

SCIENCE & LIFE

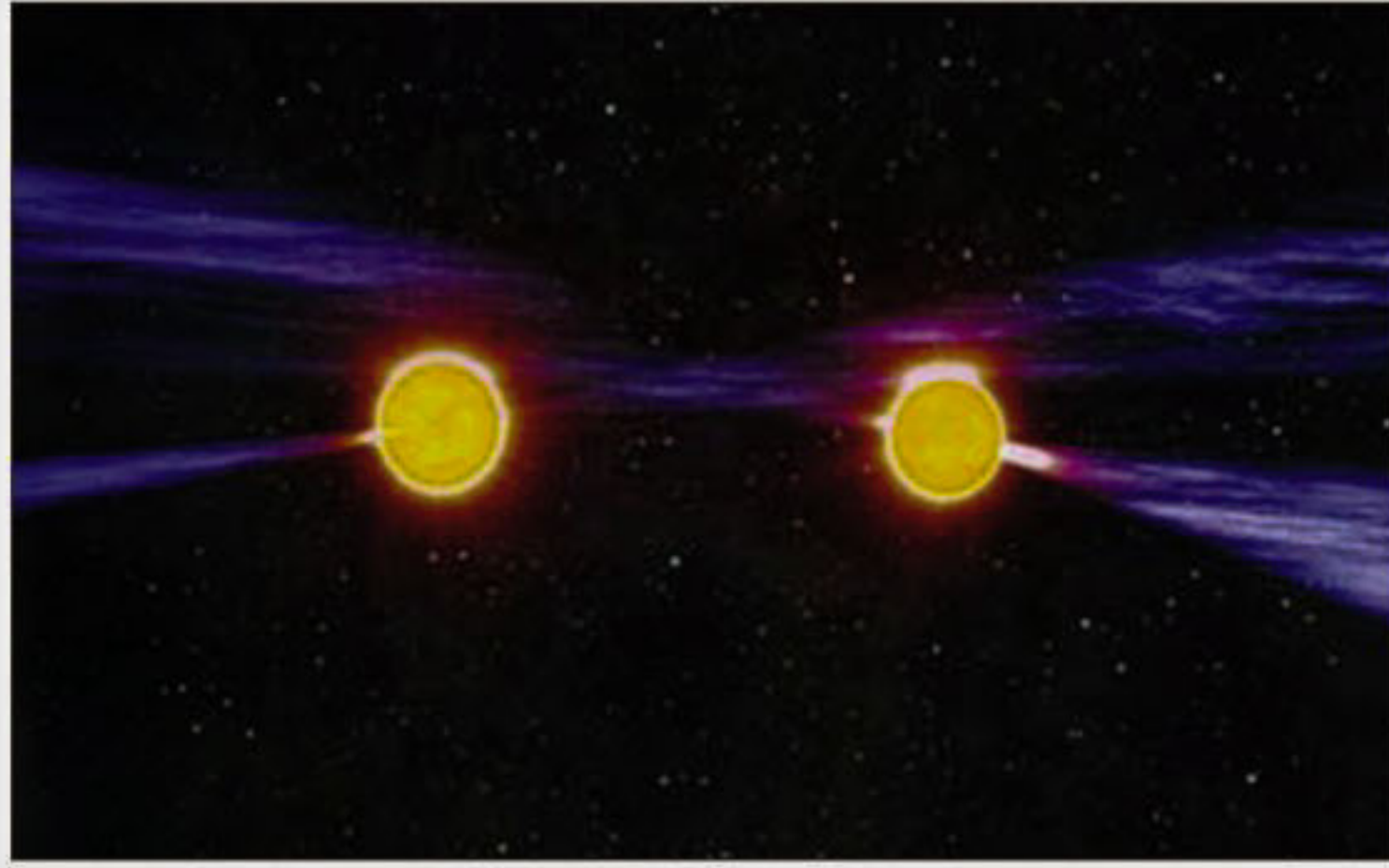
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Binary pulsar and gravitational wave

DR. MOFIZ UDDIN AHMED

A press release issued on 13 October 1993 says "The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Physics for 1993 jointly to Russell A. Hulse and Joseph H. Taylor, Jr, both of Princeton University, New Jersey, USA for the discovery of a new type of pulsar, a discovery that has opened up new possibilities for the study of gravitation". An outline of this discovery and its relation to the study of gravitational waves, is presented here.

