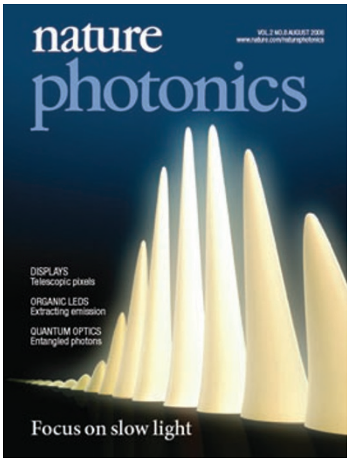

Cover story

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The high speed of light in a vacuum brings many benefits, but gaining control over the group velocity of light pulses is also important for applications in next-generation communication systems, nonlinear optics and quantum information processing. Over the years, scientists have learnt how to perform this feat in many kinds of media, including gases, optical fibres, bulk glass, semiconductor devices and engineered silicon structures, such as photonic-crystal waveguides and coupled microring resonators. This issue has a special focus devoted to the topic of slow light, which is designed to offer an accessible overview of some of the most popular control schemes and their capabilities.
[Editorial p447; Commentaries p448 and p451; Interview p454; Review Articles p465 and p474]

ENHANCING ORGANICS

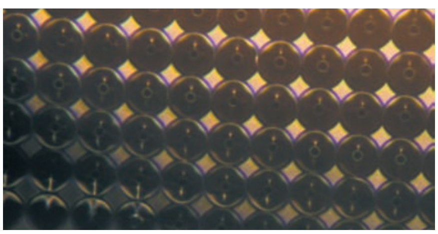
Light-emitting diodes made from organic materials, so called OLEDs, hold great promise as a new type of visible light source that is potentially highly efficient. However, there's a problem. Although the devices are very efficient at generating light, extracting it from them is notoriously difficult owing to the high refractive index of the organic materials and transparent electrodes used in their design. In effect, a significant fraction of the generated light gets trapped internally and is confined within the OLED, and only around 15–20% is outcoupled. In this issue, Yiru Sun and Stephen Forrest from the University of Michigan demonstrate experimentally a convenient solution to the problem. They describe how adding a very fine grid of a low-refractive-index material within the organic layers, and a microlens array on the device's surface, can enhance the outcoupling by more than a factor of two. Their solution takes the device efficiency to new heights without degrading the colour of the emitted light. **[Letter p483]**

PLASMON PROPAGATION

Research into surface plasmon polaritons (SPPs), charge oscillations that travel along the surface of a metal, is one of the most active areas of photonics today. Plasmonics plays a central role in the emerging field of nanophotonics for both shrinking the size and enhancing the performance of photonic devices. One of the big challenges for the field is finding a suitable means to guide SPPs over a longer range, as they usually decay rapidly. Now, Rupert Oulton and co-workers from the University of California at Berkeley propose the use of a hybrid waveguide consisting of a dielectric nanowire within a nanoscale distance to a metal surface. Coupling between the plasmonic and waveguide modes across the gap leads to strongly confined transmission over distances of tens of micrometres.
[Letter p496; News & Views p460]

TELESCOPIC PIXELS

Increasing the efficiency of displays is of great importance for reducing power consumption and increasing the battery life of portable devices. Many display technologies incorporating backlights, in particular backlit LCDs, suffer from poor backlight transmission (5–10%) owing to the inclusion of polarizers and colour filters. In this issue, Anna Pyayt and co-workers from Microsoft and the University of Washington describe a new transmissive display architecture that uses microelectromechanical-system (MEMS) technology to create highly efficient 'telescopic pixels'. In effect, each pixel acts as a miniature telescope with MEMS metal structures as primary and secondary mirrors. Applying a voltage causes the primary mirror's shape to change from planar to a parabolic 'ON' state, reflecting light onto the secondary mirror and consequently through the pixel. In contrast when the primary mirror is in its planar 'OFF' state, no light reaches the secondary mirror and light transmission through the pixel is blocked. Preliminary experiments show that the pixels can be switched between their ON and OFF states on the timescale of 1.5 ms, and that around 36% of the backlight can be transmitted in the ON state.
[Letter p492; Interview p512]



Researchers in Washington have developed a 'telescopic pixel' technology that enables backlight displays that operate with a greatly increased efficiency.

p492

NEEDLES OF LIGHT

Light beams with a longitudinal polarization, in other words polarized along the direction of propagation, are potentially useful for applications such as laser particle acceleration, second-harmonic generation and Raman spectroscopy. Now, Haifeng Wang and co-workers from the Data Storage Institute and the National University of Singapore have devised a new scheme for their generation that permits the creation of a longitudinal light needle with a subdiffraction-limit beam size. Theoretical calculations suggest that the beam does not diffract and can propagate over a distance of four wavelengths. The generation scheme involves the use of a binary phase element and a high-numerical-aperture lens to focus a radially polarized Bessel–Gaussian beam. The binary optical element works like a special polarization filter that diffracts the radial field away from the centre of the focused beam more than the longitudinal field.
[Article p501]

QUANTUM PROTECTION

The ability to perform tasks, such as computing, communication and metrology, in the quantum world efficiently will probably require means to protect quantum information carriers from destructive decoherence effects. In this issue, Takashi Yamamoto and colleagues in Japan demonstrate an optical scheme for achieving this goal in which one photon of an entangled pair is successfully encoded into and decoded from a protective decoherence-free subspace. The robustness and feasibility of the scheme is demonstrated through high-fidelity distribution of the entangled state over an optical-fibre communication channel. The researchers say that although the scheme has been demonstrated for an entangled pair it is applicable to many-photon entanglement.
[Letter p488; News & Views p461]