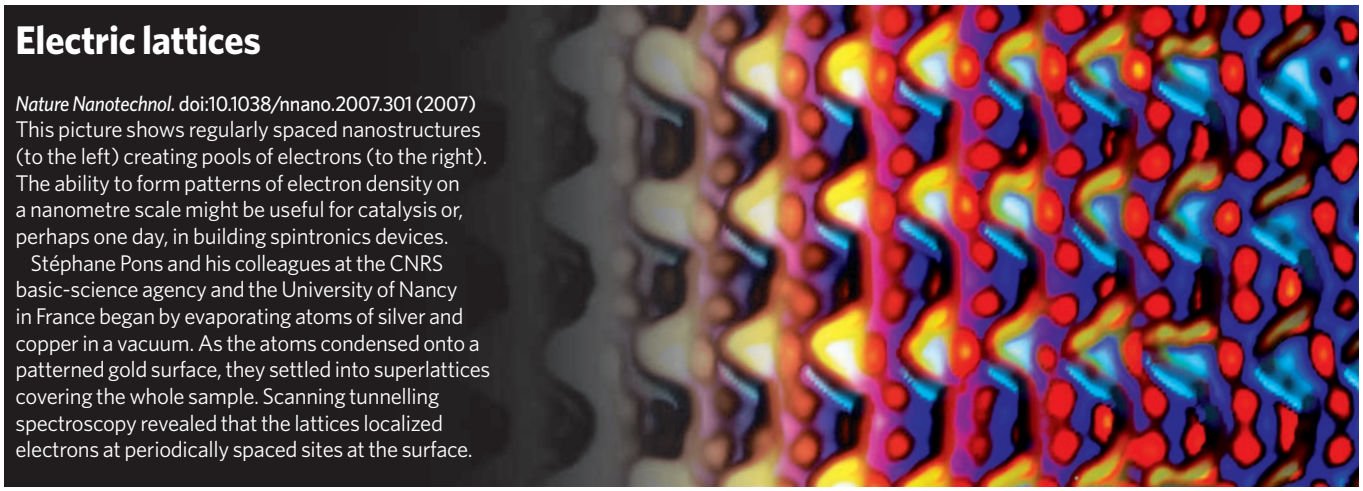
RESEARCH HIGHLIGHTS

Electric lattices



Nature Nanotechnol. doi:10.1038/nnano.2007.301 (2007)
This picture shows regularly spaced nanostructures (to the left) creating pools of electrons (to the right). The ability to form patterns of electron density on a nanometre scale might be useful for catalysis or, perhaps one day, in building spintronics devices.

Stéphane Pons and his colleagues at the CNRS basic-science agency and the University of Nancy in France began by evaporating atoms of silver and copper in a vacuum. As the atoms condensed onto a patterned gold surface, they settled into superlattices covering the whole sample. Scanning tunnelling spectroscopy revealed that the lattices localized electrons at periodically spaced sites at the surface.

LAB. PHYS. DES MATÉR./CNRS/NANCY UNIVERSITÉ

CANCER BIOLOGY

Shock strategy

Cell **130,** 1005–1018 (2007)
A protein called heat shock factor 1 (HSF1) that helps cells to handle stress seems to have a sinister alter ego. The latest findings suggest that the protein aids tumour growth.

Susan Lindquist of the Whitehead Institute for Biomedical Research in Cambridge, Massachusetts, and her colleagues studied mice that lack the *Hsf1* gene. These mice developed fewer tumours when they had cancer-linked mutations or when they were exposed to carcinogens than did normal mice. HSF1 also aided human tumour cell growth in culture.

The results have mixed therapeutic implications. They suggest that HSF1-inhibiting drugs could combat cancer. But HSF1-stimulating therapies are being explored as treatments for disorders including Parkinson's disease. Researchers will need to explore how each approach affects the problem targeted by the other.

CELL BIOLOGY

Quick release

Nature Struct. Mol. Biol. doi:10.1038/nsmb1305 (2007)
Test-tube models of a process that enables one nerve to transmit a signal to another do not accurately mimic what happens at living synapses, a study shows.

