

Is the Universe finite or infinite?

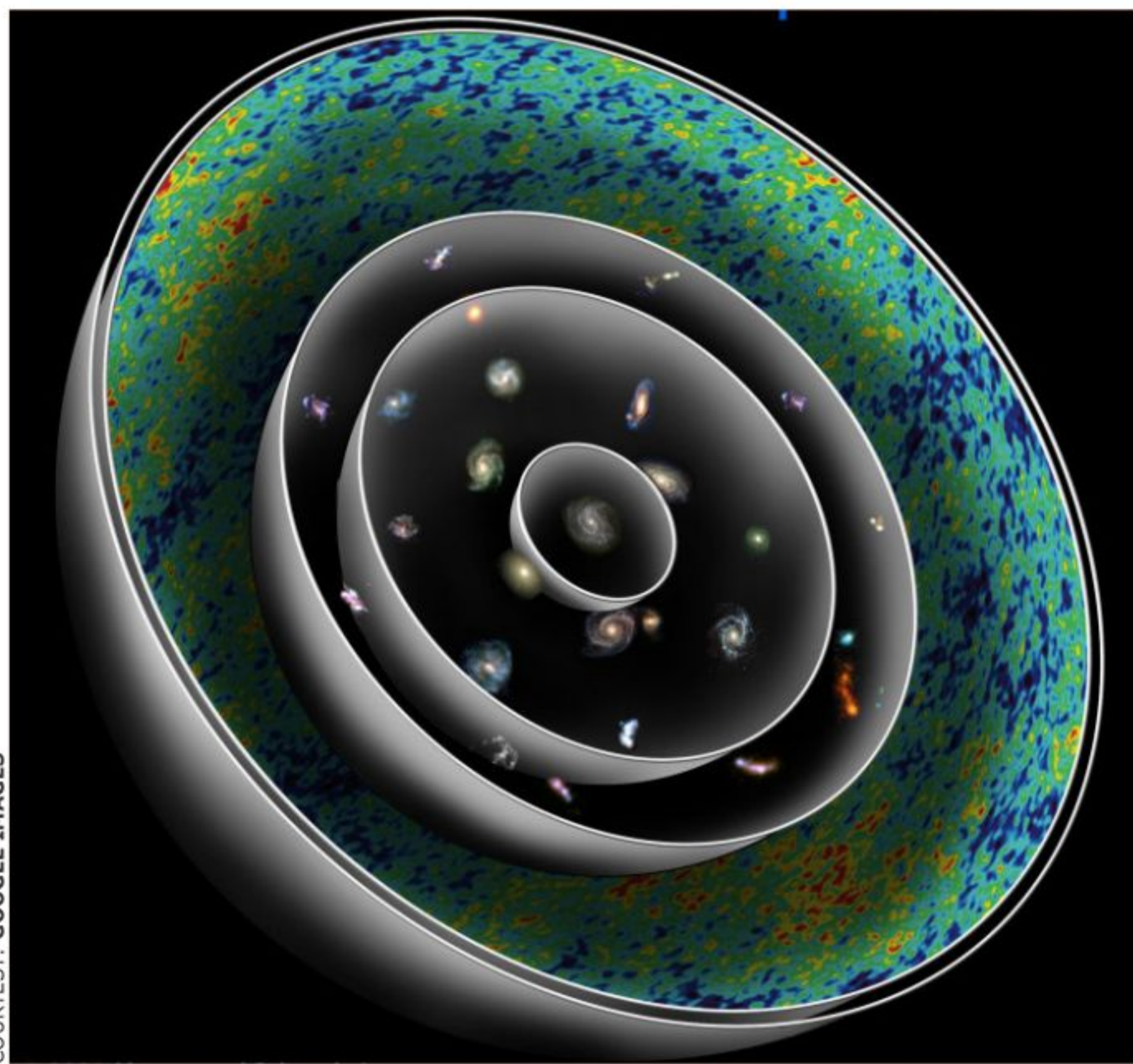
QUAMRUL HAIDER, PH.D.

HOW large is the Universe? How do we measure its size? How can we even think of measuring something that is believed to be boundless? The enormity of the Universe may be beyond our comprehension, but measuring its size is not. Our measuring sticks are the cosmic microwave background radiation (CMBR) which is relic of the super hot Big Bang radiation cooled down to three Kelvin (-270 degrees Centigrade) with wavelength in the microwave region and cosmological red-shift, increase in the observed wavelength of electromagnetic waves from a receding source.