All stars are mostly composed of hydrogen- the lightest element in nature. Under high pressure and high temperature, the nuclei of hydrogen atoms fuse together to form a heavier nuclei like helium and produce tremendous amount of energy, which is actually the hydrogen bomb. The process is called nuclear fusion. All the stars including our sun give heat and light for million years through this process. But a time arrives when the fuel is finished. Then what happens? At this moment stellar evolution occurs. Some stars evolve to neutron stars and some stars to black holes. It depends on the initial mass of the star. The limit for initial mass for different ways of stellar evolution was given by an Indian Scientist, Subramanya Chandrasekhar and the limit is called Chandrasekhar limit, for what he was awarded the Nobel prize in physics in 1983. At this stage, the external part goes out-

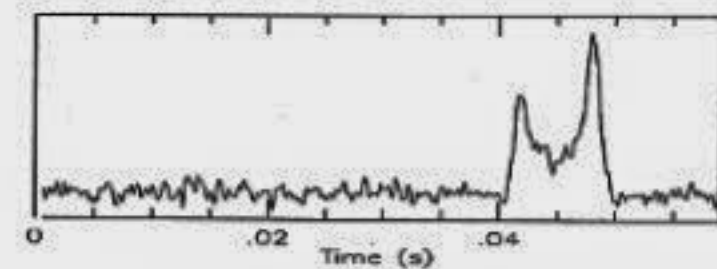


Artist's impression of the binary pulsar system PSR J0737-3039

ward giving tremendous pressure inside such that electrons in the atomic orbit enter into the proton of nucleus and make them neutrons, thus a neutron star is formed with a radius of ten kilometers having super dense materials and super strong magnetic field. The neutron star rotates several hundred times in second and radiate electromagnetic pulses with fixed interval of times, which was discovered by Antony Hewish and Jocelyn bell in 1967. Antony Hewish was awarded the Nobel Prize in physics in 1974, for this discovery.

During 1974 Joseph Taylor and Russell Hulse, two plasma physicists of Princeton University, were searching for new pulsars with the 300-m Arecibo telescope- the largest radio telescope in the world at

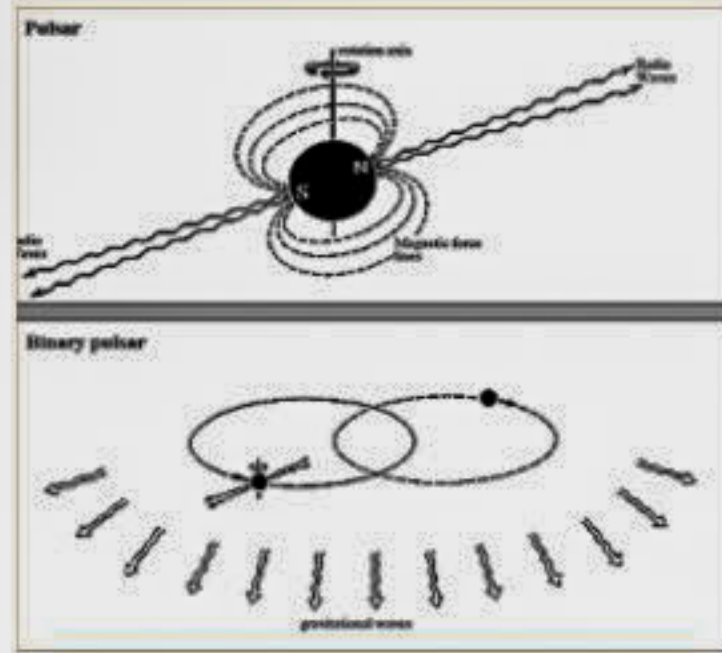
Puerto Rico, West Indies. They discovered pulsar named PSR 1913 +16, from where pulses are coming sometimes more often and sometimes less. This was interpreted as pulses are coming from two orbiting around each other pulsars-called binary pulsar. For pulsars the year of orbiting is about eight hours. Their mass is about 1.4 times mass of the sun. When they are closing to each other they emit gravitational waves. For this discovery Russel and



Pulse profile from binary pulsar

Hulse were awarded Nobel Prize in physics in 1993.

