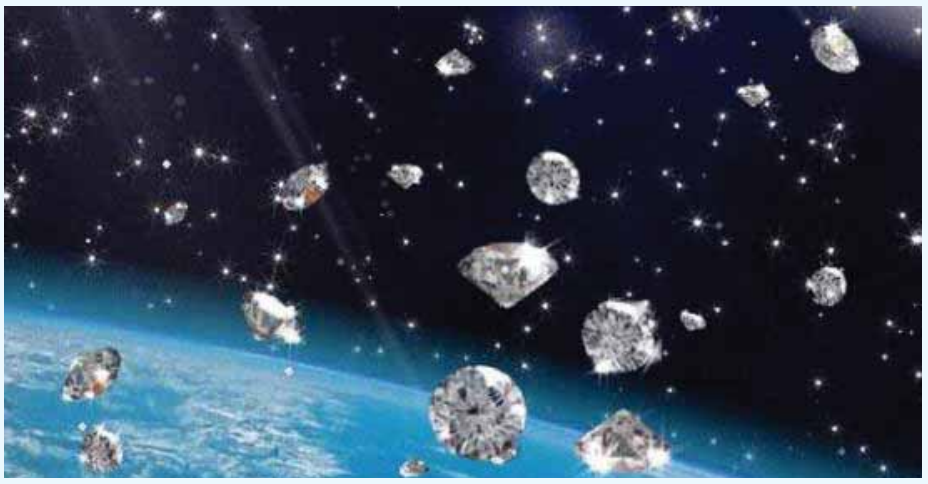
Through the Frontiers Science and Technology

'Diamond rain' could be common on Saturn and Jupiter



US scientists Dr Kevin Baines, of the University of Wisconsin-Madison and Nasa's Jet Propulsion Laboratory and Mona Delitsky, from California Speciality Engineers

are of the opinion that Diamonds that are the right size to have been worn by stars of the Silver Screen could rain down on Saturn and Jupiter. Furthermore, they have calculated Diamond rain could be "the most common precipitation in the Solar System" the authors say

The biggest diamonds would likely be about a centimeter in diameter - "big enough to put on a ring that the late film actress Elizabeth Taylor would have been "proud to wear. Uranus and Neptune have long been thought to harbour gemstones. But Saturn and Jupiter were not thought to have suitable atmospheres.

The scientists concluded that stable crystals of diamond will "hail down over a huge region" of Saturn in particular, by studying new atmospheric data for the gas giants indicating that carbon is abundant in its dazzling crystal form.

Lightning and gigantic storms turn methane into soot (carbon) which as it falls hardens into chunks of graphite and then diamond. Dr. Baines and Delitsky analysed the latest temperature and pressure predictions for the planets' interiors, as well as new data on how carbon behaves in different conditions. As the soot falls, the pressure on it increases. And after about 1,000 miles it turns to graphite - the sheet-like form of carbon you find in pencils. By a depth of 6,000km, these chunks of falling graphite toughen into diamonds - strong and unreactive.

These continue to fall for another 30,000km - "about two-and-a-half Earth-spans" says Baines."Once you get down to those extreme depths, the pressure and temperature is so hellish, there's no way the diamonds could remain solid."It's very uncertain what happens to carbon down there. One possibility is that these diamond "hail stones" eventually melt into a liquid sea in the planets' hot coreserence

It is estimated that 1,000 tones of diamonds a year are being created on Saturn.

“Diamonds aren't forever on Saturn and Jupiter. But they are on Uranus and Neptune, which are colder at their cores," says Baines.

Meanwhile, an exoplanet that was believed to consist largely of diamond may not be so precious after all, according to new research. The so-called "diamond planet" 55 Cancri e orbits a star 40 light-years from our Solar System.

A study in 2010 suggested it was a rocky world with a surface of graphite surrounding a thick layer of diamond, instead of water and granite like Earth. But new research to be published in the Astrophysical Journal, calls this conclusion in question, making it unlikely any space probe sent to sample the planet's innards would dig up anything sparkling

Carbon, the element diamonds are made of, now appears to be less abundant in relation to oxygen in the planet's host star - and by extension, perhaps the planet.

