These features make the fibres suitable for a broadband quantum memory operating at room temperature. *NH*

QUANTUM OPTICS

Optomechanical source

J. Opt. Soc. Am. B **30,** 1683–1687 (2013)

Single photons are among the most crucial elements for experiments in quantum optics, quantum cryptography, quantum communication and quantum computing. Now, Liu Qiu and co-workers from the Institute of Physics, Chinese Academy of Sciences in China have proposed an optomechanical scheme for realizing a source of single photons that does not generate vacuum or multiphoton states. The Chinese researchers modelled a cavity with an oscillating mirror at one end that is coherently driven by a weak pulsed laser field. In this system, the energy of the photon state is reduced by radiation pressure and the resonance frequencies are slightly shifted. The researchers used the quantum trajectory method to numerically simulate the photon probability distribution. They found that it oscillated with respect to the intensity of the driving field in the case of strong coupling between the photon and the oscillating mirror, whereas it exhibited a single peak for weak coupling. The shape of the probability distribution was also affected by the width of the driving laser pulses. The researchers also numerically calculated the second-order correlation of the photons and found that the correlation value was almost zero when the driving field is weak. Their theoretical analysis suggested that a high-performance single-photon light source could be realized by controlling the central frequency, width and amplitude of the driving laser pulses. *NH*

HIGH-FIELD SCIENCE

Unprecedented accuracy

Phys. Rev. A **87,** 053411 (2013)

An accurate and reliable method for measuring extremely high laser intensities of the order of 10^{15} W cm^{-2} has been developed by an international collaboration of scientists. David Kielpinski and co-workers say that their approach has an accuracy of within 1%, which is an order of magnitude better than existing approaches. Precise knowledge of the laser intensity in ultra-intense laser field experiments such as high harmonic generation and above-threshold ionization is important as such processes are highly nonlinear and thus very sensitive to the peak laser intensity. The scheme involves measuring the generation of photoelectrons from a hydrogen-atom beam that intersects the intense laser beam and then comparing the results with numerical solutions of the three-dimensional time-dependent Schrödinger equation. This method eliminates ambiguities and errors that usually arise from theoretical approximations. The researchers say that the scheme can be used to calibrate the peak laser intensity in any high-field experiment for which the photoelectron spectrum can be measured. As a proof of principle, they measured the intensity of a test beam from a 6.3 fs laser operating at a repetition rate of 1 kHz to be 4×10^{14} W cm^{-2} with an uncertainty of just $\pm 0.03 \times 10^{14}$ W cm^{-2}. *OG*

LEDS

Overcoming the 'green gap'

Appl. Phys. Express **6,** 062102 (2013)

At present, *c*-plane GaN crystals are widely used to fabricate violet and blue light-emitting diodes (LEDs). However, achieving efficient operation of green devices at longer wavelengths (>500 nm) is challenging as the large polarization fields in their active regions reduce their radiative recombination rates. This long-standing problem has led to a lack of suitable green semiconductor sources, and is often referred to as the 'green gap'. Now, Yuji Zhao and co-workers at the University of California in the USA and Mitsubishi Chemical Corporation in Japan report miniature (~0.005 mm^2) green InGaN/GaN LEDs on semipolar $(20\overline{21})$ bulk GaN substrates that show an extremely low wavelength shift and a narrow spectral linewidth up to very high current densities (10,000 A cm^{-2}), indicating reduced polarization effects. This contrasts with LEDs having the same indium concentration fabricated on $(20\overline{2}1)$ substrates. Theoretical simulations indicate that the reduced polarization effects in the $(20\overline{21})$ LEDs are caused by electric-field cancelling and Coulomb screening in $(20\overline{21})$ InGaN quantum wells. The team also fabricated small-area (~0.144 mm^2) $(20\overline{21})$ InGaN LEDs and found that they had a smaller wavelength shift and a narrower linewidth than green LEDs fabricated on other planes. These results imply that certain semipolar orientations may be advantageous for realizing stable-emission LEDs and laser diodes used in display and lighting applications. *SP*

ORGANIC OPTOELECTRONICS

White LED

AIP Advances **3,** 052125 (2013)

Scientists in China have fabricated a polymer light-emitting diode (LED) that is capable of emitting white light without using colour-converting phosphors, dyes or blends of several polymers. Their device contains a single thin layer of a polymer called PFB, which is interfaced to the hole transport material PEDOT:PSS and sandwiched between two electrodes. When driven at a few volts, the LED simultaneously emitted blue (490 nm) and red (620 nm) light. The blue emission is due to a conventional molecular lowest unoccupied molecular orbital–highest occupied molecular orbital transition in the material. In contrast, the longer-wavelength red emission originates from the creation of an electrically excited electromer state; it is found to be strongly dependent on the thickness of the PFB layer. Xinping Zhang and co-workers from Beijing University of Technology say that by tailoring the PFB thickness, the intensities of the blue and red emissions can be balanced, enabling the LED to emit white light. *OG*

NONLINEAR OPTICS

Deriving Kerr frequency combs

Opt. Lett. **38,** 1790–1792 (2013)

Despite the recent interest in generating frequency combs from high-*Q* Kerr microresonators pumped by a continuous-wave laser, little is known about the dependence of the comb's characteristics on the pump resonator. Now, by applying the Lugiato–Lefever equation to Kerr combs, Stéphane Coen and Miro Erkintalo from the University of Auckland in New Zealand have derived universal scaling laws that allow the comb bandwidth to be analytically estimated. They obtained a simple equation for estimating the achievable 3-dB comb bandwidth for given pump-resonator characteristics. The findings indicate that the bandwidth is determined solely by a resonator's finesse (or losses), nonlinearity and group-velocity dispersion coefficient. Interestingly and counter-intuitively, the comb bandwidth does not depend directly on the free spectral range (or the mode separation) of the resonator: a larger mode spacing does not result in a broader comb, but simply leads to the same overall bandwidth with fewer modes. They also showed that the route to a stable Kerr frequency comb passes through chaotic states, and that it is critical to control the cavity phase detuning parameter to reach a stable comb. The findings are likely to be very useful for future applications of chip-integrated frequency combs. *RW*

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