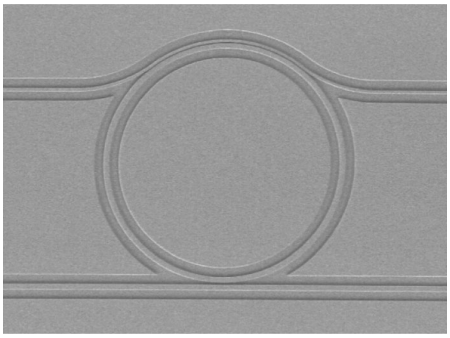
QUANTUM SOURCES

Dual wavelength chip

Nat. Phys. https://doi.org/c2cz (2019)



Credit: Springer Nature Ltd

Long-distance fibre-based quantum communications systems tend to operate in the telecommunications wavelength band (1.5 μm) in the near-infrared (NIR). In contrast, quantum systems for performing local operations, such as storage and computation, make use of optical transitions in the visible or shorter NIR wavelengths from trapped ions or atoms, defect centres, quantum dots and spins in a crystal. To link these two systems together entangled photon pair sources that bridge the telecoms and visible bands are desired. Using a high-*Q* silicon nitride microresonator platform, Xiyuan Lu and co-workers from the USA have now demonstrated a system that generates narrow-band visible–telecom photon pairs with a coincidence-to-accidental ratio of up to 3,780 ± 140 at an on-chip pair flux of 1,200 ± 300 pairs per second, at sub-milliwatt pump power. Unlike existing visible–telecom pair sources, the system combines an on-chip solution with phase- and frequency-matching of narrow-band modes over a spectral separation of >250 THz. The team report time–energy entanglement of the pairs with a visibility of 82.7 ± 0.2%. When the entanglement was distributed over >20 km in optical fibre, a visibility of 58 ± 1% was measured. *RW*

https://doi.org/10.1038/s41566-019-0386-6

OPTICAL FORCE

Dimer nanomotors

Light Sci. Appl. **7**, 105 (2018)

Recent simulations predict that dissimilar particle dimers can experience a net force that is transverse to the direction of the illuminating light and may be exploited for optically driven nanomotor applications. Now, Yuval Yifat and colleagues in Chicago have directly confirmed the effect and have measured the net forces in asymmetric nanoparticle dimers excited by plane waves. A continuous-wave Ti:sapphire laser (790 nm wavelength) illuminated a mixture of ~150-nm-diameter and ~180-nm-diameter Ag nanoparticles in a 3.4-μm-radius optical ring-trap and the positions of the particles were tracked. Both homodimer and heterodimer pairs were investigated. The anticipated optically driven motion was confirmed for heterodimers that were sufficiently close for optical coupling to occur (separations less than 1.2 μm) and is attributed to an asymmetric scattering pattern. The team hopes that asymmetric nanoparticle assemblies can actually be used as active colloids and optically driven 'nanoswimmers' that may be useful in soft condensed-matter and biophysics research. *DFPP*

https://doi.org/10.1038/s41566-019-0383-9

METAMATERIALS

One-way chiral light

Science **363**, 148–151 (2019)

Weyl points are singular points of degeneracy in three-dimensional reciprocal (momentum) space at which two energy bands intersect. Such points were experimentally demonstrated in the photonic domain in 2015 and growing interest and applications are now abounding. However, while the fact that Weyl points carry topological charges defined by the Chern numbers has been exploited in other fields of physics, photonics is still lagging. Hongwei Jia and a team from the UK, China and the US have now experimentally observed microwave zero-order Landau levels exhibiting one-way chiral propagation. They achieved this by making designer unit cells of metamaterials that generate an effective gauge field (that is, artificial magnetic field), which was confirmed experimentally and by numerical simulations. Apart from the fundamental nature of the demonstration, the concept, which does not rely on time-reversal symmetry breaking, may allow for means of robust photonic transport that could be useful for information processing and other applications. *DFPP*

https://doi.org/10.1038/s41566-019-0382-x

OPTICAL MEMORY

Terahertz read-out

Appl. Phys. Lett. **114**, 011105 (2019)

A multilevel optical memory that encodes information as the strength of transmission of terahertz radiation through an indium oxide nanoparticle film has been fabricated by scientists in Beijing, China. Hongyu Ji and co-workers from Capital Normal University and the Institution of Semiconductors dissolved 10-nm-diameter indium oxide nanoparticles in ethanol and then spin-coated the mixture onto a quartz substrate and annealed it at 340 °C for 1 hour. Experiments indicate that the terahertz transmission of the sample could be strongly modified by exposure to short-wavelength (ultraviolet or blue) light. The drop in the transmission of the sample was shown to relate to the intensity of the light exposure. The team used four relative transmission levels of 1.0, 0.8, 0.6 and 0.4 to encode information into the sample. If the sample was stored in an oxygen-rich environment, such as air, the memory effect was shown to decay and disappear after the light exposure stopped, allowing information to be wiped. However, when stored in nitrogen, the memory became a stable, non-volatile device. *OG*

https://doi.org/10.1038/s41566-019-0385-7

IMAGING

Subvoxel light-sheet microscopy

Adv. Photon. **1**, 016002 (2019)

A light-sheet microscopy system that is capable of imaging a volume of 100 mm^3 with a spatial resolution of 1.6 μm has been built by scientists from China, USA and Japan. The capabilities of their scheme, called subvoxel light-sheet microscopy (SLSM), are demonstrated with the imaging of a variety of samples, including fluorescent beads, 3D cultured cells, a mouse heart and brain, and a zebrafish embryo with cellular resolution. The approach operates by capturing a stack of low-resolution, shift-modulated images that are then processed by a reconstruction algorithm to create a high-resolution output image of the sample. A benefit of the approach is that it removes the need for any mechanical stitching to create a large field of view. Advances in computer power, notably graphics processing units (GPUs), allow the system to operate with acquisition speeds of gigavoxels per minute. *OG*

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Oliver Graydon, David F. P. Pile and Rachel Won