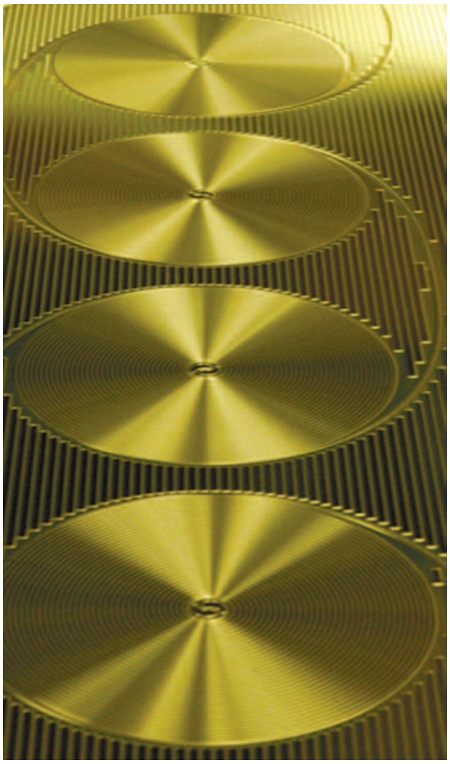
NONLINEAR OPTICS

Supercontinuum on a chip

Opt. Lett. **39,** 1046–1048 (2014)



Supercontinuua are broadband spectra of coherent light that are generated by nonlinear optical processes. Such radiation is useful for applications in imaging, metrology and optical communications. It is usually generated in a length of photonic crystal fibre that has been engineered to possess a large nonlinearity. However, it is desirable to realize sources that are more compact and integrated. Now, Dong Yoon Oh and co-workers from California Institute of Technology and the National Institute of Standards and Technology in the USA report supercontinuum generation from spiral glass waveguides on a chip. Their design consists of a series of four connected silica Archimedean spiral waveguides with a total path length of 3.5 m. Each spiral has an outer radius of 7 mm, and the chip measures 2.5 cm × 6.9 cm. When ultrashort (180 fs) pulses of infrared radiation (wavelength, 1,330 nm) from an optical parametric oscillator were launched into the chip, a broad spectrum spanning 936–1,888 nm was measured. The team says that with further refinement the approach could become a viable platform for performing various nonlinear optics tasks on a chip. *OG*

SILICON PHOTONICS

Stalking light

IEEE J. Sel. Top. Quantum Electron. **20,** 8201710 (2014)

In large-scale photonic integration, it is important to perform circuit monitoring and feedback control of devices to counteract fabrication tolerances, environmental fluctuations and crosstalk effects. An on-chip non-invasive detector that could inspect the light inside optical waveguides without altering its propagation state would be very useful for this purpose. Now, Francesco Morichetti and co-workers in Italy and the UK have demonstrated exactly that. Their contactless integrated photonic probe (CLIPP) is a few hundred micrometres in size and is fabricated on a silicon photonic platform that is compatible with complementary metal–oxide–semiconductor technology. The device works by monitoring the change in the waveguide conductance induced by the interaction of photons with intra-gap energy states localized at the waveguide's silicon–silicon oxide interface. Capacitive access to the waveguide is exploited to avoid direct contact with the waveguide core. Measurements with a dynamic range of 40 dB and a sensitivity as low as −30 dBm in waveguides and high-*Q* resonators were reported. The probe could prove useful for various applications, including telecommunications, optical interconnects, biosensing, and quantum manipulation and computing. *RW*

SOLAR ENERGY

Hot idea

Nature Nanotech. **9,** 126–130 (2014)

Thermophotovoltaic cells are a new breed of hot solar cell. They absorb sunlight and convert it into thermal emission, which then drives electricity generation in a photovoltaic cell. As the absorber can be engineered to capture the entire solar spectrum, this approach is attractive for harnessing all the energy present in sunlight. The feasibility of the scheme has already been reported, but the difficulties in engineering such devices have limited their operational efficiencies to ~1%. Now, Andrej Lenert and co-workers from Massachusetts Institute of Technology in the USA have shown that, by employing multiwalled carbon nanotubes as an absorber and a Si/SiO_2 photonic-crystal structure as a thermal emitter, it is possible to reach an operational efficiency of 3.2% under concentrated (×750) solar illumination. The highest efficiency is obtained at a temperature of about 1,235 K. The team believes that even better efficiencies should be achievable by employing InGaAsSb photovoltaic cells that have higher fill factors, open-circuit voltages and active areas. *OG*

QUANTUM CRYPTOGRAPHY

Room-temperature detection

Appl. Phys. Lett. **104,** 021101 (2014)

Lucian Comandar and co-workers at Toshiba Research Europe and Cambridge University in the UK have demonstrated room-temperature single-photon detectors that support quantum key distribution with record secure key rates of 1.26 Mbit s^{-1} over a fibre distance of 50 km. This performance exceeds even that of cooled detectors. The detector was an InGaAs avalanche photodiode (APD) integrated with electronics based on the self-differencing technique. A pulsed diode laser is synchronized to 1/64 of the APD gating frequency, and its output is attenuated to an average of 0.1 photon per pulse before being coupled to the APD. The APD is switched periodically above and below the breakdown voltage. The team found that the noise is dominated by 'after pulses' for fibre lengths shorter than 65 km and that the noise is reduced at higher temperatures. Consequently, the measured secure key rate at 50 km varied

QUANTUM DOTS

Two-colour emission

Nano Lett. **14,** 456–463 (2014)

Hanbury-Brown and Twiss (HBT) interferometry is a fundamental measurement technique for investigating the quantum coherence of light sources. David Rivas and co-workers from Spain and Italy have now demonstrated a switchable two-colour excitation method based on HBT interferometry for evaluating the exciton and noncorrelated electron–hole dynamics associated with single-photon emission from InAs quantum dots. A single quantum dot is optically excited by light from an 830 nm laser alone, by light from a 790 nm laser alone and by light from both lasers; these three excitation schemes respectively generate neutral excitons, negative trions, and both neutral excitons and negative trions. The simultaneous emission of both excitons and trions results in two-colour emission. To prevent emission from multi-exciton states, the pumping powers of the 830 nm and 790 nm lasers were selected to be 76 nW and 20 μW, respectively. The researchers propose that the simultaneous detection of two-colour, single-photon emission from InAs quantum dots could be used to design a NAND logic gate function. *NH*