one-dimensional wave equations 'driven' by a fluctuating vacuum field. The team predicts that van der Waals and Casimir effects can be transmitted effectively along the waveguides, and that their strength could be enhanced by several orders of magnitude compared with the free-space interaction, depending on parameters such as the distance between the dipoles. Although the theory includes the approximation of perfect conductors at zero temperature, the authors propose that a superconducting coplanar waveguide experiment could be a candidate for experimentally demonstrating the predictions. *DP*

OPTOELECTRONICS

Broadband lasers

Appl. Phys. Lett. **104,** 251101 (2014)

Powerful semiconductor sources of broadband light are useful for sensing, spectroscopy and biomedical imaging schemes such as optical coherence tomography. Although LEDs and superluminescent diodes offer broadband emission, their output powers are usually limited, which restricts applications. Now, a team from China and Scotland report that an InGaAs/GaAs quantum well laser could be a more powerful alternative. Their device emits up to 50 mW of pulsed 1.06 μm light with a large spectral bandwidth of 38 nm. The device was fabricated using metal organic chemical vapour deposition and, contrary to conventional laser diodes and LEDs, it features two additional elements above the active layer of the quantum well — a GaAs tunnel junction for electrons and a GaAs heterostructure. These additions help improve the temperature stability and optical gain of the laser. The design may also prove useful for realizing devices that suit mode-locking for short-pulse generation, or offer tunable or multiple wavelength operation. However, the team says that more theoretical modelling and analysis is required. *OG*

OPTICAL COMMUNICATIONS

A dark soliton laser

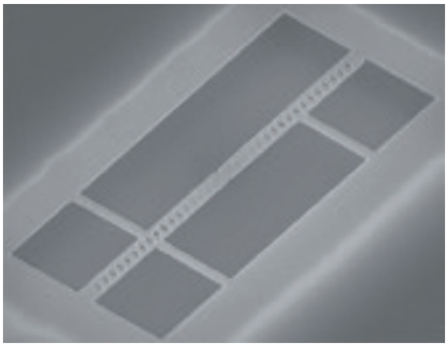
Opt. Lett. **39,** 3484–3487 (2014)

Optical solitons are localized wave packets that retain their shape during propagation in an optical fibre due to the interplay of competing nonlinear and dispersive effects. Those with a peak intensity larger than the background are called 'bright' and those with a lower intensity than the background are called 'dark'. The latter are less sensitive to noise and fibre losses than the bright type and hence are promising for robust optical communication. Now, Y. F. Song and colleagues from the Jiangsu Normal University in China and the Nanyang Technological University in Singapore have demonstrated a dark soliton fibre laser around 1580 nm that operates at repetition rates as high as 280 GHz. The researchers took advantage of the modulation instability induced in a fibre loop cavity to increase the repetition rate of the dark solitons that naturally form. The repetition rate was then externally controlled by adjusting the power of the pump laser. *MM*

OPTOMECHANICS

Nanocavity torque sensor

Phys. Rev. X **4,** 021052 (2014)



APS

The interaction of light with mechanical vibrations is at the heart of many fundamental experiments, including ground-state cooling, mechanical squeezing of light and optomechanically induced transparency. Marcelo Wu and co-workers from Canada have now harnessed the interactions necessary to create an optomechanical torque detector with a sensitivity of 1.3×10^{-21} N m Hz$^{-1/2}$ operating in a vacuum pressure of 2 Torr. The torque detector — composed of a Si-based photonic crystal split-beam nanocavity operating at a wavelength of 1530 nm — was created by using a pair of suspended nanobeam waveguides that were separated by two small (60 nm) air gaps that allowed mechanical movement. The nanobeams were patterned with periodic holes serving as mirrors. When the nanobeams deflect, the cavity's optical resonance and transmission changes and this can be used to determine the magnitude of torque. The optomechanical coupling between the optical mode and the nanocavity mechanical resonances was studied by measuring the optical power transmitted through the split-beam nanocavities. The researchers observed interference between dissipative and dispersive coupling mechanisms and claim that this can be used to further enhance detection sensitivity. *NH*

QUANTUM CASCADE LASERS

2D photonic crystal laser

Opt. Lett. **39,** 3962–3965 (2014)

Quantum cascade lasers are a convenient source of radiation in the terahertz frequency range of the electromagnetic spectrum. Now, Y. Halioua and co-workers from the University of Leeds and the Université de Paris-Sud have reported a device that exhibits extremely low beam divergence and a high output peak power of 17 mW. This was achieved by incorporating a novel type of photonic crystal (PC) design and ensuring that the device only operates on the PC's radiative modes. The use of PC structures offers the benefits of tight optical confinement and ultra-high cavity Q-factors as well as the possibility to control the emitted mode pattern and beam shape. Previously, power was limited by the competition between non-radiative and radiative modes of the PC structure, which can constructively or destructively interfere. The researchers assert that even higher output powers should be possible by increasing the lateral size of the resonator. *MM*

OPTOMECHANICS

Vibrating VCSELs

Nature Commun. **5,** 4038 (2014)

Planar microcavites, which employ distributed Bragg reflectors (DBRs) as 'mirrors', can support both optical and acoustic resonances and thus lend themselves well to observing enhanced interactions between photons and phonons. Thomas Czerniuk and colleagues from Germany, the United Kingdom and Ukraine, have now used picosecond strain pulses in such a structure to achieve 40 GHz modulation of a vertical cavity surface emitting laser (VCSEL). Two different types of VCSEL light-generating active layers were incorporated into DBR microcavities: in the first case, twelve quantum well layers were distributed over three of the multilayer stacks forming the DBR; in the second case, a single quantum dot layer was used. The DBR was formed by AlGaAs/AlAs double layers for the first case, and GaAs/AlAs double layers for the second. The strain pulse was optically excited by a 140 fs laser pulse — from a Ti:sapphire laser centred at a wavelength of 800 nm — incident on a 100-nm-thick aluminium film on the substrate. The same laser was used to drive the laser oscillation in the microcavity. The amplitude of modulation was up to 4% in the first case and 50% in the second. *DP*

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