Discovery of binary pulsar and their existence is an excellent laboratory for testing the theory of gravity. Yet undiscovered binaries will provide even better opportunities to test general relativity. Astronomers are searching binary pulsars in our Milky Way Galaxy with increasingly better technology. There are about 1700 pulsars are known and 8 of them are binaries.



Orbiting of binary pulsars and emission of gravitational waves.

one of the recent discovery in 2003 is the double pulsar system, PSR J0737-3039, in which both neutron stars are visible pulsars. The discovery of binary pulsar and the decreasing of its orbital period is a proof of existence of gravitational waves and the manifestation of general theory of relativity which is an astonishingly beautiful theory. The Soviet physicists Lev Landau and Evgeny Lifshits wrote in their

text book 'The Classical Theory of Fields' that it is the most beautiful and profound of existing theories. The German physicist Max Born said once he enjoyed general theory of relativity as he would enjoy an object of art. And the Soviet physicist Vitaly Ginzburg wrote that "this theory makes an experience something akin to what one feels when contemplating the masterpieces of painting, sculptures, or architectures."

Gravitational wave is a concept of Einstein's General Theory of Relativity given in 1916. According to the theory, accelerating mass should radiate gravitational waves as accelerating charges radiate radio waves. Gravitational wave is a deformation of space-time. An object exposed to gravitational waves should become alternately longer and thinner, shorter and broader. The variation however so small (10⁻¹⁷ in dimensionless) that it does not yet possible to detect. Several direct detectors of gravitational are being built in USA. The best known of these are Laser Interferometer Ground Observatory (LIGO) and Laser Interferometer Space Array (LISA). In Bangladesh, theoretical research on pulsar, gravitational waves and earthquake prediction from space are being done at the Department of Mathematics and Natural Sciences of BRAC University.

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WONDER & AWE

Cathedral of darkness



This hauntingly beautiful image is no painting, but a real snapshot from our local universe. A recent Hubble Space Telescope image, it shows a nebula, or cloud of dust and gas, designated IRAS 05437+2502. Astronomers aren't sure what is lighting up this foggy region, especially the upside-down V-shaped formation near the top. From the Earth perspective, the nebula covers only one-eighteenth of the width of a full moon against our night sky, and lies toward the constellation Taurus, or The Bull.

Source: NASA, ESA, Hubble, & R. Sahai/JPL



PARADOX OF TIME



KNOWING SELF



DEATH OF QILIN!

Why it can't stop, but must

In our experience, nothing ever really ends. When we die, our bodies decay and the material in them returns to the earth and the air, allowing for the creation of new life. We live on in what comes after. But will that always be the case? Might there come a point sometime in the future when there is no "after"? Depressingly, modern physics suggests the answer is yes. Time itself could end. All activity would cease, and there would be no renewal or recovery. The end of time would be the end of endings.

This grisly prospect was an unanticipated prediction of Einstein's general theory of relativity, which provides our modern understanding of gravity. Before that theory, most physicists and philosophers thought time was a universal drumbeat, a steady rhythm that the cosmos marches to, never varying, wavering or stopping. Einstein showed that the universe is more like a big polyrhythmic jam session. Time can slow down, or stretch out, or let it rip. When we feel the force of gravity, we are feeling time's rhythmic improvisation; falling objects are drawn to places where time passes more slowly. Time not only affects what matter does but also responds to what matter is doing, like drummers and dancers firing one another up into a rhythmic frenzy. When things get out of hand, though, time can go up in smoke like an overexcited drummer who spontaneously combusts.

Source: Scientific American.



Introspection: Gray and white matter

A specific brain region is larger in people who are good at turning their thoughts inward and reflecting on their decisions, a new study suggests.

This process of "thinking about your thinking," called introspection, is a key part of human consciousness. But scientists have noted plenty of variation in peoples' abilities to introspect.

The study is to be published in the Sept. 17 issue of the research journal Science.

