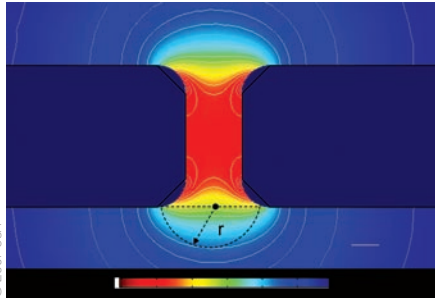


## COLLOIDAL QUANTUM DOTS

## Filling the gap



*Opt. Express* **15**, 17163–17170 (2007)

Getting the most out of nanoscale photonic integrated circuits requires a detector with suitable dimensions. Now, scientists at the University of Washington have presented an elegant answer. Michael Hegg and Lih Lin use colloidal nanocrystal quantum dots to create a near-field photodetector for subdiffraction nanophotonic integrated circuits. The quantum dots used have highly tunable emission and absorption wavelengths and flexible surface chemistry suitable for many self-assembly processes.

To fabricate the detector, the scientists first create a small gap (1.5–25 nm) between two 50-nm-wide gold electrodes, on an organic polymer layer. They then drop-cast CdSe/ZnS nanocrystal quantum dots, with a nominal size of 5.2 nm, into the gap. For a device with a 25-nm nanogap, the team measured a detection sensitivity of 62 pW and a maximum responsivity of 2.7 mA W<sup>-1</sup>. The scientists also found that the signal-to-dark current ratio increases linearly with gap size and that higher responsivity can be achieved in a smaller device area. Their approach provides an alternative photodetection approach for nanophotonics integrated circuits. In addition, the scientists hold the opinion that the simple, flexible drop-casting process can be easily used for other self-assembled and solution-processed components of nanophotonic integrated circuits.

## OPTICAL STORAGE

## Safe and sound

*Science* **318**, 1748–1750 (2007)

In the field of optical communications, it is important to be able to temporarily store incoming information so that it doesn't all arrive at the same time. Although this is very simple to achieve with electronic signals, light is far more difficult to manipulate. Now, however, Zhaoming Zhu

and co-workers from Duke University and the University of Rochester in the USA have come up with an elegant technique that can delay pulses of light by over 10 ns. They do this by converting optical pulses travelling along an optical fibre into sound waves.

In their approach, data travels along the optical fibre as a series of pulses with a wavelength of 1.55  $\mu\text{m}$ , while a strong laser pulse at a slightly different wavelength propagates in the opposite direction. If the difference in the wavelengths of the counter-propagating pulses is just right, then some of the energy of the data pulses is converted into an acoustic wave. A similar process is used to retrieve the data. The storage time is limited by the lifetime of the acoustic vibrations. After being stored for 12 ns, 2% of the data signal could still be retrieved, and this could be improved by using a more appropriate fibre material.

Although a number of alternative techniques for optical storage have been shown in the past, the method used by Zhu *et al.* has the important advantage that it works at any signal wavelength: all that is required is to select an appropriate wavelength for the write and read laser pulses.

## ATTOSECOND PHYSICS

## Ionizing action

*Phys. Rev. Lett.* **99**, 233001 (2007)

Attosecond pulses are useful for controlling electron dynamics inside atomic and molecular systems on very fast, subfemtosecond timescales. Using attosecond light to generate attosecond electron wave-packets, researchers in Sweden and the USA have now shown that they can control when ionization in a helium atom occurs, as well as its probability, with attosecond precision.

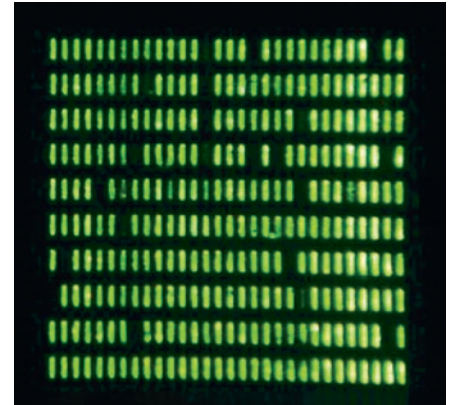
Until now attosecond pulses had been used to control the time at which ionization occurs but not its likelihood. Johnsson *et al.* use a train of UV attosecond pulses to excite helium atoms in the presence of an infrared field. The attosecond pulses, which are produced by high-order-harmonic generation in xenon, are phase-locked to the infrared field; their energy (23 eV) is lower than the ionization threshold of helium. By controlling the delay between the infrared field and the field of the attosecond pulses, it is possible to control the number of helium ions produced.

The unprecedented control demonstrated in this experiment arises

from interference between electron wave packets generated by different attosecond pulses. With further work, this study should pave the way for detailed insights into electron wave-packet dynamics in driven atomic and molecular systems.

## DISPLAY TECHNOLOGY

## Driven by nanowires



*Nano Lett.* doi: 10.1021/nl072538+ (2007)

An enticing prospect for future flat-panel-display technology is the development of displays that are flexible and transparent. With this goal in mind, Sanghyun Ju and colleagues based in the USA have demonstrated flexible active-matrix organic LED (AMOLED) displays that are driven by simple, mass-producible nanowire electronics and are optically transparent.

Although AMOLED displays have previously been demonstrated, these have incorporated thin-film transistors based on low-temperature polysilicon or amorphous silicon, and they have been opaque and not well-suited for flexible displays. Nanowire transistors, on the other hand, are ideal because of their transparency, small size, electrical behaviour and fast switching properties, not to mention the fact that they can be produced at a low temperature. These devices have one or more semiconductor nanowires as the active-channel region.

Ju *et al.* present transparent AMOLED displays in which the switching and driving circuits are comprised solely of nanowire transistor electronics. Indium oxide nanowires are used for the active channels, along with a self-assembled nanodielectric as the gate insulator and polymer organic LEDs. The 2 mm  $\times$  2 mm displays offer an optical transmittance of 72% and a brightness of over 300 cd m<sup>-2</sup>, and could be used in hand-held applications or integrated onto plastic substrates.