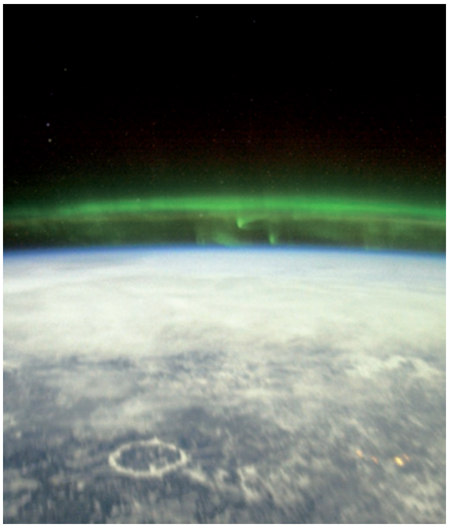
## Ions in the wind

*Phys. Rev. Lett.* (in the press)



DON PETTIT/ISS EXPEDITION 6/NASA

Streams of charged particles blown from the Sun's corona — known as the solar wind — can produce extreme space weather, such as geomagnetic storms and aurorae. The solar wind is not uniform: there are different velocity flows with speeds of several hundreds of kilometres per second and large temperature variations. Intriguingly, heavy ions in the solar wind — helium in particular — tend to be much hotter than the dominant component of ionized hydrogen. Justin Kasper and colleagues explain that a certain type of plasma wave is the cause of this preferential heating.

Ions are heated through a resonant interaction with oscillations in the plasma called ion cyclotron waves. Kasper *et al.* suggest that ions heavier than hydrogen can also interact with counter-propagating waves and therefore experience stronger heating. These predictions agree well with the seventeen years' worth of observational data collected by NASA's Wind spacecraft, and explain why helium can be up to seven times hotter than hydrogen.

As the distribution of plasma waves near the corona is not yet fully understood, it is hard to pinpoint the exact location where ion heating occurs, but new clues are expected from observations made by spacecraft flying close to the Sun. *IG*

## One way, or the other

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Interference is one of the hallmarks of a wave. The effect is even evident at the quantum level, when waves start to display properties more usually associated with particles. Erwann Bocquillon and colleagues now demonstrate this concept in reverse: individual particles acting like waves and interfering.

A single wavepacket can leave a beam splitter by one of two exits with equal probability. When two indistinguishable wavepackets meet in the beam splitter, they interfere and their exit directions become inherently linked. Photons, for example, both leave the same way. Electrons always take opposite exits. This is the Hong–Ou–Mandel effect.

Bocquillon and team created two quantum-dot single-electron sources. The individual electrons from each source were synchronized so that they simultaneously arrived at an electronic beam splitter. The researchers demonstrated a correlation in the electrons' exit paths by measuring how the low-frequency fluctuations of the electrical current in the outputs were related to the fluctuations of the number of transmitted particles. This demonstration of interference showed that the two electrons were indistinguishable even though they came from different sources. *DG*

## Two Higgs or not two Higgs?

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Data from the CMS and ATLAS experiments at CERN have revealed the presence of a Higgs-like boson, whose mass is around 125 GeV. However, the data from the various decay channels of this Higgs-like particle don't all line up at a mass of 125 GeV, but rather are spread from 123 to 128 GeV. Although the discrepancies may well be solved by increasing the statistics in the analyses (as will be done for the next round of conferences this spring), theorists are pondering the possibility that we could actually be looking at more than one Higgs-like particle in the 125-GeV mass region.

John F. Gunion and colleagues propose a set of 'double ratios', based on the rates at which Higgs particles, formed through the fusion either of gluons or of vector bosons, decay into two photons, two bottom quarks, or two *W* bosons. The ratios are constructed so that their value is one if there is only a single Higgs in the data, but deviates from one if two or more Higgs are contributing to the signal. Such degeneracy would be consistent with some models of supersymmetry. *AW*

## Controlled shakes

*Nature Nanotech.* http://doi.org/kg7 (2013)

Magnetism is often thought of as a bulk property, but isolated molecules can also have a non-zero magnetic moment. Application of these single-molecule magnets (SMMs) often requires that the spin state remains stable for a prolonged time. However, vibrations can switch the magnet between different states. Marc Ganzhorn and colleagues have now shown how nanomechanical resonators can help.

A spin state cannot relax unless a phonon of commensurate energy is available. The key then is to control the vibrations. The continuous energy range of vibrations in three-dimensional materials makes this impossible. One-dimensional materials, however, only support phonons with a discrete set of energies.

Ganzhorn *et al.* grafted an SMM known as $TbPc_2$ to a suspended carbon nanotube. They demonstrate strong coupling between the two by showing that a longitudinal phonon mode of the nanotube is activated whenever the spin of the magnet flips direction. This system could be used as a probe of magnetic fields, or even as a quantum bit. *DG*

## Days and days of thunder

*Icarus* **223,** 460–478 (2013)

Saturn's greatest thunderstorm has been recorded in its entirety by two instruments onboard the Cassini Orbiter spacecraft. Massive storms occur every Saturnian year (or 30 Earth years), but this one, observed by Kunio Sayanagi and co-workers, is the first one seen to catch up with its own tail. The Great Storm of 2010–2011 is the longest, lasting 267 days. It began near the site of the String of Pearls in the northern hemisphere and eventually encircled the entire planet, covering a circumference of 300,000 km.

Jovian storms are also huge, but they do not include thunder and lightning. Thus, the Saturnian storm is more similar to hurricanes on Earth, except there is no land to stop the winds. Instead of feeding off warm water, however, warm gas is the energy source. It spawned a vortex that stretched for 12,000 km. When the head of the storm hit the vortex, the storm finally dissipated. How exactly this encounter killed the giant storm is a puzzle that remains to be solved. *MC*

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