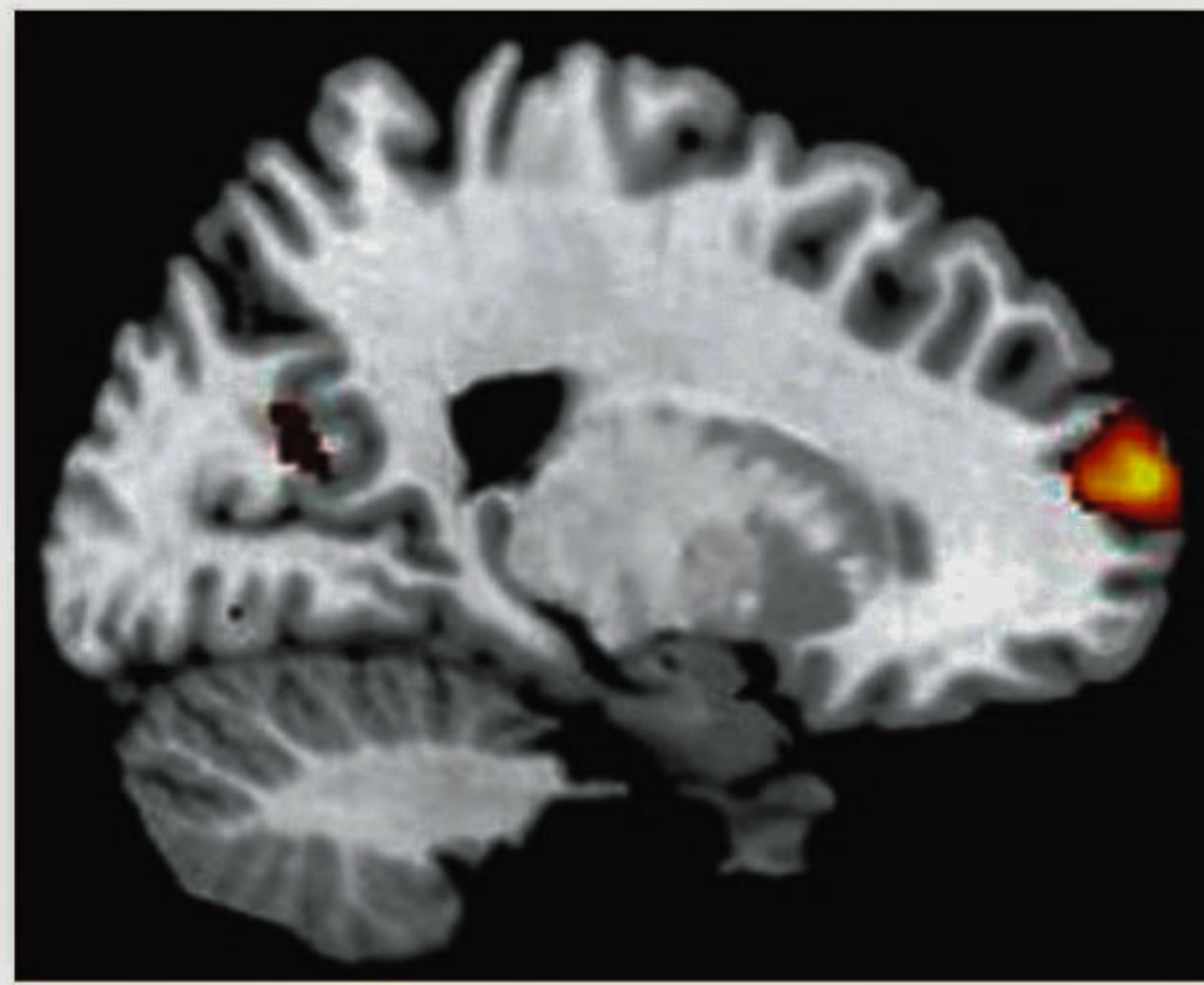
"We want to know why we are aware of some mental processes," while others proceed without awareness, said Stephen Fleming of University College London, one of the authors.

"There may be different levels of consciousness, ranging from simply having an experience, to reflecting upon that experience. Introspection is on the higher end of this spectrum. By measuring this process and relating it to the brain we hope to gain insight into the biology of conscious thought."

The brain region found to be apparently linked to introspection is the called the anterior prefrontal cortex, right behind our eyes, said the scientists, who were led by researcher Geraint Rees of the university. The "gray matter" in this region tends to be larger in people with greater introspective ability, they explained. Gray matter consists of the types of brain cells chiefly known for processing information, called neurons.

Also linked to introspection is the "white matter" connected to this brain region, the investigators said. White matter consists of nerve fibers, thread-like extensions of neurons which link the cells to each other so that signals can pass between them.