The size depends on the distinction between "visible" and "observable" Universe. Although there is no general consensus among astronomers about the actual size, one thing they agree on for sure is how far away we can see.

We can argue that if the age of the Universe is 13.7 billion years (see "Universe in age crisis!" TDS July 10, 2012) and since light travels with a finite speed, we can't see anything beyond 13.7 billion light years. (One light year is about six trillion miles.) In reality, we can see lights that were emitted only after the decoupling epoch, a time around 380,000 years after the Big Bang, when radiation broke free from matter and could travel through space unimpeded.

The maximum distance light can travel since the birth of the Universe defines the "cosmic horizon." Astronomers use the distance to the horizon as the radius of the visible Universe with Earth at the center. It is also known as the Hubble Length and is 13.7 billion light years. But is it really the size of



the Universe?

Calculating the size of the Universe is a little tricky. Let us start with the premise that Big Bang is the correct theory of the origin of the Universe. The theory posits that the Universe, born out of a tremendous explosion from an infinitesimally small volume, is undergoing expansion at a rapid rate. It was, however, an explosion of space; not an ex-

plosion into space. Consequently, the Universe does not have an "edge" where space just runs out. Hence the cosmic horizon is a boundary in time, not in space. It still lies at the beginning of time - the moment of Big Bang. It exists because we cannot see back to a time before the Universe was born.

As the Universe is expanding at high speed in all directions, the most distant

objects we can see were once much closer to us. The recession speed of stellar objects, according to Edwin Hubble, is directly proportional to their distance from us. He also noted from cosmological red shift that farther a galaxy is from us, faster it is moving away from us.

Thus the cosmic horizon is continually expanding outward and the observable Universe is growing larger in radius with each passing second. This implies that since the birth of the Universe, distant stars and galaxies have been pushed away from us far beyond the distance of 13.7 billion light years. The observable Universe, therefore, is much bigger than the visible Universe. The radius of the observable Universe is also referred to as the "comoving distance" because it is increasing with time.

What then is the radius of the Universe today? The answer is given by our measuring sticks cum cosmic storytellers, red shift and CMBR. Without going into the nitty gritty of calculation, they tell us that because of accelerated expansion, it is 94 billion light years across putting the edge of the observable Universe 47 billion light years away from us. Whatever the size is, thanks to the inflationary Universe; it increased our observational power to the extent that we can see or have seen things that are now at least 47 billion light years away from us in all directions.

"Two things are infinite: the Universe and human stupidity; and I'm not sure about the Universe." Albert Einstein.

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DECODED

Dolphin's math skills



By studying the clicks of Atlantic bottlenose dolphins, researchers have figured out a way to create sonar that sees through bubbles.

DOLPHINS could teach humans a thing or two about finding Nemo. The aquatic mammals may pinpoint prey hidden in bubbles by using mental math.

By adjusting the volume of sonar clicks, then processing the incoming echoes, dolphins might have solved a problem that still stymies man-made sonar: how to peer through frothy water. Using clicks that mimic an Atlantic bottlenose dolphin, scientists devised a system that weeds out sound clutter from underwater bubbles.

"It's really ingenious, actually," says oceanographer Grant Deane of the Scripps Institution of Oceanography in La Jolla, Calif. "I think it's very clever work, and there are a number of significant applications for it."

Using something like a fireman's hose, researchers shot bubbles into a huge water tank set underground. The bubbles cloaked a submerged target: a steel ball slightly smaller than a baseball. Then, the researchers sent out short bursts of sound the faux dolphin clicks underwater, collected the echoes, and processed the data mathematically to figure out the steel ball's location.

Source: Science News



LIGHTS



LA DEN SEAS

Father of Atomic Theory

JOHAN DALTON grew up to be an English chemist, meteorologist and physicist. Before he had pronounced the Atomic Theory, he had already attained a significant status. He worked for the development of modern Atomic Theory, Gas Law, and his research on colour blindness. Until 1800,



John Dalton

he had also worked as a teacher of mathematics and natural philosophy at the "New College" in Manchester, a dissenting academy. A second work by Dalton "Elements of English Grammar" was published in 1801.

Much of Dalton's collected work was damaged during the bombing of the Manchester Literary and Philosophical Society on 24 December 1940. The damaged papers are now in the John Rylands Library having been deposited in the university library by the Society.

Dalton never married and had only a few close friends. He lived for more than a quarter of a century with his friend the Rev. W. Johns in George Street, Manchester. He suffered a minor stroke in 1837; a second one in 1838 left him with a speech impediment, though he still was able to carry on with his experiments. On July 27, 1844, Dalton, fell from his bed and was found lifeless by his assistant.

