RESEARCH HIGHLIGHTS

Storm warning

Science doi:10.1126/science.1160495 (2008)

A realignment of Earth's magnetic field lines rather than a disruption of current across its magnetosphere triggers the geomagnetic substorms that lead to luminous polar auroras. That, at least, is what the first results from NASA's five-satellite THEMIS mission suggest.

The magnetosphere is a volume enveloping the planet that protects it from a stream of charged particles from the Sun. Before a substorm, Earth's magnetic field becomes entwined with this solar wind. When the field snaps back into place, it prompts the chain of events that causes the substorm.

Vassilis Angelopoulos of the University of California, Los Angeles, and his team used THEMIS to observe a nascent substorm in February. They found that the snapping back, or realignment, of the magnetic field preceded a brightening of the aurora. Disruption to the magnetospheric current came after that.

C. ANDERSON/AURORA CREATIVE/GETTY

MOLECULAR BIOLOGY

Telling time

Cell **134,** 317–328 (2008); *Cell* **134,** 329–340 (2008)

A protein that is associated with metabolism and short lifespan also regulates the body's internal clock, two research groups report.

Ueli Schibler at the University of Geneva in Switzerland and his colleagues discovered that the protein, called SIRT1, is needed for normal expression of several important clock genes. Meanwhile, Paolo Sassone-Corsi of the University of California, Irvine, and his colleagues found that deleting the gene that encodes SIRT1 from the DNA of liver cells disrupted the circadian rhythms of mice.

Both teams also showed that SIRT1 forms a complex with CLOCK, a protein that, as its name suggests, has a key role in regulating the body clock. Because SIRT1 activity is dependent on NAD^+, a cellular metabolite, the protein provides a molecular link between metabolism and the circadian clock.

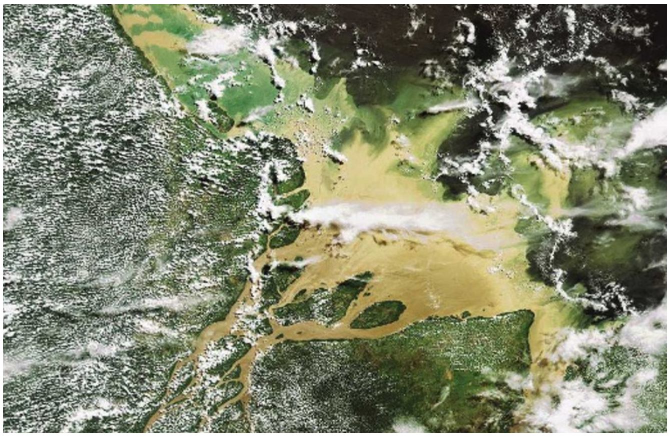
ENVIRONMENTAL SCIENCES

Fresh data

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0710279105 (2008)

Murky plumes of Amazonian fresh water are carried hundreds of kilometres out to sea (as pictured by satellite, right). Whether these waters suppress or enhance primary production in the Atlantic has been up for debate.

With this in mind, and with data from 82 oceanic field stations to hand, Ajit Subramaniam of Columbia University in New York and his co-workers have labelled the Amazon's discharge a carbon sink. They calculate that photosynthetic nitrogen-fixing organisms that assimilate iron and phosphorus in the plume — and then die and fall to the sea floor — sequester 20.4 million tonnes of carbon per year. A further 7.2 million tonnes of carbon is fixed annually by organisms that use nitrate delivered to the ocean by the river.



ESA

PHYSICAL CHEMISTRY

Over ice

Phys. Rev. Lett. **101,** 036101 (2008)

Might water freeze spontaneously in tight spaces? K. B. Jinesh and Joost Frenken at Leiden University in the Netherlands say that a film of water just a few molecules thick turns to ice at room temperature when it is confined between a piece of graphite and a blunt tungsten needle.

They write that the needle tip moved jerkily across the graphite, similarly to chalk across a blackboard, rather than being lubricated by the intervening water. The jerks suggest a surface corrugation closer to that of ice than graphite. Given previous controversy about how water behaves in nanoscale spaces, the claim is likely to excite lively debate.

NANOTECHNOLOGY

Weighing options

Nature Nanotech. doi:10.1038/nnano.2008.200 (2008)

Physicists at the University of California, Berkeley, have developed a way to make carbon nanotubes weigh things. Like all objects, nanotubes vibrate with their own characteristic frequency, which is related to their mass. So if a tiny object attaches to the nanotube, making it heavier, the nanotube's resonant frequency will decrease.

Kenneth Jensen and his colleagues set a nanotube in a vacuum and released gold atoms into the chamber. When one of these landed on the nanotube, its vibration rate changed.

The technique is sensitive to frequency changes that correspond to mass increases of 10^{-25} kilograms. This is not as accurate as conventional mass spectrometry, but does not require a sample to be ionized, a process that can destroy biological molecules.

QUANTUM COMPUTING

Cloudy computing

Phys. Rev. Lett. **101,** 040501 (2008)

Quantum computing is in its infancy, in part because creating a large number of quantum bits, or 'qubits', is impossible without better control over quantum states. Side-stepping this snag, Klaus Mølmer and his colleagues