It remains unclear how the relationship between introspection and the two types of brain matter really works, Rees and colleagues said. The findings don't necessarily mean that all people with more gray matter in the anterior prefrontal cortex have more introspec-



tive thoughts, but they do establish a correlation, they stressed.

Rees and colleagues designed a test of introspective abilities in which 32 participants were shown two screens, each containing six patterned patches. One screen, though, contained a patch that was slightly brighter than the others. The researchers asked the participants to identify which screen contained the brighter patch, and then to rate how confident they felt about their final answer.

By working with the participants, the investigators adjusted the task to each person's skill level, until they all performed equally well. But their performance still varied in the accuracy with which they judged their own decisionmaking. This was taken as a measure of introspective ability.

It's unknown whether these differences are innate or a result of learning, the investigators noted. Also unclear is

the nature of the mental computations and biological processes behind introspection.

Still, the finding may help scientists understand how certain brain injuries affect the ability to reflect on one's own thoughts and actions, Fleming said. With such an understanding, it may eventually be possible to tailor appropriate treatments to patients, such as stroke victims or those with serious brain trauma, who may not even understand their own conditions.

"Take the example of two patients with mental illness: one who is aware of their illness and one who is not," said Fleming. "The first person is likely to take their medication, but the second is less likely. If we understand self-awareness at the neurological level, then perhaps we can also adapt treatments and develop training strategies for these patients."

Source: World Science

Asian 'Unicorn' dies in captivity

One of the rarest animals in the world has been sighted for the first time in more than 10 years, according to the government of Laos. Sightings of the animal, called a saola, are so rare that the creature has been likened to a unicorn, despite the fact that it has two horns, not one.

The Lao government announced that in late August villagers in the central province of Bolikhamxay captured a saola, which looks similar to an antelope, and brought it back to their village.

When news of the saola's capture reached Lao authorities, the Bolikhamxay Provincial Agriculture and Forestry Office immediately sent a team, advised by the International Union for Conservation of Nature (IUCN) and the Wildlife Conservation Society (WCS) to examine the saola and release it. Unfortunately, the animal, an adult male, weakened by the ordeal of several days in captivity, died shortly after. The animal was photographed while still alive.

"The government of Lao PDR and WCS are to be commended for their rapid response and efforts to save this animal. We hope the information gained from the incident can be used to ensure that this is not the last saola anyone has a chance to see," said William Robichaud, coordinator of the IUCN Saola Working Group.

Asian "unicorn"

This is the first confirmed record of the species since two photographs of wild saola were taken in Laos by automatic camera traps in 1999.

The Saola was first discovered in 1992, in Vietnam near the country's border with Laos. With its long horns and white facial markings, the saola resembles the antelope of North Africa, but is more closely related to wild cattle.

Saola are secretive and so seldom seen (no biologist has ever reported spotting one in the wild) that they have been likened to mythical unicorns. Some speculate that a Chinese myth of a magical unicorn, the qilin, may have been derived from familiarity with saola in prehistoric China, although the species does not occur there today, if it ever did.

The saola is listed as critically endangered on the IUCN Red List of Threatened Species and probably no more than a few hundred exist. With none in zoos and almost nothing known about how to maintain them in captivity, extinction of saola in the wild would mean its extinction everywhere.

"The death of this saola is unfortunate," the Provincial Conservation Unit of Bolikhamxay Province said in a statement. "But at least it confirms an area where it still occurs and the government will immediately move to strengthen conservation efforts there."

It is not clear why the villagers took the saola into captivity. After its death, the technical team took the carcass to Pakxan, the provincial capital, where biologists from the WCS and the Lao government preserved all parts for analysis, future study and reference. This is the first saola specimen to be so completely preserved.

Source: Live Science



Rare saola in captivity



HOW MUCH IS LEFT?



