ATMOSPHERIC DYNAMICS

A world of rain

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Credit: Martin Siepmann / imageBROKER / Alamy Stock Photo

In this era of anthropogenic climate change, understanding the mechanisms underlying extreme weather events could help their forecast. At the regional scale, weather systems exhibit spatial correlations — after all, when it's raining outside, we usually expect our friends elsewhere in the city to be getting soaked too. But as Niklas Boers and colleagues have now reported, extreme rainfall events exhibit correlations over substantially longer distances.

The authors constructed a complex network whose nodes corresponded to spatial grid cells in the rainfall data. Links were placed between nodes that exhibited synchronization in days of extreme rainfall, up to ten days apart. The analysis revealed a bimodal probability density function for the link distances: a power-law decay at short scales, arising from regional weather systems, followed by a bump at around 2,500 km. This signals the presence of large-scale climate teleconnection patterns, providing evidence that far-flung extreme events may be generated by the same perturbations to the jet stream, known as Rossby waves. *FL*

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SOFT ROBOTICS

It's how you wear it

NATURE PHYSICS | www.nature.com/naturephysics*Ext. Mech. Lett.* **27**, 52–58 (2019)

The idea of a soft wearable robot is appealing: imagine a glove that could grasp for you. Early prototypes using isotropic materials have given way to designs made from textiles, which are both light and intrinsically anisotropic — thus dispensing with the complex architectures. But cutting and sewing textiles takes time, and introduces weaknesses into any would-be robot. Now, Fionnuala Connolly and co-workers have come up with a bending actuator that can be fabricated quickly without seams, and optimized to perform a given task.

The team used a film to make their textiles impenetrable to air, and found that it could also bond to itself with the help of a heat press — offering a no-sew, time-saving solution. They then formulated a method based on strain energy minimization to predict the deformation of the actuator and optimize its parameters. Their test case — a glove designed to aid grasping — demonstrated the power of both fabrication and optimization processes by successfully picking up a glass jar. *AK*

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ULTRACOLD MOLECULES

Long-awaited degeneracy

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Compared with atoms, molecules are much more complex owing to the additional rotational and vibrational degrees of freedom. This complexity makes it challenging to cool them all the way down to their ground state, and to reach the quantum degenerate regime where the thermal de Broglie wavelength exceeds the intermolecule distance. After a decade of effort, this goal has now been achieved by Luigi De Marco and co-workers, who have created a degenerate Fermi gas of potassium–rubidium polar molecules.

The molecules were made by cooling potassium and rubidium atoms to a few hundred nanokelvin and coherently associating them into deeply bound states. At the lowest achievable temperature, a Fermi–Dirac distribution shown in the density profile signified that the Fermi gas deviated from its classical regime. The quantum correlation caused a reduction of the density fluctuations, leading to the suppression of chemical reactions and molecular losses, thus making the system surprisingly long-lived and promising for future applications. *YL*

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OPTICAL MANIPULATION

Circus tricks with light

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The fact that light can control the motion of small particles has been known for some time. Going further, Albert Bae and collaborators have implemented a way to 'juggle' with two glycerol droplets using just a single laser.

When two droplets are caught and levitated by the laser beam, the first may be a little in front of the other so that it obscures the light from the second. The first droplet is accelerated by the beam as usual, but the partially eclipsed one is not so it drops and falls towards the centre line of the laser. At some point, the two particles cross and their roles are reversed, resulting in a rising-and-falling motion akin to balls being juggled. This effect can last for up to 30 min and the trajectory of the juggling can be controlled via the polarization of the laser, indicating that the technique can be used to probe two-particle interactions in a new way. *DA*

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GEOPHYSICS

Shake it

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Changes in the ionosphere have been observed before earthquakes, which are thought to be caused by atmospheric perturbations around the earthquake's epicentre from environmental changes of, for example, pressure or temperature. These perturbations are expected to propagate into the ionosphere, but no such atmospheric gravity waves have yet been observed. Now, Shih-Sian Yang and colleagues have studied the spatiotemporal evolution of atmospheric gravity waves in the stratosphere before an earthquake in Kumamoto, Japan, and found signatures of a causal relation.

Close to the epicentre's location, the potential energy of the atmospheric gravity waves was significantly enhanced a week before the earthquake. At the same time, perturbations in the sub-ionosphere were observed. These findings hint at a correlation of atmospheric gravity waves in the ionosphere and the onset of an earthquake. Atmospheric observations might therefore serve as a future pre-warning system for earthquakes. *SR*

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