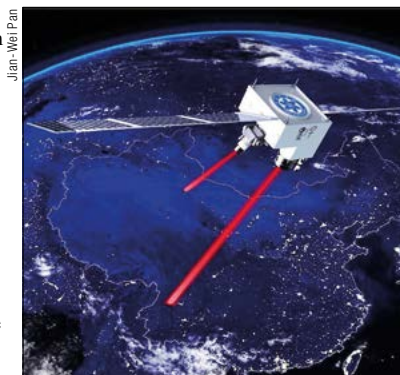


Sciencewatch

COMPILED BY JOHN SWAIN, NORTHEASTERN UNIVERSITY

Quantum comms in space

China's Micius satellite, launched in August last year, has been used to distribute quantum entanglement over a distance of 1200 km – beating previous terrestrial records by an order of magnitude. Juan Yin of the University of Science and Technology and co-workers used a 405 nm laser to pump a periodically poled KTiOPO₄ crystal inside a Sagnac interferometer on board the satellite, producing two entangled down-converted photons with a wavelength of about 810 nm. These were then sent to separate receiving stations in Delingha and Lijian located 1200 km apart in the Tibetan mountains. The team observed the survival of two-photon entanglement and measured a violation of



High-altitude receiving stations minimise the effects of the atmosphere.

Bell's inequality by a factor 2.37 ± 0.09 under Einstein locality conditions. Until now, free-space demonstrations of entanglement have been limited to line-of-sight links across cities or between mountaintops, with link separations limited to around 100 km due to scattering and coherence decay. The new result therefore marks a big advance for secure communications networks and, in the future, a space-based quantum internet.

● Further reading

J Yin *et al.* 2017 *Science* **356** 1140.

Dialects and magnets

A remarkable analogy with magnetism can explain how regional dialects develop, according to a new study. James Burridge of the University of Portsmouth in the UK has shown that a simple spatial model of language change reproduces a wide range of observations and predictions of linguists who study dialects in which speakers adopt the dialect they most hear. This leads to a local "alignment" similar to that of spins in a ferromagnet, and the appearance of dialect domains bounded by domain walls or "isoglosses", to use the linguists' term. Taking into account varying population densities makes the isoglosses spontaneously bend, reflecting relevant geographical features.

● Further reading

J Burridge 2017 *Phys. Rev. X* **7** 031008.

Quantum voting

Arrow's theorem, perhaps better known to political scientists than to physicists, proves that no electoral system in which voters simply rank candidates can rank them for the population as a whole while simultaneously satisfying three "fairness criteria": if every voter prefers option A over option B, the population prefers A over B; if every voter's preference between A and B is unchanged then the population's preference remains unchanged; and there is no one voter (no dictator) who can always determine the

The shapes of eggs

Understanding why the shapes of avian eggs vary between species has long puzzled researchers, but a new study sheds light on the issue. Mary Caswell Stoddard of Princeton University and co-workers studied egg-shape diversity in terms of asymmetry and ellipticity using a sample of 49,175 eggs from some 1400 species of bird in 35 extant orders and two extinct ones. The team was able to explain the distribution in terms of a simple model based on geometric and mechanical properties of the egg membrane. The researchers also found that the shape of eggs correlates with the ability of birds to fly, and suggest that adaptations for flight may have been critical factors driving egg-shape variations.

● Further reading

M Caswell Stoddard *et al.* 2017 *Science* **356** 1249.



The team measured the degree to which avian eggs are symmetrical, round or bottom-heavy.

population's preference. This assumes classical voting, but Ning Bao and Nicole Yunger Halpern of Caltech have now shown that if entanglement, superposition and interference are used, a quantum version of such voting becomes possible. This quantum version of majority rule is shown to violate the quantum Arrow conjecture, elucidating how quantum phenomena can be harnessed for strategic advantage.

● Further reading

N Bao and N Yunger Halpern 2017 *Phys. Rev. A* **95** 062306.

Invisible solar cells

The performance of silicon solar cells can be boosted by cloaking their metal contacts such that they are invisible to incoming light, according to a demonstration by Martin Schumann of Karlsruhe Institute of Technology and co-workers. Today's commercial solar cells lose around nine per cent of their efficiency due to light being blocked by their metallic contacts. While diffractive optical structures can help, the new scheme is based on coordinate-transformation materials that bend light around the contacts to achieve all-angle invisibility. Results showed that the short-circuit current density of the cloaked cell increases by 7.3%, while its power-conversion efficiency is enhanced by 9.3%.

● Further reading

M Schumann *et al.* 2017 *Adv. Opt. Mater.* 1700164.

ULTRA HIGH VACUUM. WE ARE THE EXPERTS.

The ultra high vacuum capabilities of our extensive range of products and nearly 100 years expertise in the field means you can trust us to provide a complete vacuum solution for your application.

Gamma capture pumps from Edwards are specifically designed for ultra high vacuum applications, and available with specially modified elements that extend the range of application to meet the lowest possible pressures in the extreme high vacuum range.

- **Ion Getter Pumps (IGP)**, with diode, noble diode or triode elements.
- **Titanium Sublimation Pumps (TSP)**, for integration with Ion Getter Pumps or as standalone pump units.
- **Non Evaporable Getter (NEG) pumps**, which can be integrated with Ion Getter Pumps with either the Ion Pump or the NEG pump as the main pumping technology or as standalone units.
- **Controllers** for all product ranges.

