Cover story

Vol.1 No.11 November 2007

For almost a century, scientists have known that light can exert a force through the momentum that it carries. In the ordinary, macroscopic world, this momentum is not usually significant. But when optical modes shrink down to nanometre dimensions, the forces created by light can become important. Peter Rakich and colleagues from the Massachusetts Institute of Technology in the USA have now harnessed these forces to control tiny optical cavities and their resonances. By coupling together two microcavities and allowing their optical modes to interact, they show that a tug-of-war can develop between the optical forces involved, with the result that the cavity's moving parts become pinned — at the picometre level. The results could offer researchers a fundamentally new way of making tiny optical circuits adaptive in response to light. **[Letter p658; News & Views p616]**

MINI MAGNETOMETRY

The optical properties of a cloud of alkali atoms, such as caesium, are very sensitive to magnetic fields. Vishal Shah and colleagues from the National Institute of Standards and Technology in the USA have now taken advantage of this phenomenon to create small but sensitive laser-based magnetometers. Conventionally, the cells that contain the atomic vapour were handmade by blowing glass, a time-consuming approach that limited how small the instrument could be made. Shah *et al.* have borrowed techniques from semiconductor-device manufacture, enabling them to create a large number of cells with volumes of a cubic millimetre on a silicon wafer. When a cell filled with rubidium atoms is optically probed, it is possible to measure magnetic fields with a subpicotesla sensitivity. Unlike competing technology, there is no need for awkward cryogenic systems. **[Letter p649; News & Views p613; Interview p670]**

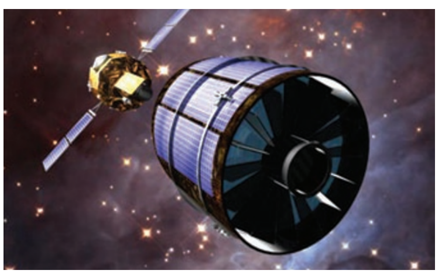
STOP THE SPREAD

The tight confinement of light that is possible in photonic-crystal fibres has opened the door to a wide variety of different physical phenomenon. One example is supercontinuum generation — the creation of intense, broad-wavelength light from a very-short laser pulse.

Supercontinuum generation is possible owing to the complex interplay of a host of effects, and not all the physics is fully understood. Andriy Gorbach and Dmitry Skryabin, from the University of Bath, UK, have investigated one question in particular: why does an optical pulse not temporally broaden as it propagates along a fibre under normal-dispersion conditions? Solitons are the key to the solution. Solitons are non-dispersive pulses that only exist under certain dispersion conditions. The light pulse and the soliton, propagating at different wavelengths, interact with one another, the slower-moving soliton acting as a barrier to the light pulse and preventing it from broadening. This advance in understanding is likely to aid the design of broad-wavelength light sources. **[Letter p653; News & Views p611]**

PREPARING FOR TAKE OFF

The European Space Agency (ESA) Cosmic Vision programme, which will run between 2015 and 2025, will strive to give scientists a better understanding of the Universe and its origins. The good news for the optics community is that photonics looks set to play a key role. If all goes according to plan, a series of sophisticated space observatories will be launched, which will use state-of-the-art photonics to probe the Universe. So far, ESA has received over 50 mission ideas for consideration, and opportunities include searching for dark matter and potentially habitable exo-planets, and studying the evolution of black holes and galaxies. Philippe Gondoin describes the instruments and technology that are likely to be involved and explains how interferometry, wide-field imaging in the visible and near-infrared, and observation of X-ray emission could help answer some of the most important questions in astronomy. **[Commentary p605]**



Preparing for launch. Space-based sophisticated imaging equipment will soon be exploring the Universe.

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THE POTENTIAL OF PLASMONICS

Research into plasmonics, the study of the nanoscale interaction between photons and electron oscillations on the surface of a metal, has become a hot topic in recent years. Exciting possibilities include the creation of cleverly designed miniature metallic circuits to guide, enhance or modulate the transmission of light. In this issue, Naomi Halas and co-workers from Rice University, USA, review the progress that has been made so far in making plasmonic devices for sensing and waveguiding applications. A topic discussed in detail is surface-enhanced Raman spectroscopy, which uses plasmonics and a nanotextured substrate to enhance the detection sensitivity of biomolecules by a factor of typically a million or more. Arguably, this has been one of the most important applications of plasmonics so far, however there is no doubt that many more will follow. **[Review p641]**

ENERGETIC IDEAS

Finding cost-effective and efficient ways to generate electricity has been a pressing issue for politicians and scientists for some time, and the topic was in the limelight at the recent annual meetings of the Optical Society of America (OSA) and SPIE. Many believe that photonics can help through innovative designs of solar cells that offer improved price-to-performance ratios. Although it is often suggested that organic materials based on novel blends of semiconducting polymers offer an answer, it may be that exploiting materials in the natural world could also prove useful. One of the latest ideas is to exploit algae that generate hydrogen when illuminated by sunlight. According to the researchers, an acre of such algae could generate 80 kilograms of hydrogen per day, with each kilogram providing about 40 kWh of energy. **[Editorial p603; News & Views p618]**