MAX PLANCK INSTITUTE
for the science of light

Newsletter

n°6 | June 2013

OSKAR PAINTER APPOINTED MPL'S FOURTH DIRECTOR

Oskar Painter, Professor of Applied Physics at the California Institute of Technology and co-director of the Kavli Institute for Nanoscience, is now director of MPL's fourth division. He has also been awarded an Alexander-von-Humboldt Professorship, which he will hold at the Friedrich-Alexander University in Erlangen. This prestigious research prize brings funding to the tune of €5m over a period of five years. Prof. Painter is a pioneer in the engineering and physics of optical devices at the nanoscale. His current research activities focus on the use of radiation pressure to control the quantum mechanical behaviour of tiny mechanical objects. A great many applications are envisaged, including quantum-limited precision sensors and quantum-optical communication networks. ■

Inside THIS ISSUE

MPL IS THE COORDINATING INSTITUTION FOR BRISQ2

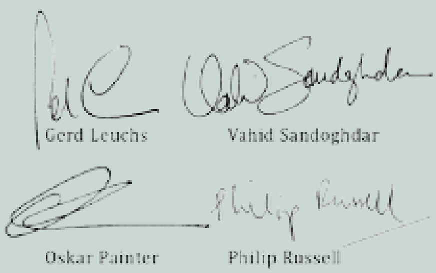
MPL is the coordinating institution for BRISQ2, a three-year EU FP7 project involving research teams from Germany, Italy, Russia, the Czech Republic and Poland. It commenced on December 1st, 2012. The project aims to study bright squeezed vacuum, a state that emerges at the output of an unseeded parametric amplifier. It is called vacuum because it has zero mean values of electric and magnetic fields and hence contains only fluctuations. These fluctuations amount to macroscopic photon numbers and are therefore bright. Bright squeezed vacuum is interesting because it is a counter-example to the widely accepted view that only microscopic objects behave in a truly quantum manner. BRISQ2 will study the quantum nature (nonclassicality, entanglement) of bright squeezed vacuum, and the possibility of engineering or filtering its mode structure. The project also intends to apply bright squeezed vacuum in quantum information technologies such as quantum imaging, quantum metrology, and quantum key distribution. ■

http://brisq2.eu

Message FROM THE DIRECTORS

Every now and then it is time to pause, sit back, and review recent developments at MPL. On this occasion we are tempted to look back a bit further. July 1st this year will be the tenth anniversary of the establishment of both the Institute of Optics, Information and Photonics (IOIP) at the Friedrich-Alexander University (FAU) in Erlangen and what was then called the Max Planck Research Group, which in practice meant a large five year block grant for IOIP. Over the next several years followed a succession of evaluations and celebrations, leading ultimately to the founding of MPL on January 1st 2009. Now, with the recent appointment of Oskar Painter, who has left Caltech to join us, MPL has its full complement of directors. Needless to say, we are very pleased and happy with Professor Painter's decision, and also proud that he has won an Alexander von Humboldt Professorship, just as Vahid Sandoghdar did two years ago. Now the only thing missing is MPL's new building, the ground-breaking ceremony for which will take place on July 11th 2013 at the new site close to the Department of Physics on FAU's science campus. By close coincidence our first recruit in the summer of 2003 was Dr. Sabine König, now Executive Secretary to the Directors (Institutsbevollmächtigte) at MPL. Much of the MPL's success is due to her. Happy Anniversary Sabine!

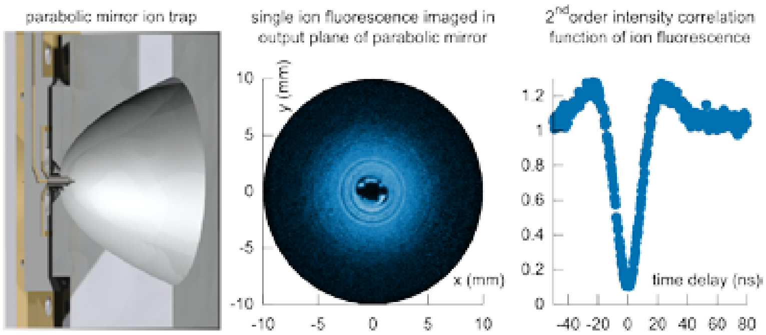
Sharing infrastructure and resources and maintaining close links with FAU, in particular the Department of Physics, is very important to all of us at MPL. On-going strategic developments include several joint academic appointments and research projects, as well as joint participation in the International Max Planck Research School on the Physics of Light (IMPRS-PL) and the Optical Imaging Centre Erlangen (OICE).