John Dalton was from a Quaker family at Eaglesfield in England, born on September 06, 1766. He was a son of a weaver, he joined his older brother, Jonathan at age 15 in running a Quaker school in nearby Kendal.

Source: Wikipedia

'Ocean fertilisation' experiment stores CO2

GERMAN researchers say they had evidence that sowing the ocean with iron particles sucks up and stores carbon dioxide.

But their work, touching on a fiercely controversial issue called geo-engineering, came under attack from other scientists and environmentalists.

They claim a far bigger question - whether such schemes could damage the marine biosphere - remained unanswered.

Published in the science journal Nature, the paper is one of the biggest and most detailed probes into ocean fertilisation, a practice that is banned under international law although scientific research into it is permitted.

Its goal is to take CO2 from the atmosphere and store it in the deep sea so that it no longer adds to the greenhouse effect.

This would be done by scattering the ocean surface with iron dust, a nutrient for microscope marine vegetation called phytoplankton. As the plants gorge on the iron, they also suck up atmospheric CO2 thanks to natural photosynthesis.

In the next step, the phytoplankton die and sink to the deep ocean floor - taking with them the CO2, which would lie in the sediment, possibly for centuries.

Critics, though, say geo-engineering schemes are riddled with unknowns, both in cost effectiveness and risks for the environment.

Creating a 'fluff layer'

Scientists led by Victor Smetacek of the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven took a research ship to the Southern Ocean off Antarctica in 2004.

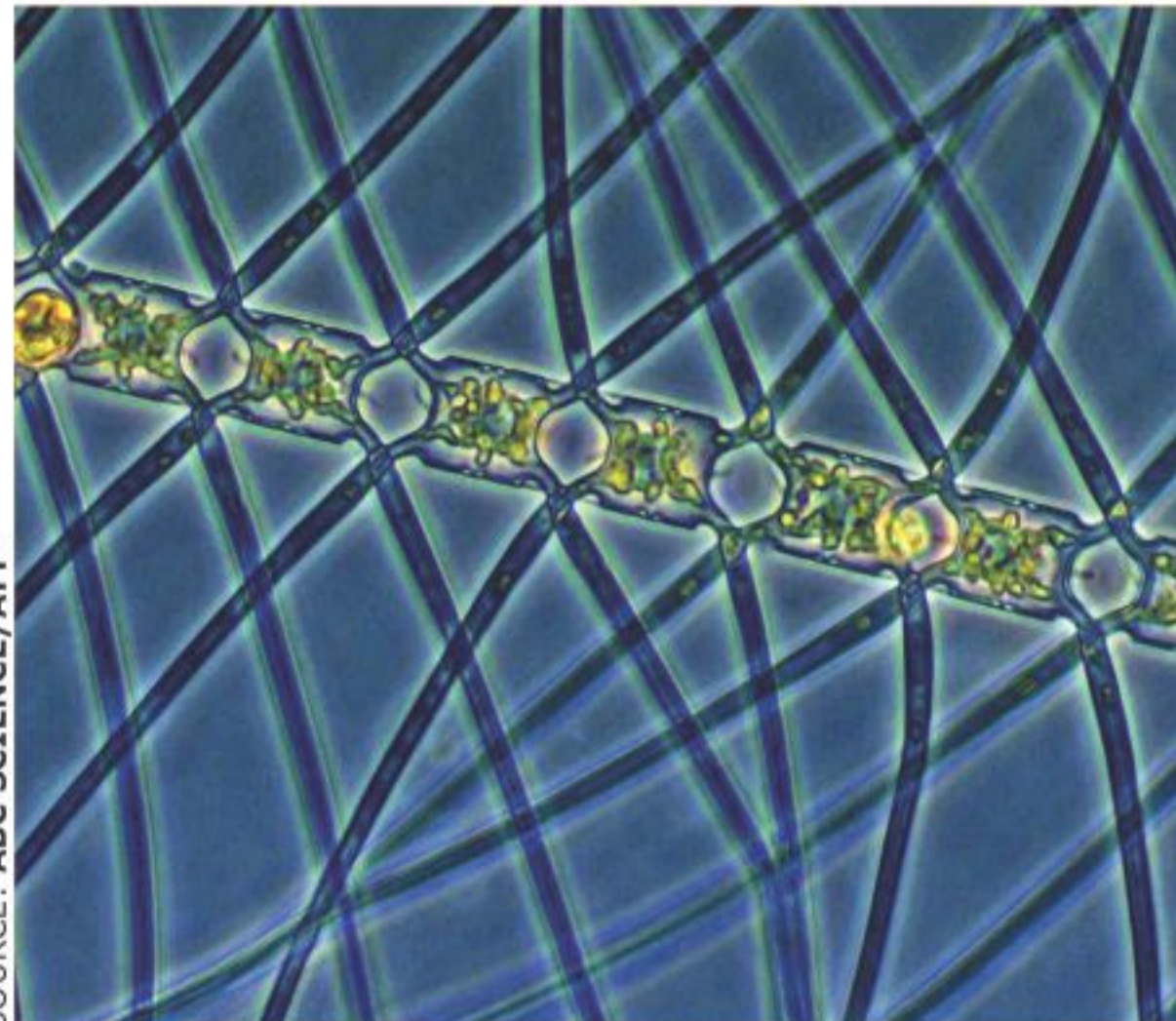
There, they located a giant eddy - a slowly-moving clockwise-rotating swirl 60 kilometres across that had relatively little interchange with the rest of the ocean - and used it as a test bed for a five-week experiment.

