RESEARCH HIGHLIGHTS

PARTICLE PHYSICS

Nearly caught in a trap

Phys. Rev. Lett. **100,** 113001 (2008)
Why is the Universe mostly matter, when the Big Bang should have produced equal amounts of matter and antimatter? Researchers from the Antihydrogen Trap collaboration at CERN, near Geneva, have nudged along the search for an answer.

Gerald Gabrielse of Harvard University and his team hope to measure subtle differences in the properties of antihydrogen and hydrogen that might explain antimatter's demise. But antihydrogen annihilates on the walls of a confining apparatus too quickly for it to be probed in detail.

So the team prolonged the interaction of antiprotons and positrons using a form of magnetic confinement called an Ioffe trap. However, full proof that antihydrogen is trapped inside its new container still awaits.

SEDIMENTOLOGY

Natural beauty

Nature Phys. doi:10.1038/nphys911 (2008)
The beauty of limestone landscapes such as those loved by the poet W. H. Auden comes from sculptural erosion. That of landscapes of travertine, another form of calcium carbonate (pictured below), is built through patterns of deposition. A new way of modelling this growth has been developed by John Veysey and Nigel Goldenfeld of the University of Illinois at Urbana-Champaign.

The authors simulated the environment as a lattice of rule-obeying cells, an approach that yielded similar results to data they collected from two years of time-lapse photography of travertine pools and terraces forming in hot springs.

The method ignores the microscopic specifics of deposition and thus might prove applicable to other environments.

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R. CALDWELL

A secret visual world

Curr. Biol. **18,** 1–6 (2008)
The mantis shrimp *Odontodactylus* (pictured) has a secret and unique way of looking at the world that it may use for sexual signalling.

Whereas humans can see only the colour and intensity of light, some invertebrates can see linearly polarized light. This gives them cues to navigate and helps them communicate surreptitiously.

Justin Marshall of the University of Queensland in Brisbane, Australia, and his colleagues now report that species of *Odontodactylus* can discern circularly polarized light, the first organism shown to do this. The mantis shrimps even have specialized cells in their eyes that distinguish between right- and left-handed circularly polarized light.

GENETICS

Self-sterile squirts

Science doi:10.1126/science.1152488 (2008)
Avoidance of self-fertilization in the hermaphrodite sea squirt *Ciona intestinalis* intrigued the genetic pioneer Thomas Hunt Morgan. His breeding experiments have now been replicated by Yoshito Harada of Nagoya University in Toba, Japan, and colleagues, who have identified two cooperatively acting pairs of genes controlling self-sterility, each pair containing a 'male' and a 'female' gene.

The male determinant is thought to encode a receptor in sperm that recognizes the 'self' product of the female gene, which is part of the matrix surrounding the egg. Sperm thus fail to attach to the matrix of an egg from the same individual.

CELL IMAGING

Sweet glow of success

Angew. Chem. Int. Edn **46,** 2394–2397 (2008)
Seeing where particular fat and sugar molecules congregate inside live cells has been made easier by chemists at the University of California, Berkeley, who have found a way to fluorescently label these biomolecules without causing other constituents of the cell to glow.

Producing pictures of particular proteins and nucleic acids inside living cells is fairly routine, but achieving good pictures of fats and sugars has proved more difficult; the background fluorescence tends to be too strong.

Matthew Hangauer and Carolyn Bertozzi designed a reagent with an ester bond that keeps its fluorescence quenched. When the reagent meets its target a chemical reaction breaks the bond, causing the labelled compound to glow.

PHYSICS

Universal freeze

Phys. Rev. Lett. **100,** 093003 (2008)
An instrument called a reverse coilgun may soon bring atoms to a full stop. Using a series of independently controlled coils, physicists have successfully slowed a beam of paramagnetic neon atoms from 447 to 56 metres per second.

The approach, devised by Mark Raizen at the University of Texas in Austin and his

NASA/JPL-CALTECH/UNIV. WISCONSIN

colleagues, might eventually be able to halt any atom that has an unpaired electron. Slowed atoms could then be held in a magnetic trap.

Containing and cooling atoms in this way could lead to the study of a process such as β-decay in tritium, which has never been trapped before.