RESEARCH *articles*

A SINGLE ION HEADLIGHT

Fundamental research in both quantum optics and optical quantum information technology profits tremendously from efficient interaction of light with material quantum objects. Any tool mediating such interaction should efficiently couple the incident field to the quantum object, or collect photons emerging from the quantum object with high efficiency. Our solution to both requirements is to employ a sufficiently deep parabolic mirror hosting a single ion. The metallic parabolic mirror is used both as the focusing or collimation optics and as one electrode of an ion trap. Additional trap electrodes are housed inside the parabolic mirror by means of a bore collinear to the optical axis of the mirror. The mirror covers 81% of the solid angle and enables coupling strengths, to a linear dipole, of up to 94 % of the maximum possible value in free space. With this set-up we have successfully trapped single Yb ions in the focus of the parabolic mirror. Collection rates leaving the parabolic mirror were as high as 30 million photons per second, making the system a bright single ion headlight. ■



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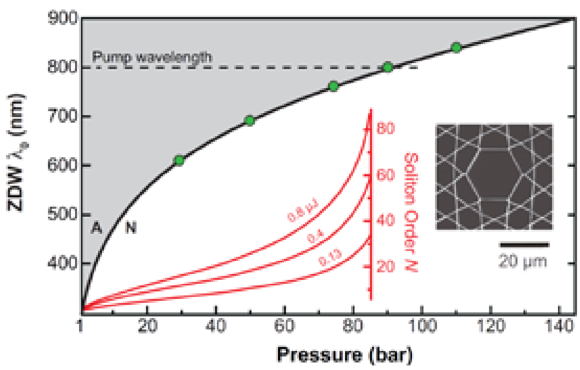
Group: *Leuchs Division*
Reference: R. Maiwald et al., Phys. Rev. A **86**, 043431 (2012).

HIGH PRESSURE FIBRE OPTICS

The effective Kerr nonlinearity of hollow-core kagomé-style photonic crystal fiber (PCF) filled with argon gas increases to ~15% of that of bulk silica glass when the pressure is increased from 1 to 150 bar, while the zero dispersion wavelength shifts from 300 to 900 nm. The group velocity dispersion of the system is uniquely pressure-tunable over a wide range while avoiding Raman scattering—absent in noble gases—and having an extremely high optical damage threshold. As a result, detailed and well-controlled studies of nonlinear effects can be performed, in both normal and anomalous dispersion regimes, using only a fixed-frequency pump laser. The system has great potential for the realization of reconfigurable supercontinuum sources, wavelength convertors and short-pulse laser systems. Other noble gases may be used: for instance, Xe would attain a nonlinearity comparable to that of silica at a pressure of 150 bar. Gas-filled kagomé PCF thus may be viewed as transforming gases into "honorary solid state materials", with the additional advantages of tunable dispersion and extremely high optical damage resistance. ■



Contact: mohiudeen.azhar@mpl.mpg.de
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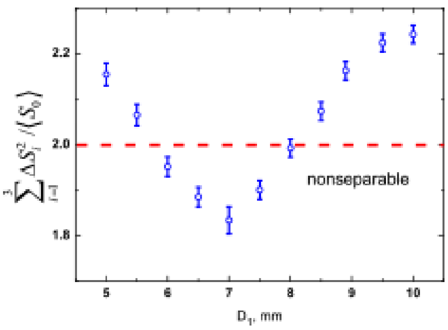
Reference: M. Azhar et al., Opt. Express **21**, 4405-4410 (2013)

ENTANGLED PULSES OF 10^5 PHOTONS

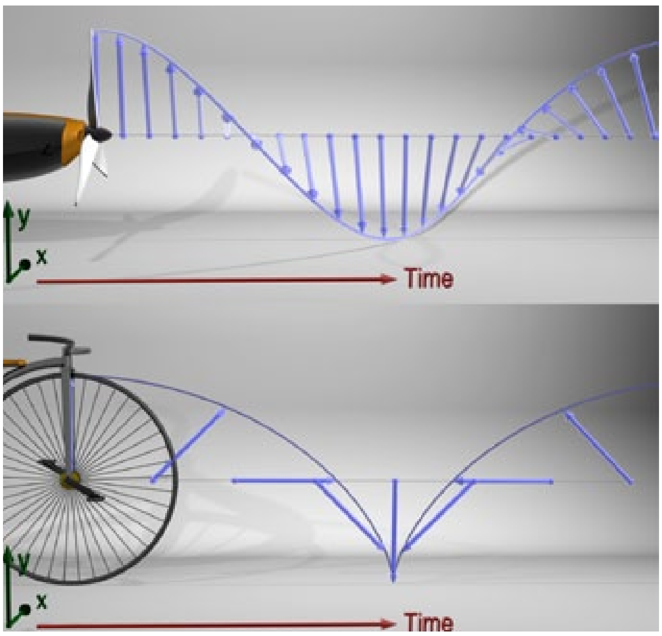
Recently we have produced bright pulses, each containing 10^5 photons, that manifest macroscopic entanglement. Although the photons emitted into beams A and B are randomly polarised, their polarisation states are strictly correlated. This means that the number of photons in any polarization mode of beam A is exactly equal to the number of orthogonally polarised photons in beam B. To verify this entanglement, we used a simple criterion: for a separable (non-entangled) state, the sum of the variances for three Stokes observables normalized to the mean photon number cannot be less than 2. The measurement, performed jointly on beams A and B, shows violation of this condition by more than five standard deviations and thus confirms entanglement. The violation occurs only in a certain range of the diameter D1 of an aperture providing proper mode matching between beams A and B. ■



Contact: maria.chekhova@mpl.mpg.de
Group: *Single Photon Technology TDSU*
Reference: T. Sh. Iskhakov et al., Phys. Rev. Lett. **109**, 150502 (2012).