They scattered seven tonnes of commercial iron sulphate particles, which within four weeks developed into a giant bloom of diatom plankton.

The diatoms then died, sinking in clumps of entangled cells, "far below" a depth of 1000 metres, according to samples measured with a fluorometer.

They were probably deposited on the sea floor in a "fluff layer" that should remain for "many centuries and longer," Smetacek's team say.

Further work is needed to see what happens when sideways currents hit the diatom blooms, they add.



After absorbing CO2 the diatoms die and fall to the sea floor where they remain for up to several hundred years.

Wider effects unknown

Other voices sounded a loud note of caution, saying the experiment took place in exceptional conditions and did not consider other environmental consequences.

Among them was Professor John Shepherd, who chaired a landmark report in 2009 by Britain's Royal Society into geo-engineering.

It concluded that ocean fertilisation would not suck up that much CO2 and could be harmful to the marine biosphere.

"Whilst the new research is an interesting and valuable contribution in this evolving field, it does not address the potential ecological side effects of such a technology in what is a poorly understood field," says Shepherd.

The Canada-based ETC Group, an environmental NGO campaigning against geo-engineering, says the study "only focuses on a few narrow aspects and disregards or ignores others."

"The intended purpose of ocean fertilisation is to significantly disrupt marine ecosystems through drastic changes on phytoplankton, which is the base of the marine food web, so the effects would propagate throughout the ocean in unpredictable ways," it says.



