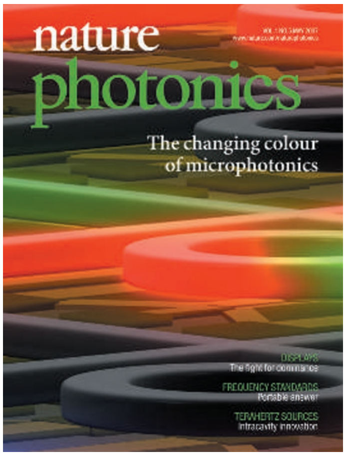

Cover story

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The creation of optoelectronic chips that can convert the colour of light beams is important for the future of optical information processing. Now, Michal Lipson and colleagues from Cornell University have come up with a scheme that not only fits on a silicon chip, but also offers the potential for electronic tunability and control. By using ultrafast electro–optic changes in the cavity resonance of a silicon microscale ring resonator, the researchers demonstrate a wavelength change of 2.5 nm in a probe beam with up to 34% on–off conversion efficiency. The trick is inducing small refractive-index changes in the cavity using free-carrier effects generated by a pump beam. The index reduction causes a shift in the resonance of the cavity and a blue shift to the wavelength of a probe light propagating in the resonator. The achievement opens the door to chip-based wavelength-division-multiplexing systems. **[Letter p293; Interview p298]**

TERAHERTZ TRICK

Until recently, the study of material interactions in the terahertz spectral region (commonly defined as wavelengths between 30 μm and 300 μm) was hindered by the lack of practical sources of terahertz radiation. Although a convenient semiconductor laser that directly emits terahertz waves and operates at room temperature has yet to be realized, a convenient alternative could soon be at hand. Mikhail Belkin and his co-workers have exploited the nonlinear optical properties of GaAs to convert the mid-infrared light from a dual-wavelength quantum cascade laser into terahertz light through intracavity difference-frequency generation. The approach, now achieved experimentally for the first time, combines electrically pumped semiconductor lasers and nonlinear optical effects to create a continuous-wave terahertz source that operates at room temperature. At present, the source emits approximately 60 nW of terahertz power at an output wavelength of 60 μm, but the researchers are confident that microwatt and milliwatt powers could be within reach in the future.
[Letter p288; News & Views p257]

PORTABLE PRECISION

So far, the use of highly stabilized lasers that emit extremely pure light that could help form the basis of future time and frequency standards has been limited by the absence of a scheme for passing the optical signals between different locations. In essence, researchers need a means to transfer the signals between remote sites and to different wavelengths without significant loss of precision. Inspired by the achievements of fibre-optic networks in the microwave-frequency region, Ian Coddington and colleagues from the USA and France have now constructed an optical network that is capable of transferring coherent signals with high frequency stability, low time jitter and low optical phase noise. The network uses erbium fibres and optical frequency combs based on Ti:sapphire lasers. The researchers successfully transfer an optical carrier over 750 m while keeping the undesirable jitter to a minimum. What's more they expect that by optimizing the design it should be possible to extend the transmission distance much further.
[Letter p283; News & Views p258]

A NEW START

When the Optoelectronics Research Centre at the University of Southampton went up in flames in autumn 2005 and millions of dollars of equipment was destroyed, many probably believed that the centre would never be able to fully recover and that it might take years to get back on its feet. The reality is in fact quite different as Nadya Anscombe reports. She describes how the researchers have overcome the catastrophe and actually used the interruption in their research to their benefit, giving them the time to stop and plan for the future. The researchers are now more strong-minded and a new, modern research building with state-of-the-art equipment is to be completed in 2008. In effect, the black clouds of smoke did in fact have a silver lining after all. **[News & Views p255]**

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Clouds of black smoke billow out from the Mountbatten Building at the University of Southampton.

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PAPER GETS A MAKEOVER

With much effort and publicity in the display sector centred around making larger and larger flat-panel displays, other achievements are being somewhat overlooked. A case in point is electronic paper — a new type of display that makes images and text appear as clearly as print does on paper. Electronic paper has now started to gain attention in the marketplace for signage and portable electronics owing to its unique features, such as low power consumption, flexibility and no need for a backlight. In this issue, Duncan Graham-Rowe and Ichiko Fuyuno provide a round-up of the progress in the latest efforts to commercialize the technology and discuss its most promising applications so far.
[Out of the Lab p248]

OPTICAL WI-FI

There is no doubting the convenience of wireless hotspots that enable cable-free Internet access while sipping coffee in cafes or at airports, for example. Unfortunately, the frequency of the radio waves or microwaves that are commonly used to carry data puts fundamental limits on the maximum data-transmission rates that will be obtainable in the future. In this issue, Dominic O'Brien from the University of Oxford and colleagues from Imperial College London discuss a future alternative — free-space optical communication — that could overcome the looming bandwidth bottleneck. By moving to the optical regime, which offers higher frequencies and thus higher bandwidth, optical hotspots could yield far better performance. Although challenges still need to be overcome, the potential of optical wireless communication is not to be undervalued.
[Commentary p245]