PHOTONIC CRYSTALS
Spacing out the colours
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Chameleons change colour for camouflage, communication and regulation of body temperature. It has been thought that they change colour through the dispersion and aggregation of melanosomes — organelles in the skin that contain light-absorbing pigment. However, this process cannot easily explain the large colour variation seen in adult male panther chameleons under stress, whose background colour of the skin shifts from green to yellow or orange. Now, Michel Milinkovitch and colleagues at the University of Geneva show that male panther chameleons from Madagascar change colour by altering the spacing of guanine nanocrystals found in their skin.

Using histology and transmission electron microscopy, the researchers found that unlike other lizards, the skin of panther chameleons has two thick superimposed layers of iridophores — reflective and iridescent cells. The upper layer, which was seen to be fully developed only in the adult male, consists of iridophores containing closely packed guanine nanocrystals organized in a triangular lattice. When excited (for example during male–male contests), the distance between the nanocrystals increased. It is suggested that the shift in reflectivity from blue and green in the resting skin to yellow, orange and red seen in the excited state is due to this alteration in the geometry of the nanocrystals. Excited skins subjected to hypertonic solutions that cause the crystal lattice to shrink to the resting state resulted in a blue-shift in reflectivity, further confirming that the change in skin colour is due to the expansion and contraction of the crystal lattice. The lower layers of iridophores did not change colour. Instead, they reflected sunlight in the near-infrared range, suggesting that this layer is for thermal protection. *ALC*

SUPRAMOLECULAR CHEMISTRY
Porphyrins on the move
Angew. Chem. Int. Ed. http://doi.org/f25t8s (2015)

Spatial control in the formation of covalent bonds can be exerted by using template molecules. Template-directed approaches have, for example, been used to form large porphyrin-based macrocycles starting with porphyrin dimer subunits. In these techniques, the initial subunits polymerize until the recognition sites of the template are saturated. Now, Harry Anderson and colleagues at the University of Oxford have prepared two supramolecular systems each consisting of two 6-arm star-shaped molecules that can template the formation of either an 8-porphyrin or a 10-porphyrin macrocycle. The template arms end with a 4-pyridyl group that binds to the zinc centre of the porphyrin, guiding the polymerization of the porphyrin dimer all around the two templates. One of the arms of each template is not engaged with the porphyrin and sits in the centre of the resulting 2:1 complex.

The researchers then looked at the dynamics of the complexes using exchange NMR spectroscopy, which probes specific hydrogen atoms as they exchange position by conformational dynamics. They found that both the template rings and the porphyrin macrocycle rotate by 60° in a stepwise fashion. They confirm this mechanism through a series of control experiments in which either a palladium compound that binds to the loose arms of the two templates is used, or the 6-arm templates are replaced by 5-arm templates. In both cases the resulting complexes remain static.

The intramolecular stepwise rotation described by Anderson and colleagues mimics the working principle of a caterpillar track. *AM*

ELECTRONIC DEVICES
Oxide interfaces under control
Nano Lett. http://doi.org/2z8 (2015)

Ever since the formation of a metallic layer was observed at the interface between the two insulators $LaAlO_3$ and $SrTiO_3$ around a decade ago, oxide interfaces have shown a range of interesting phenomena, including magnetism and superconductivity. Various efforts have been focused on the realization of devices with nanometre dimensions. Most of these efforts are based on modifying, by oxidation for example, the material surrounding a conductive channel. Such methods work well, but are not versatile. Srijit Goswami, Andrea Caviglia and colleagues at the University of Delft have now demonstrated that high-quality devices can be obtained by simply evaporating properly designed metallic gates on the surface of a $LaAlO_3/SrTiO_3$ interface.

The researchers first showed that by evaporating a single gate with nanometre dimensions they could control the conductivity of the area of the interface under the gate. They then studied a split gate configuration, in which two narrow gates are placed next to each other leaving a small gap in between. Finally, by measuring the electron conductivity at low temperature (around 50 mK), they were able to induce a superconducting-to-insulating transition, and observed signs of Josephson tunnelling. Although these observations are not that surprising, the demonstration of a technique to fabricate nanodevices with various geometries could become an important tool. For example, it may allow transistors to be developed that can be used for fundamental studies of magnetism and superconductivity at the nanoscale. *FP*

MAGNETIC DOMAIN WALLS
Pushed by spin waves
Phys. Rev. Lett. **114,** 087203 (2015)

The controlled motion of magnetic domain walls in nanostructures is envisaged to be a promising tool for the development of spintronic devices for logic operations or information storage. Various driving mechanisms can generate the torques responsible for domain wall motion, from magnetic fields to spin currents. Spin waves — collective excitations of the electron spins in a crystal — carry spin currents and, when they traverse a domain wall, they displace it by transferring angular momentum to the local magnetic moments. Now, Hans Fangohr and colleagues at the University of Southampton show that in materials with certain magnetic properties spin waves can also exchange linear momentum with the domain walls, resulting in a 10-fold increase in domain wall velocity.

The key ingredients are the Dzyaloshinskii–Moriya interaction (DMI) and an easy-plane magnetic anisotropy. The researchers studied the domain wall dynamics in a nanowire by micromagnetic simulations and analytical models, using material parameters typical of FeGe, a material with bulk DMI. They show that velocities of a few metres per second can be achieved depending on the spin wave frequency, with a peak velocity at 24 GHz. *ED*

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