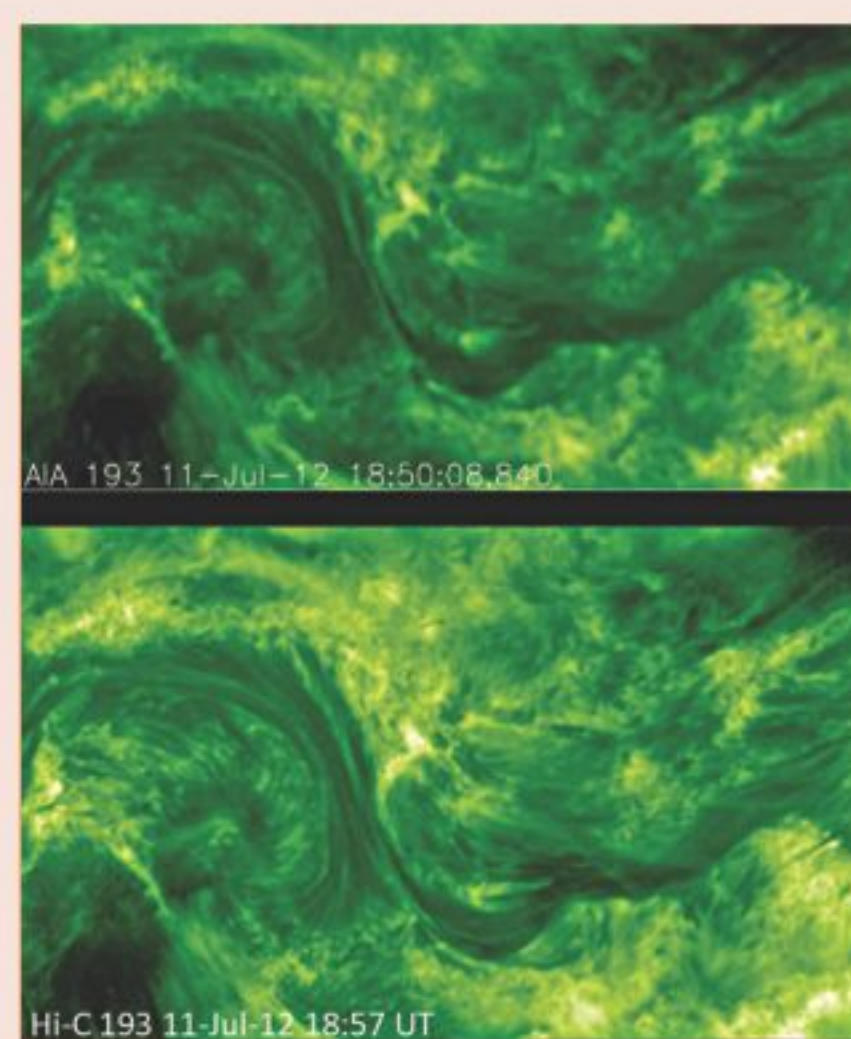
LOOK



SHARPER DID YOU KNOW?

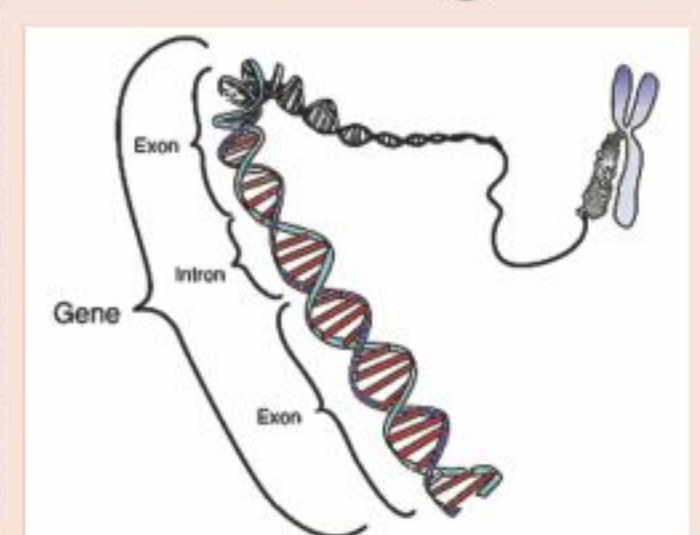
Solar Corona revealed

These photos of the solar corona, or million-degree outer atmosphere, show the improvement in resolution offered by NASA's High Resolution Coronal Imager, or Hi-C (bottom), versus the Atmospheric Imaging Assembly on NASA's Solar Dynamics Observatory (top). Both images show a portion of the sun's surface roughly 85,000 by 50,000 miles in size. Hi-C launched on a sounding rocket on July 11, 2012 in a flight that lasted about 10 minutes. The representative-color images were made from observations of ultraviolet light at a wavelength of 19.3 nanometers (25 times shorter than the wavelength of visible light).



SOURCE: SCIENCE DAILY

What is a gene?



This stylistic diagram shows a gene in relation to the double helix structure of DNA.

They carry information that helps make you who you are: curly or straight hair, long or short legs, even how you might smile or laugh, are all passed through generations of your family in genes."

In informal language, it is a unit of heredity that is transferred from a parent to offspring and is held to determine some characteristic of the "proteins coded directly by genes"

In technical terms, it is a distinct sequence of nucleotides forming part of a chromosome.

Genes are the things that play an important role in determining physical traits how we look and lots of other stuff about us.



GUEST UAVs!

'Invisible UFOs' fill skies

"WHY are all the good UFOs invisible?" one Gather.com user asked in response to the latest "invisible UFO" report posted to the site.

You might have thought a defining characteristic of a UFO would be visibility. But thanks to zealous alien hunters doggedly scanning the sky with night-vision cameras, a new class of flying objects that only emit infrared light has emerged from the darkness. Are they spies from the great beyond?

