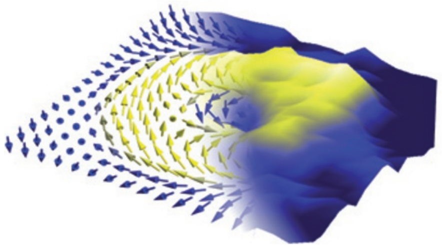
Laser-generated spin textures

Phys. Rev. Lett. **110,** 177205 (2013)



© 2013 APS

Complex spin textures such as skyrmions have recently garnered the attention of condensed-matter physicists. Named after the particle physicist Tony Skyrme, these solitonic excitations share the same topology as a set of magnetic moments wrapped around a sphere, but projected onto a plane. The ingredients necessary to stabilize them in a magnetic system have been known for some time, most notably a weak but asymmetric effect known as the Dzyaloshinskii–Moriya interaction, but the degree to which they are stable to external perturbations has come as a surprise. Another ingredient that was thought to be essential to their formation is an externally applied magnetic field. Now, Marco Finazzi and colleagues demonstrate that this is not the case, by using a laser to stabilize skyrmions and related spin textures in a thin alloy film consisting of terbium, iron and copper. The stabilization occurs as a result of the combination of short- and long-range interactions present in the film, and suggests skyrmions may be easier to manipulate than previously thought. *AT*

Sulphur in the melt

Nature Chem. **5,** 518–524 (2013)

Millions of tons of elemental sulphur are produced as a side product of petroleum and oil-refining processes each year, however, only a small proportion is recycled within the chemical industry. Now, Jeffrey Pyun and colleagues report a copolymerization reaction that uses a large excess of sulphur and smaller amounts of divinyl comonomers to make sulphur copolymers that are synthetically inexpensive but have practically valuable chemical and processing characteristics. The first step of this process, termed inverse vulcanization, involves dissolution of the divinylic styrenic comonomers in liquid sulphur. On heating, diradical sulphur species react with the comonomers to yield sulphur copolymers that form red glassy materials when cooled to room temperature. The copolymers are stable to depolymerization and can be processed in the melt to produce large-area films and more complicated micropatterned surfaces, using imprint lithography techniques. Moreover, the copolymers maintain the attractive electrochemical properties of elemental sulphur, and when incorporated as the active material of Li–S batteries show higher specific capacity compared with other polymer-based cathodes. *AS*

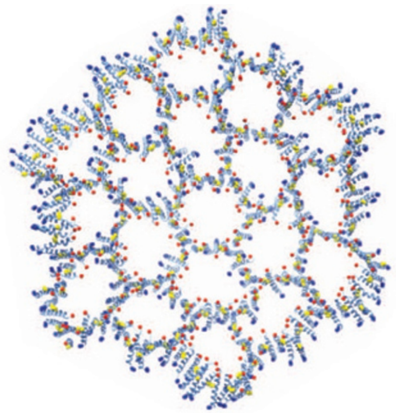
Optogenetics goes wireless

Science **340,** 211–216 (2013)

The continuous efforts in understanding brain physiology are driving the development of implantable tools with the ever-improving capability of stimulating and recording neuronal activity, and that have a reduced risk of causing tissue lesions. Kim *et al.* have now demonstrated a soft multifunctional device integrating platinum microelectrodes, temperature sensors, photodetectors and novel micrometre-scaled light-emitting diodes on a mechanically compliant polymeric substrate, suited for *in vivo* implantation in mice. To facilitate placement in deep regions of the brain, this tool is first attached by means of a silk-based glue to a stiff microneedle; then, the biodegradable adhesive is removed and the rigid support is released, thus minimizing the mechanical mismatch between the chronically implanted part and the surrounding tissues. The device is finally connected to a wireless antenna, which enables bidirectional communication of stimuli and data without limiting the movements of the mouse during optogenetic experiments. The authors predict that the performance stability, demonstrated over several months, will accelerate the use of these devices in clinical research studies. *LM*

Coiled-coil balls

Science **340,** 599–595 (2013)



© 2013 AAAS

As illustrated by fullerenes (and footballs), a sphere cannot be tiled with regular hexagons only; pentagons are always needed. Derek Woolfson and colleagues now show that coiled-coil peptides can self-assemble into sheets made of hexagons, and that these close up to make spheres. The team designed and synthesized two types of tripod-like module — each made of three distinct coils arranged roughly in parallel — with matching (that is, attractive) ends. When the aggregates were mixed in solution, they formed hexagonal (graphite-like) sheets, which closed in on themselves to form spheres each about 80 nm in diameter. Using atomistic simulations, the researchers show that the formation of closed cages is driven by the minimization of network edges (that is, of unmatched peptide coils), and speculate that the necessary imperfections needed for the network to close up are possible because of the flexibility of the modules, which may allow for mismatched pairings. This modular approach for peptide self-assembly of porous cages may find advantageous uses in drug delivery and synthetic biology. *PP*

Scattered light for white LEDs

Appl. Opt. **52,** 2602–2609 (2013)

There is a strong worldwide drive to efficiently generate white light using light-emitting diodes (LEDs). In white LEDs, light is purposefully scattered many times to generate a 'random walk'; the light then becomes diffuse, which is crucial for even lighting. Photons are recycled to save on colourants and to improve cost and energy efficiency. Present challenges in understanding white LEDs arise from a limited knowledge of the light-scattering process, which hampers the development of efficient ones. Willem Vos and colleagues from Twente University and Philips have now performed an innovative study of this problem. The researchers collected and spectrally resolved all light that scatters inside LED diffusers. They used nanophotonic theory to derive the mean-free path for LEDs, that is, the average step-size of the random walk. A model without adjustable parameters was developed that successfully interpreted the results. The new insights are being used to design more energy-efficient LEDs that are more environmentally friendly. *KT*

Written by Luigi Martiradonna, Pep Pàmies, Alison Stoddart, Andrea Taroni and Kosmas Tsakmakidis.