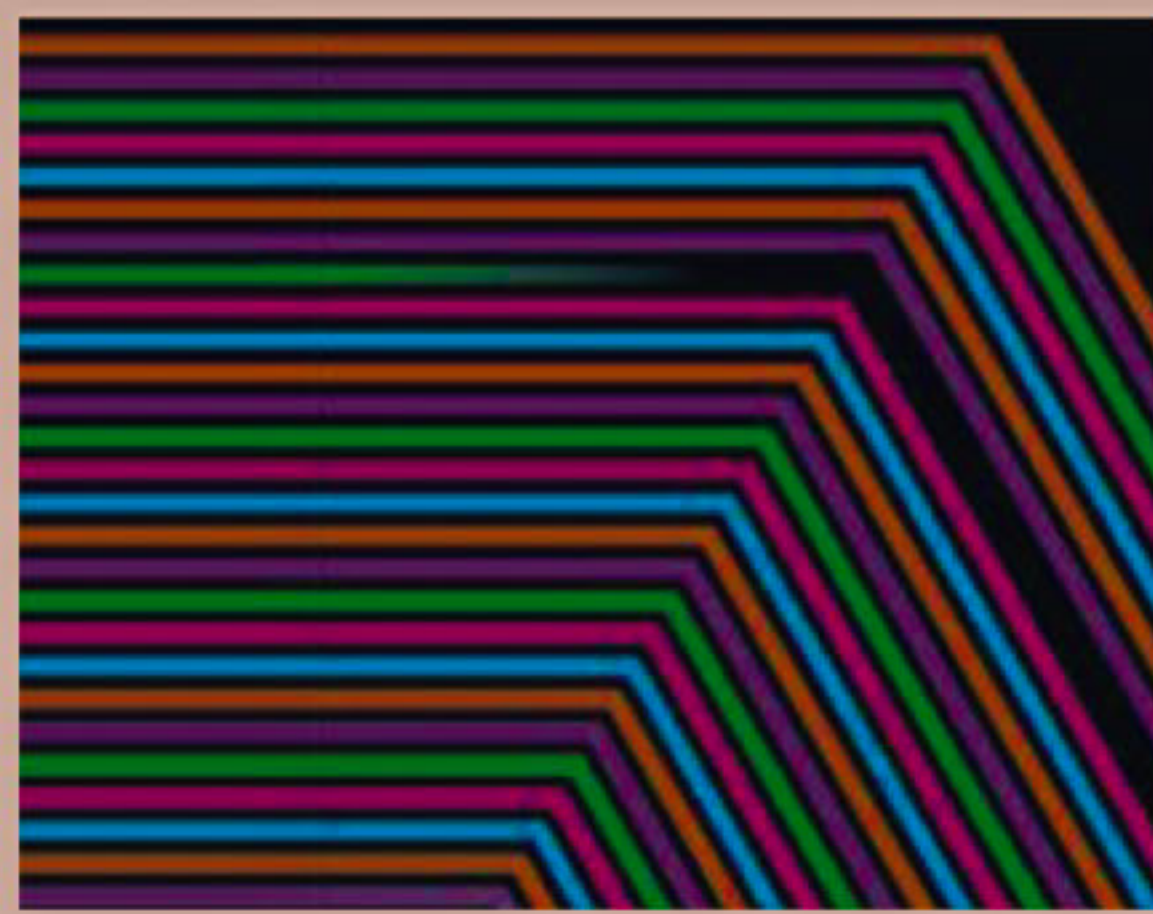
DO YOU KNOW?

Limits of earth's resources

If the 20th century was an expansive era seemingly without boundaries a time of jet planes, space travel and the Internet the early years of the 21st have showed us the limits of our small world. Regional blackouts remind us that the flow of energy we used to take for granted may be in tight supply. The once mighty Colorado River, tapped by thirsty metropolises of the desert West, no longer reaches the ocean. Oil is so hard to find that new wells extend many kilometers underneath the seafloor. The boundless atmosphere is now reeling from two centuries' worth of greenhouse gas emissions. Even life itself seems to be running out, as biologists warn that we are in the midst of a global extinction event comparable to the last throes of the dinosaurs.

The constraints on our resources and environment-compounded by the rise of the middle class in nations such as China and India-will shape the rest of this century and beyond. Here is a visual accounting of what we have left to work with, a map of our resources plotted against time.

Source: Scientific American



A map of our resources plotted against time

What is kangaroo touch?



Kangaroo touch is a technique used to encourage skin-to-skin contact between a newborn, usually premature baby and its mother as this touch is believed to keep it healthy. It is also encouraged between siblings. The name comes from the way kangaroos

hold their young in their pouches. Kangaroo touch or care is now increasingly promoted in hospitals for the many benefits the mother's warmth provides to the baby. It was initially developed to care for pre-term infants the way an incubator would in areas where it was not available.