Nerves transmit impulses to each other thanks to small packets of neurotransmitters, which wait just inside the nerve cell until an influx of calcium ions triggers them to fuse with the cell membrane and release their contents into the synapse. Reinhard Jahn and his colleagues at the Max Planck Institute for Biophysical Chemistry in Göttingen studied how synaptotagmin, the vesicle protein that detects calcium ions, accelerates vesicle fusion. As well as resolving some questions about the mechanism, they found that experiments with artificial vesicles do not mimic synaptotagmin's normal function owing to incorrectly structured complexes of proteins called SNAREs.

EVOLUTIONARY BIOLOGY

Protective custody

Proc. R. Soc. B doi :10.1098/rspb.2007.1028 (2007)
The human menopause might have evolved to protect offspring from being orphaned by the death of an elderly mother or to allow children to benefit from the care of grandmothers — or to do a bit of both. A test of these theories, using population data from two villages in the Gambia between 1950 and 1975, provides evidence that grandmothers might indeed have evolutionary importance.

D. SHANLEY

The Gambian data gave Daryl Shanley, from the Institute for Ageing and Health at Newcastle University, UK, and his colleagues a rare chance to study data from a natural cycle of birth and death, because the villages' populations had little access to medical care at that time. By adjusting the age of menopause in a population model based on these data, the team showed that having a post-menopausal grandmother improved survival of the offspring.

CHEMISTRY

Handle with care

J. Phys. Chem. B **111,** 10897–10904 (2007)
RDX is not a compound many would want to study. A powerful explosive used since the Second World War and favoured by several terrorist groups, RDX is apt to be detonated by shock. But why? Zbigniew Dreger and his colleagues at Washington State University in Pullman tried to find out. Their spectroscopic measurements of single RDX crystals subjected to shock waves show that the compression caused by the shock changes the crystal structure. They think this switch might predispose the material to chemical reactions, thereby initiating explosive decomposition.

PHYSICS

Chill out

Phys. Rev. Lett. (in the press)
Physicists hoping to see quantum mechanics affecting the motion of macroscopic objects have a new trick to try: a cooling technique reported by Kenton Brown and his colleagues

at the National Institute of Standards and Technology in Boulder, Colorado.

Rather than using light, as in standard laser cooling methods, the researchers damp a small cantilever's vibrations through the electrical force between it and a nearby plate, which is connected to an electrical circuit that oscillates at radio frequencies. They reduced the cantilever's temperature from room temperature to 45 kelvin, but say that the method could in principle cool the device enough for quantum effects to show. This is predicted to happen when the object's thermal jitters are small. The technique might also improve the sensitivity of mechanical vibration and position sensors.

GENETICS

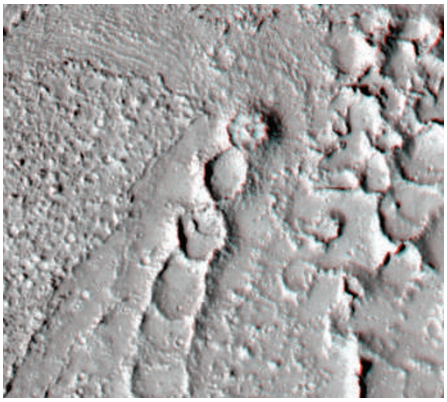
Dangerous repeats

Hum. Mol. Genet. **16,** 2326–2332 (2007)

A neurodegenerative disease called Fragile X-associated tremor and ataxia syndrome may be treatable by targeting abnormal RNA, research suggests.

The syndrome occurs in some people who have 60–200 copies of the nucleotide sequence CGG, which are transcribed into an RNA sequence that is thought to be toxic. Another disorder, called FRAXE, is caused by more than 200 repeats of the complementary sequence CCG.

Juan Botas and David Nelson of Baylor College of Medicine in Houston, Texas, and their colleagues, showed that expression of just one 90-copy CCG repeat in *Drosophila* eyes was enough to cause ocular deformities. However, flies that expressed both this sequence and a 90-copy CGG repeat had normal eyes. The researchers propose that the two RNA transcripts bind to each other, prompting their degradation. The effect depends on a protein, Argonaute-2, that is required for the process of RNA interference.



NASA/UNIV. ARIZONA/US GEOLOGICAL SURVEY

PLANETARY SCIENCE

Rivers of rock

Science **317,** 1709–1711 (2007)

The fluid that flowed most recently through Athabasca Valles, the youngest of the 'outflow channels' on the surface of Mars, was lava and not water, according to data from the Mars Reconnaissance Orbiter.

