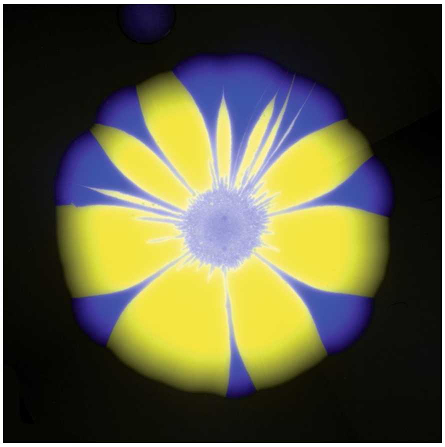
MECHANOBIOLOGY

Fighting fit

Nat. Ecol. Evol. https://doi.org/gfkwp2 (2018)



Credit: Springer Nature Ltd

Cells in the middle of a crowded colony get jostled around as they grow and divide. And they also have an evolutionary handicap: cells at the edge grow more rapidly, and their progeny enjoy the same advantage — endowing mutant clones with higher frequencies by chance. Now, Jona Kayser and colleagues have shown that crowding screens differences in evolutionary fitness, slowing down the elimination of mutations.

Kayser and colleagues tracked the evolution of model mutant cells competing with their wild-type counterparts in a colony of yeast cells (pictured), and found that the mutants were initially eliminated at a constant rate. But when the mutant subpopulation dropped below a critical size, their removal slowed down, allowing them to persist at the front longer than expected.

The team identified suppressed curvature at the leading edge as the culprit, and showed that an effective surface tension served to align the mutants with their wild-type neighbours, thereby masking the difference in fitness between the two subpopulations. They then demonstrated numerically that mechanical forces due to cellular crowding could reproduce the same effect. *AK*

https://doi.org/10.1038/s41567-018-0395-2

SPINTRONICS

Microwave amplification

Nat. Nanotech. https://doi.org/cxqd (2018)

Spintronics often relies on the conversion of charge and spin currents to create new devices, but the role of heat dynamics can be important too. Now, Minori Goto and collaborators have made the first heat-based microwave amplifier with substantial gain, based on the spin dynamics in a device usually employed in memory technology.

The time-dependent Joule heating associated with an oscillating current through a magnetic tunnel junction makes the magnetic anisotropy vary in time. The spins in the free layer of the magnetic tunnel junction rotate — following the magnetic anisotropy — and so the magnetoresistance effect changes the resistance of the junction. Therefore, the heat converts the d.c. part of an input current to an a.c. output with the frequency of the magnetic rotation, amplifying the oscillating part of the input. By choosing appropriate materials, the authors made a device where gain in the device exceeds unity. *DA*

https://doi.org/10.1038/s41567-018-0396-1

QUANTUM GASES

When topology met disorder

Science **362**, 929–933 (2018)

Topological insulators have a bandgap in their bulk, which means that transport can only occur through topologically protected edge states. These states are robust to disorder when it's weak, but for sufficiently strong disorder, all the bandgaps are closed, meaning topological features should be destroyed. The prediction that non-trivial topology can emerge from a trivial band structure with the addition of disorder therefore came as something of a surprise. Now, Eric Meier and co-workers have verified the prediction by observing such a phase.

The authors demonstrated a topological Anderson insulator in atomic wires made of ultracold atoms. Their system was designed so that disorder could be added through random tunnelling, and the topological phases were identified by measuring the mean chiral displacement. When the amplitude of the random tunnelling was large enough, the authors showed that an initially clean and trivial system could be driven into a topologically non-trivial phase, in which topology manifested in the localized states of the spectrum. *YL*

https://doi.org/10.1038/s41567-018-0399-y

ENERGY STORAGE

Power through order

Nature https://doi.org/gfkfj3 (2018)

Lithium is typically used in energy-storage devices that exhibit a high energy density, or a low self-discharge rate. Improving the performance of lithium batteries requires a detailed knowledge of the in situ atomic structure of these devices under working conditions — a notoriously difficult task for such light elements. Now, Matthias Kühne and colleagues have found a way to visualize lithium atoms sandwiched within bilayer graphene connected to an electrochemical cell — revealing ordering on an atomic level that has so far gone unseen.

Kühne and colleagues used a contrast-enhanced transmission electron microscope with sub-ångström resolution to image the device, thus allowing controlled time-resolved lithiation by voltage tuning. They observed a crowded multilayer ordering of lithium between the graphene sheets, which may be useful for designing batteries with enhanced storage capacity. *JPK*

https://doi.org/10.1038/s41567-018-0397-0

GRAVITATIONAL WAVES

Dark energy in doubt

Phys. Rev. Lett. **121**, 221101 (2018)

On 17 August 2017, the LIGO and Virgo observatories detected yet another gravitational wave. So far, unremarkable. But within seconds of recording this signal — which originated from a neutron-star merger — a gamma-ray burst was independently observed. This combination places tight constraints on the velocity of gravitational waves. And, as a result, theoretical models of dark energy predicting a modification of the gravitational wave speed were suddenly called into question. Could this be the end of the most popular dark energy models?

Perhaps not, say Claudia de Rham and Scott Melville. They pointed out a crucial detail: the speed of the gravitational wave could, in principle, depend on the frequency scale of its measurement. This means that dark energy models could still predict a deviation from the speed of light at low frequencies, but not at higher scales. Future experiments involving LISA or the Einstein Telescope will either confirm or rule out certain dark energy models — but their time isn't up just yet. *SR*

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