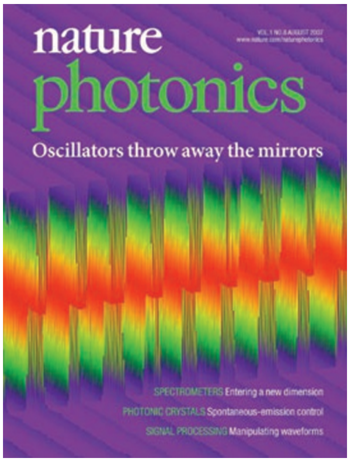


Cover story

Vol.1 No.8 August 2007

Cavity mirrors are often an integral part of coherent light sources, such as the optical parametric oscillator (OPO). Now, scientists from Sweden have built the first ‘mirrorless’ OPO. Based on an optical nonlinear material — periodically poled KTP — the device exploits so-called quasi phase-matching to generate widely tunable coherent light. According to the scientists behind the achievement, Carlota Canalias and Valdas Pasiskevicius from the Royal Institute of Technology in Stockholm, the result could lead to the development of an OPO that does not require optical-component alignment. The initial prototype mirrorless OPO is demonstrated with picosecond pump pulses having a wavelength of around 800 nm and signal and idler wavelengths of 1.1 μm and 2.9 μm, respectively. **[Letter p459; News & Views p446; Interview p484]**

PHOTONIC INK

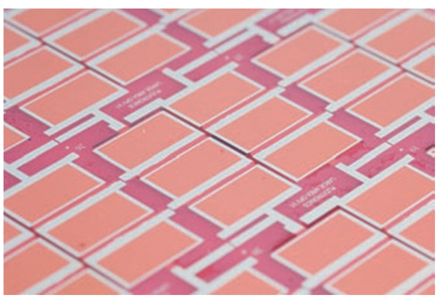
Although the use of photonic-crystal technology in optical communications and semiconductor light sources has been widely reported, it may have yet another important application — displays. In this issue, Geoffrey Ozin and co-workers report an electrically tunable full-colour display based on electro-active colloidal photonic crystals. Unlike many other display technologies their approach does not require colour filters or a backlight, and has the additional benefit of being bistable, meaning that it does not need power to display a static image. Dubbed photonic ink (P-Ink), the approach relies on electro–chemical swelling and shrinking of a solvent, which fills the gaps between an array of silica spheres and is used to control the sphere’s spacing and hence optical response. The researchers from Canada and the UK demonstrate stripes and pixels with an electronically controlled reflection that spans the entire visible spectrum from around 450 nm (blue) at 0 V to 600 nm (red) at 2 V. **[Letter p468]**

SPECTROMETRY ON A NEW SCALE

A new generation of high-resolution ultracompact spectrometers that have submillimetre dimensions and no moving parts could now be on the horizon thanks to research from Grenoble in France. The science behind the idea is the sampling of an interferogram generated by stationary waves in a small waveguide. The researchers call the approach stationary-wave integrated Fourier-transform spectrometry, or SWIFTS. As the necessary nanodetectors for fully integrated SWIFTS are not yet available, the team has instead demonstrated the principle of operation using a waveguide containing gold nanowires instead of detector elements. The nanowires scatter the interferogram so that it can be analysed by an external CCD detector. The preliminary device measures just 1 mm in size and has a resolution of 4 nm and a spectral range of 96 nm, centred at 1,500 nm.
[Article p473; News & Views p444]

PHOTOVOLTAICS GO ORGANIC

With mounting concerns over energy generation and pollution, it’s probably no surprise that any ideas for improving the efficiency and cost of renewable energy sources are in great demand. One such approach that is receiving considerable investment and attention in the USA in particular is the use of organic photovoltaics, which in theory should be much cheaper to make and easier to deploy than their silicon counterparts. Based on novel semiconducting polymers that can be printed or sprayed onto thin plastic substrates, the approach could lead to flexible solar cells that could be applied to roof tiles, windows and portable electronics. Duncan Graham-Rowe delves into the details in his regular piece on technology commercialization.
[Out of the Lab p433]



Organic photovoltaics promise to make solar energy generation a more enticing prospect.

p433

PROGRAMMING LIGHT

The optical frequency comb, an array of closely spaced spectral lines, is an important tool in next-generation metrology and information processing. However, manipulating light within a comb is tricky and so far has been limited to groups of lines or a handful of individual lines. Now Zhi Jiang and colleagues from Purdue University have demonstrated an optical arbitrary-waveform generation technique that is capable of independently processing more than 100 individual lines, each spaced by just 5 GHz — the closest spacing and largest number of lines so far. Examples of the line manipulation demonstrated include blocking every other comb line or complex phase programming of the individual lines. The team say that their approach, based around pulse shapers made from liquid-crystal-modulator arrays, is also scalable to larger numbers of lines by using modulators with more pixels.
[Letter p463; News & Views p447]

FAREWELL UNWANTED EMISSION

The ability to gain ultimate control over the generation and propagation of light within semiconductors has long been a goal of scientists worldwide. Now, thanks to improvements in photonic-crystal technology, physicists are able to fabricate nanostructures that can prevent the propagation of light of certain wavelengths and confine and store light in ever smaller cavities. In this issue, Susumu Noda and colleagues from Kyoto University in Japan provide a round-up of achievements in photonic-crystal technology, with an emphasis on the progress that has been made in suppressing and controlling spontaneous emission. In the future, such technology could lead to smaller, more efficient lasers and optical chips that can store and process light signals.
[Review p449]