Windy Jaeger of the US Geological Survey, Flagstaff, Arizona, and her colleagues have identified features in photos taken by the orbiter's unprecedentedly acute HiRISE camera that they can only explain in terms of volcanic flow. The researchers also say that surface features interpreted in 2005 as dust-covered pack ice on a frozen sea are instead a pooled portion of this lava flow.

Those eager for evidence of water on Mars can take comfort in the fact that the distinctive ring-mound landforms (pictured left) spotted in these images were produced by outbursts of gas from below the lava flows. They presumably mark spots where ice or ground water in the rocks over which the lava flowed vaporized explosively.

MARINE BIOLOGY

Seaweed searches

Proc. Natl Acad. Sci. USA doi:10.1073/pnas.0704778104 (2007)

The lush kelp forests that characterize some cold ocean waters have now been discovered in tropical locales. The finding overturns the prevailing hypothesis that tropical waters are too warm and nutrient deficient to support the large seaweeds.

Michael Graham of Moss Landing Marine Laboratories in California, and his colleagues, used oceanographic data to model kelp habitats. The model accurately located known kelp forests, but also predicted more than 23,500 square kilometres of potential kelp habitat in deep tropical regions where upwelling brings in nutrients and clear waters allow sufficient light to penetrate. The researchers then searched the waters near the tropical Galapagos Archipelago and found several new kelp forests, as predicted.

These tropical kelp forests could provide unique biodiversity hotspots that may warrant inclusion in marine conservation programmes.

JOURNAL CLUB

David K. Campbell
Boston University, USA

A physicist highlights a three-in-one deal for nonlinear science

As a student of nonlinear phenomena, I am continually amazed by new examples of deterministic chaos, solitary waves and fractals.

A recent study (R. H. Goodman and R. Haberman *Phys. Rev. Lett.* **98,** 104103; 2007) gave me the rare pleasure of seeing all three of these fundamental manifestations of nonlinearity woven together.

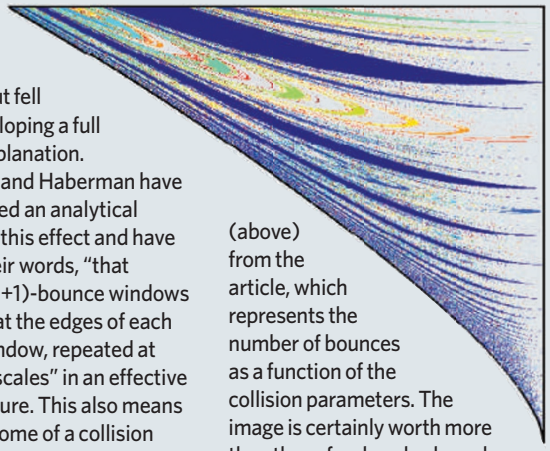
This paper addresses the collisions of solitary waves — localized nonlinear waves that propagate without changing shape and are found in systems ranging from solids to optical fibres.

In the 1980s, with several colleagues, I studied this problem numerically (see, for example, D. K. Campbell and M. Peyrard *Physica D* **18,** 47–53; 1986). We discovered a surprising 'bounce' phenomenon, in which solitary waves would collide, remain trapped for a number (n) of bounces and then escape to infinity. This behaviour occurred only when the waves had specific relative velocities on colliding; these bounce windows were interspersed with regions in which the waves repelled each other immediately.

We developed a heuristic explanation for this behaviour, consistent with the waves behaving like elastic particles that can be deformed, but fell short of developing a full analytical explanation.

Goodman and Haberman have now developed an analytical treatment of this effect and have shown, in their words, "that clusters of (n+1)-bounce windows accumulate at the edges of each n-bounce window, repeated at diminishing scales" in an effective fractal structure. This also means that the outcome of a collision is exquisitely sensitive to the initial velocity, a hallmark of deterministic chaos.

If all the above seems dry, take a look at the wonderful graphic



PHYS. REV. LETT.

(above) from the article, which represents the number of bounces as a function of the collision parameters. The image is certainly worth more than these few hundred words.

Discuss these papers at **http://blogs.nature.com/nature/journalclub**