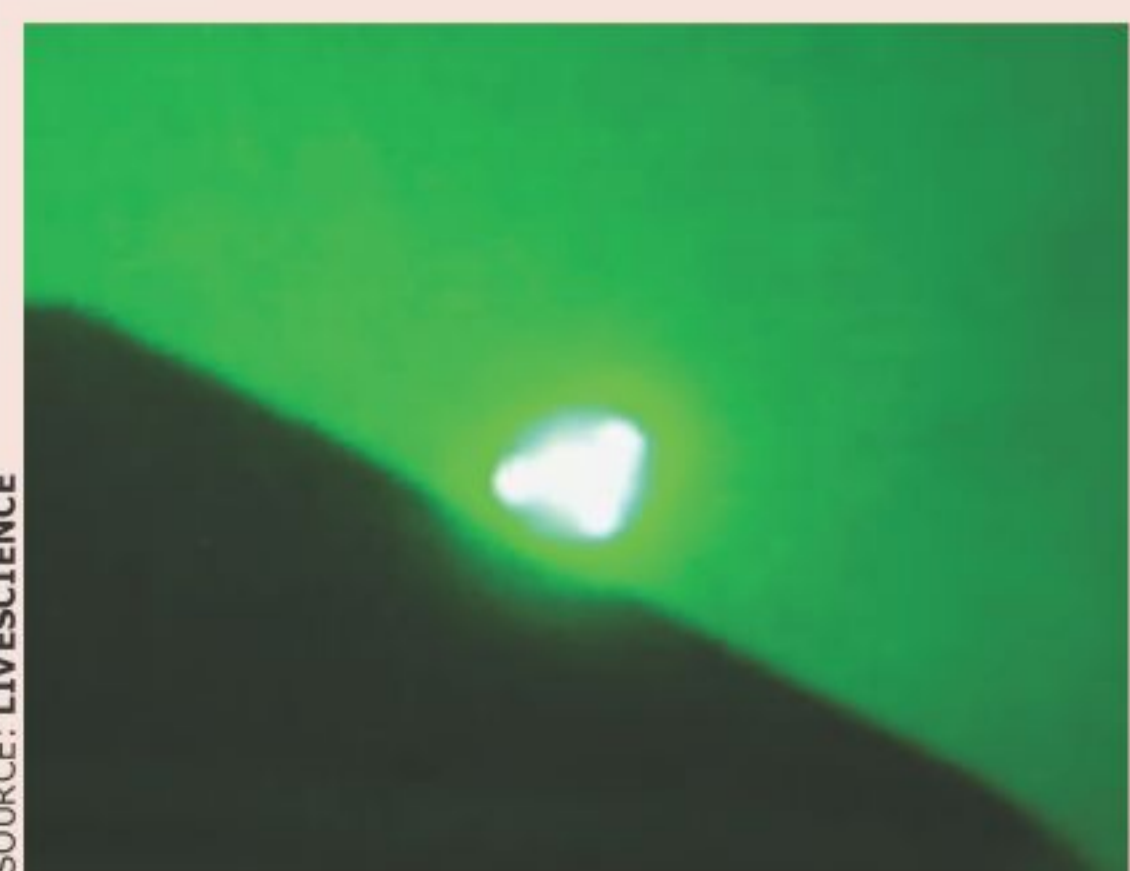
"Some people claim to see actual battles between UFOs up in the sky, using night-vision equipment," the ufologist Robert Sheaffer told Life's Little Mysteries. "Those devices magnify faint objects so much that the sky seems to be filled with invisible UFOs. In reality, of course, they are seeing owls, bats, moths, airplanes, satellites, etc." Night-vision optics trade low resolution for high sensitivity, he explained, so that points of light (such as distant satellites) spill out into circles that make the objects appear huge.

However, some of the invisible UFOs out there really are spies of a sort or whatever else you choose to call military drones. [7 Things Most Often Mistaken for UFOs]

Consider, for example, an invisible triangle UFO recently caught on camera by the Laredo Paranormal Research Society, a Texas group. In their footage, captured using an infrared-sensitive third-generation night-vision camera and posted to YouTube July 13, an object composed of three evenly spaced glowing orbs streaked southward across the field of view and disappeared behind the roof of a house.

According to LPRS founder Ismael Cuellar, the "infrared-cloaked" object could not be seen with the naked eye, and cruised silently. "[We] have ruled out birds, bugs, airplanes, helicopters, and even flying drones by comparing them side by side as a point of reference," Cuellar told Life's Little Mysteries. This seems to leave just one explanation: It's a cloaked alien spaceship.

Not so, according to Ben McGee, a geoscientist, aerospace consultant, UFO skeptic and lead field researcher on the National Geographic series "Chasing UFOs." In McGee's opinion, all the signs point to this object being a border patrol drone with infrared anti-collision or identification lights. Here's why he thinks so.



Invisible triangle "UFO" recorded with a night vision camera in South Texas.

SOURCE: LIVESCENCE