'Blueprint' for a Universal flu vaccine

Li-fi is an emerging technology that could see specialised LED lights bulbs providing low-cost wireless internet connectivity almost everywhere.

Micro-LEDs can transmit large amounts of digital data in parallel. UK researchers say they have achieved data transmission speeds of 10Gbit/s via "li-fi" - wireless internet connectivity using light.

Using a digital modulation technique called Orthogonal Frequency Divisional Multiplexing (OFDM), researchers enabled micro-LED light bulbs to handle millions of changes in light intensity per second, effectively behaving like an extremely fast on/off switch. This allows large chunks of binary data - a series of ones and zeros - to be transmitted at high speed

The researchers used a micro-LED light bulb to transmit 3.5Gbit/s via each of the three primary colours - red, green, blue - that make up white light.This means over 10Gbit/s is possible.

The research, known as the ultra-parallel visible light communications project, is a joint venture between the universities of Edinburgh, St Andrews, Strathclyde, Oxford, and Cambridge, and funded by the Engineering and Physical Sciences Research Council.

The tiny micro-LED bulbs, developed by the University of Strathclyde, Glasgow, allow streams of light to be beamed in parallel, each multiplying the amount of data that can be transmitted at any one time.

Last month, Chinese scientists reportedly developed a microchipped LED bulb that can produce data speeds of up to 150 megabits per second (Mbps), with one bulb providing internet connectivity for four computers.

'Light fidelity'

Prof Harald Haas has been in the forefront of "li-fi" research. He coined the term "light fidelity" or li-fi - also known as visual light communications (VLC) - and set up a private company, PureVLC, to exploit the technology.

Li-fi promises to be cheaper and more energy-efficient than existing wireless radio systems given the ubiquity of LED bulbs and the fact that lighting infrastructure is already in place.

Visible light is part of the electromagnetic spectrum and 10,000 times bigger than the radio spectrum, affording potentially unlimited capacity.

Another advantage, Prof Haas argues, is that evenly spaced LED transmitters could provide much more localised and consistent internet connectivity throughout buildings.

The disadvantage of traditional wi-fi routers is that the signal weakens the further you are away from it, leading to inconsistent connectivity within offices and homes.

Prof Haas also believes light's inability to penetrate walls makes VLC technology potentially more secure than traditional wi-fi connectivity.

Cassini's infrared spectrometer finds Plastic ingredients on Saturn’s moon Titan

As reported in Astrophysical Journal Letters, Cassini's infrared spectrometer has discovered an interesting atmospheric chemistry on Saturn's moon Titan. The probe has detected propane, or propylene. On Earth, this molecule, which comprises three carbon atoms and six hydrogen atoms, is a constituent of many plastics. It is the first definitive detection of the plastic ingredient on any moon or planet, other than our home world.

According to Conor Nixon, a NASA planetary scientist from the agency's Goddard Space Flight Center, “This chemical is all around us in everyday life, strung together in long chains to form a plastic called polypropylene". A classic example would be the plastic boxes used to store food in kitchens worldwide.

Titan is dominated by hydrocarbons - principally methane, which after nitrogen is the most common component of the atmosphere. Sunlight drives reactions that break apart the methane, allowing the fragments to join up and form even bigger molecules. Cassini's plasma spectrometer has seen evidence for hydrocarbons with an atomic mass thousands of times heavier than a single hydrogen atom.

Other common species seen at the moon as a result are propane, which on Earth is used in portable cooking equipment, and ethane, which is the raw material for another ubiquitous plastic - polyethylene.

When the effects of ultraviolet light are combined with the bombardment from particles driven in Saturn's magnetic field, it becomes possible to cook up some very exotic chemistry. The likes of methane, propane, propane and ethane are dwarfed by some truly colossal hydrocarbons that have been detected in Titan's atmosphere.

Based on reports from Journals Natiure, Scientific American, BBC and Sky & Telescope

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