COSMOLOGY

Separated by birth

Astron. J. **135,** 1106–1116 (2008)

The Small Magellanic Cloud is 2 billion or 3 billion years younger than the Milky Way and other nearby galaxies, a finding that suggests the galaxies of the early Universe did not form all at once, as had been previously thought.

The Small Magellanic Cloud is a dwarf galaxy about 200,000 light years from the Milky Way (pictured above). Katharina Glatt from the University of Basel, Switzerland, and her colleagues determined the age of its oldest star cluster using images taken by the Hubble Space Telescope.

Although other, older star clusters in the dwarf galaxy might have existed but not survived, the authors conclude it is more likely that star formation in the Small Magellanic Cloud began much later than imagined.

ZOOLOGY

Croc 'n' roll

J. Exp. Biol. doi:10.1242/jeb.015339 (2008)

Alligators use muscles normally employed in breathing to shunt their lungs around like a buoyancy aid, enabling them to perform death-rolls and dives.

Todd Uriona and C. G. Farmer at the University of Utah in Salt Lake City discovered the secret of these manoeuvres by implanting electrodes in young alligators' diaphragm, pelvic, abdominal and rib muscles. These recorded how the creatures worked those muscles to shift the lungs towards the tail during a dive — and then back towards the head to resurface. The same muscles move the lungs sideways when the alligator wants to roll.

PALAEOCHRONOLOGY

Righting the rings

Nature Geosci. doi:10.1038/ngeo128 (2008)

Palaeoclimate researchers can now use tree-ring records to make more precisely dated measurements further back than 12,400 years, he original maximum. Raimund Muscheler of Lund University in Sweden and his team used comparisons with isotopic data from ice cores to ascertain the true age of more ancient tree-ring chronologies that until now had 'floated' in time.

The abundances of both carbon-14 and beryllium-10 vary with solar activity. The researchers used this correlation to link the floating tree-ring records, which contain carbon-14, to a period chronicled in ice cores from Greenland, which are dated by their beryllium-10 content.

ECOLOGY

Better than bleaching

Proc. R. Soc. Lond. B doi:10.1098/rspb.2008.0069 (2008)

A shift in the composition of their symbiotic algae can enable corals to acclimatize after periods of higher water temperatures leave them 'bleached'.

Ray Berkelmans of the Australian Institute for Marine Sciences in Townsville, Queensland, and his colleagues monitored the types of zooxanthellae inside the coral *Acropora millepora* on the Great Barrier Reef before and after natural bleaching. They report a dramatic reshuffling of the symbiotic community within the surviving coral: of the colonies with predominantly heat-sensitive algae before bleaching, 71% had predominantly heat-resilient varieties a few months later.

JOURNAL CLUB

Moty Heiblum
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A physicist applauds evidence for the quantum spin Hall effect.

I have been fascinated by the ballistic (collisionless) motion of charge carriers in solids since the start of my career. In practice this motion is often impeded by unavoidable impurities in the solid. But when it works, the charge carriers maintain their quantum properties while dissipating a minimum amount of energy.

Applying a strong magnetic field perpendicular to a two-dimensional conducting layer can accomplish the feat. Then, the quantum Hall effect kicks in, forcing the charges to the edges of the sample where they skip along in so-called 'chiral edge channels'. Backward scattering is virtually eliminated because that would require the charges to find a way to the opposite edge, where charges move in the opposite direction.

Recently, Laurens Molenkamp of the University of Würzburg in Germany and his colleagues took a step towards verifying the quantum spin Hall effect (M. König *et al*. *Science* 318, 766–770; 2007). This is where chiral edge channels form spontaneously in semiconductor insulators with peculiar electronic structures — namely, where the valence band is energetically higher than the conduction band because of the strong spin-orbit interaction between electron spins and electron velocities. This means that spin-up electrons are carried only by edge channels moving in one direction and spin-down elections are carried by edge channels moving in the opposite direction.

Molenkamp's team used a thin layer of mercury telluride sandwiched between two layers of mercury cadmium telluride. Because measuring spin current is difficult, they recorded the conductance of this middle layer to verify the ballistic transport that characterizes edge-channel transport. It was quantized, as predicted.

With further verification, the finding could lead to low-power devices based on the transport of spins rather than charges. Thus a quirk in the scientific field I have always loved might find a practical application.

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