FERROELECTRICS
Skyrmions all round
Nature Commun. **6,** 8542 (2015)

The swirling spin textures known as skyrmions have generated great interest in the magnetics community. Stabilized by chiral interactions, these vortex-like excitations are topologically non-trivial, making them fairly robust against perturbations and useful for a range of technological applications. As ferroelectric compounds lack chiral interactions, one might expect that such textures cannot form in these materials, but this may not be the case.

Using first-principles-based methods, Yousra Nahas and colleagues have shown that a combination of geometric confinement and dipolar interactions can stabilize a skyrmionic configuration of polarization in ferroelectric nanocomposites. Although, at first glance, they seem similar to magnetic skyrmions, electrical skyrmions have a distinct topological charge density that has four-fold, rather than cylindrical symmetry. Perhaps more interestingly, they can be stabilized down to just a few nanometres, which will surely interest those working to develop skyrmion-based devices.

Unfortunately, such polarization textures do not seem to be stable at anywhere near room temperature. But the same was said of their magnetic counterparts, which recently achieved this feat. So although experimental confirmation is yet to materialize, one wonders how far extrinsic topological protection can be pushed in ferroelectrics. *LF*

ASTROPHYSICS
Useful glitches
Science Adv. **1,** e1500578 (2015)

Much like young people, young pulsars don't like to play by the rules. Their very fast rotation period, which is extremely stable for older pulsars, exhibits abrupt changes known as glitches. During these glitches the pulsar suddenly starts to spin faster for a short period of time. This is believed to be the result of the interactions between the normal matter in the outer crust of the star and the superfluid inner crust. But the estimated superfluid reservoir needed to explain the observational data is larger than that available in the crust. To explain this, Wynn Ho and colleagues have suggested that the superfluid extends to the core of the star.

Ho *et al.* tested several superfluid models, providing the additional moment of inertia needed to explain the pulsar glitches. One such model successfully accounted for the observational data and the temperature dependence of superfluidity. And this turns out to have an unexpected application: using the pulsar glitch data and the interior temperature, one can determine the mass of the star. *IG*

ROSETTA MISSION
Cometary curiosities
Nature **525,** 500–503 (2015);
Astron. Astrophys. http://doi.org/8b9 (2015);
Nature **526,** 678–681 (2015)

Comet 67P/Churyumov–Gerasimenko (67P) is better known as the Rosetta comet, after the orbiting spacecraft that continues to make unprecedented discoveries.

Using the Visible Infrared and Thermal Imaging Spectrometer (VIRTIS) on board the spacecraft, Maria Cristina De Sanctis *et al.* have found a cyclic condensation of water on the surface of 67P, which follows solar illumination. Comparison with a thermo–physical model can explain the diurnal cycle: gas sublimates from below the surface and condenses directly onto the surface. Such a process can lead to differential erosion and may keep water ice near the surface.

This is consistent with results from the Microwave Instrument onboard the Rosetta Orbiter (MIRO) on the dark side of 67P, which had been in the dark for about five years. Thermal inertia measurements analysed by Mathieu Choukroun's team suggest ice on the surface or within tens of centimetres of the surface.

And finally, Andre Bieler *et al.* have reported Rosetta Orbiter Spectrometer for Ion and Neutral Analysis Double Focusing Mass Spectrometer (ROSINA DFMS) results that show levels of molecular oxygen in the coma to be too high for current models of Solar System formation. Moreover, the correlation between O_2 and H_2O suggests a common primordial origin. *MC*

FRACTURE MECHANICS
Cracking columns
Phys. Rev. Lett. **115,** 154301 (2015)

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Basalt columns, as seen in the staggering rock formations of the Giant's Causeway in Northern Ireland (pictured), are produced by volcanic activity. As lava solidifies, it cools down from the top, generating patterns of cracks due to thermal shrinkage. Secondary fractures that appear perpendicular to primary cracks yield the highest energy release per crack face — so the initial rupture network consists of T-junctions forming a pattern of squares or rectangles. But as the cracks propagate downwards, their contact angles change from 90° to 120° and T-junctions morph into Y-junctions — resulting in basalt columns' well-known hexagonal prism shape.

Martin Hofmann and colleagues have analysed the T- to Y-junction transformation by means of finite-element simulations. Their starting point was a periodic rectangular structure, featuring T-junctions. For realistic material parameters of basalt, the calculated interplay between stress, strain and displacement fields, driven by a temperature gradient from 100 °C to approximately 1,000 °C, reproduced the transition from rectangular to hexagonal crack patterns over a short distance (roughly half of the initial crack length). During further downward crack propagation, the hexagonal configuration remained stable. *BV*

RANDOM WALKS
Roots manoeuvre
Proc. Natl Acad. Sci. USA http://doi.org/8cc (2015)

Plant roots can take on some weird and wonderful morphologies, but understanding how these patterns form is complicated by the difficulty in imaging through soil. Tzer Han Tan and colleagues have remedied this by growing plants whose roots are embedded in a transparent hydrogel — finding similarities between the way that roots and single-celled organisms target nutrients.

By tuning the growth with the help of a rigid barrier, Tan *et al.* were able to observe straight, coiled and wavy morphologies. They interpreted their measurements by drawing inspiration from bacterial motility. In a way reminiscent of the run-and-tumble method that *E. coli* uses to search for food, the roots they imaged branched out according to a grow-and-switch mechanism described by a 2D biased random walk. Switching events were regulated by the roots' sensitivity to gravity, in analogy with the way *E. coli* responds to chemical cues. *AK*