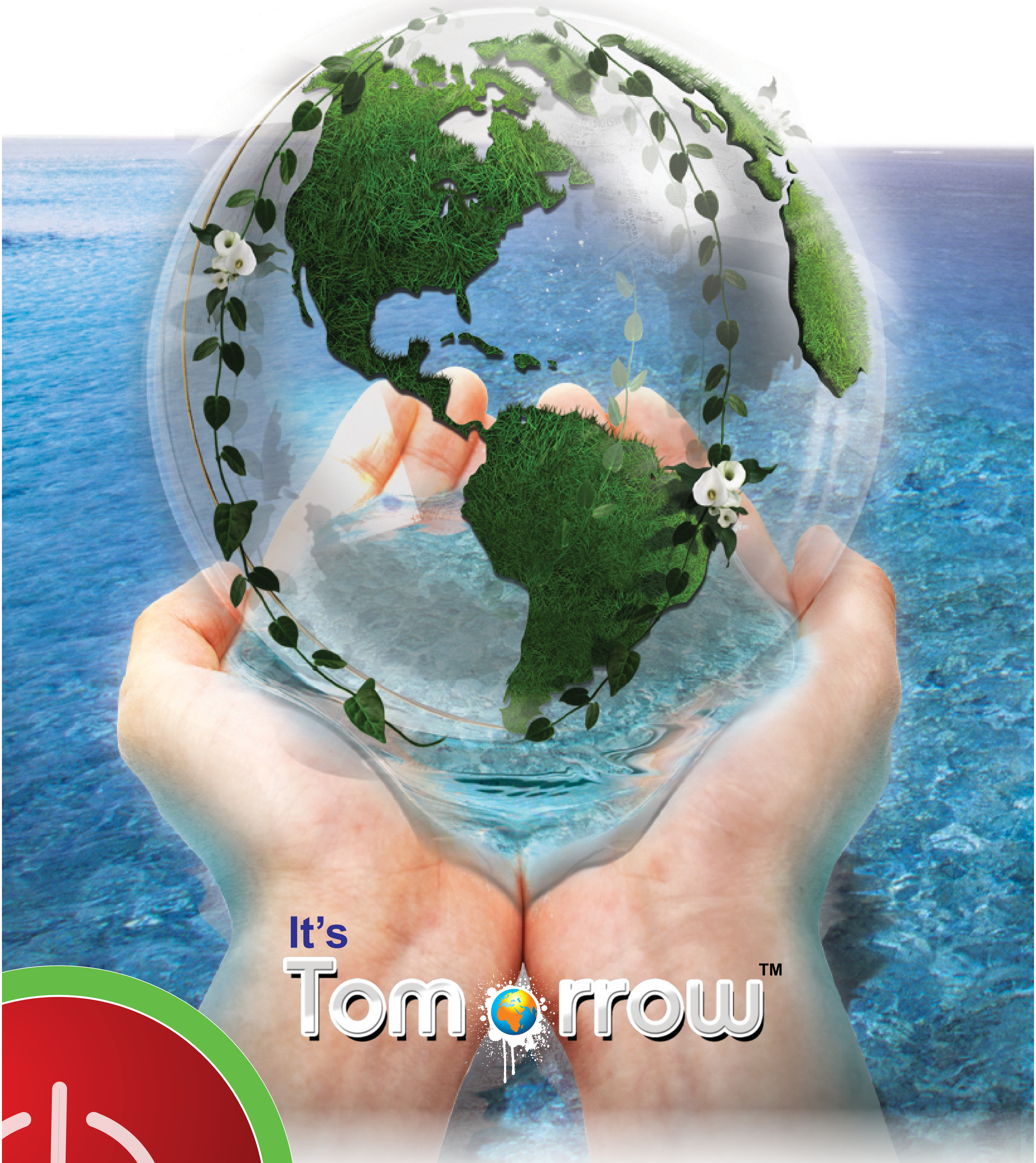

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