A PHOTONIC WHEEL

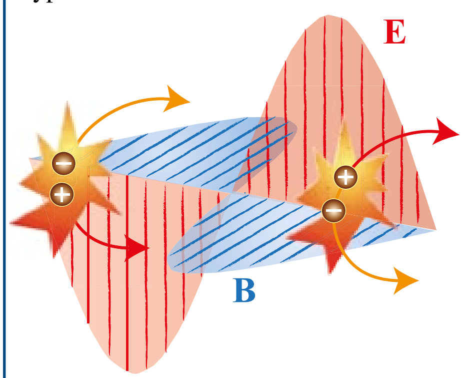
The angular momentum of a massive particle can be arranged to point parallel or transverse to its direction of linear motion. Longitudinal angular momentum is found, for instance, in aircraft propellers. Transverse angular momentum is present, e.g., in a spinning bicycle wheel. When considering a massless wave system, however, the situation seems to be more restricted. Photons can carry two components of angular momentum: spin (linked to the polarization state) and orbital (related to the phase front). Both are longitudinal only (see figure, top). Thus, as far as angular momentum is concerned, light is dynamically closer to a propeller than to a bicycle wheel. We have recently demonstrated the existence of the analogue of a rolling mechanical wheel, namely a novel state of the light field with purely transverse angular momentum – a photonic wheel (see figure, bottom). We create this state by tightly focusing a spin-tailored beam and test it existence experimentally using a nanoprobing technique. A striking possibility unique to this new approach is to induce a rolling movement of a nano-object on a substrate under illumination at normal incidence. ■



Contact: peter.banzer@mpl.mpg.de
Group: *Leuchs Division*
Reference: P. Banzer et al., J. Eur. Opt. Soc. Rapid Pub. **8**, 13032 (2013)

A LINK BETWEEN PARTICLE PHYSICS AND MAXWELL'S EQUATIONS

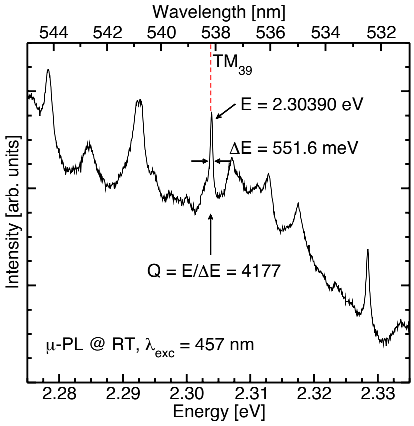
Surprisingly there seem to be unexplored links between classical optics and quantum physics. Maxwell introduced his system of four equations in 1864 and it is astounding that the later revolutions leading to special relativity and quantum physics did not change these equations. They were Lorentz invariant from the start and they also describe the mode functions used in quantum electrodynamics. Yet, with one exception, the parameters in Maxwell's equations determining the spatio-temporal dynamics of light have not been related to the typical relativistic quantum properties of space-time through which they propagate. These parameters are the speed of light, the impedance of the vacuum and implicitly also the zero-energy-value of the fine structure constant. Now—it seems—the link has been found. Particles and anti-particles appear and disappear in the vacuum of the Universe. With these virtual pairs modelled as electric dipoles causing a polarization of the vacuum, the impedance of empty space depends only on the sum of the square of the electric charges of particles (but not their masses). If this model is correct, the value of the velocity of light combined with the value of vacuum impedance gives an indication of the total number of charged elementary particles existing in nature. The energy dependence of the fine structure constant, determined through experiments, supports this hypothesis. ■



Contact: gerd.leuchs@mpl.mpg.de
Group: *Leuchs Division*
Reference: G. Leuchs et al., Eur. Phys. J. D **67**, 57 (2013).

HIGH QUALITY FACTOR WHISPERING GALLERY MODES FROM HEXAGONAL GaN MICRORODS

Self-assembled GaN microrods have been grown on sapphire substrates by metal-organic vapour phase epitaxy without the use of any catalyst and mask. Regular hexagonal shaped microrods formed, with diameters of 3-4 µm, sharp edges and smooth sidewall facets. Micro-photoluminescence investigations showed the existence of whispering gallery modes (WGMs) superimposed on the characteristic yellow defect band of GaN. Many of the WGMs had a quality factor $Q > 1000$, demonstrating the high morphological and optical quality of such microcavities. Calculations are in agreement with the spectral positions of the WGMs. For a transverse magnetic (TM) WGM we observed a Q as high as 4177, which is comparable to the values reported by other groups in GaN microdisks fabricated using a more complicated procedure. We expect that lasing in the visible range can be achieved if these structures are surrounded with an optically active medium, e.g., incorporating InGaN quantum wells or dots. Furthermore, the microrods provide a basis for studying light-matter interactions at room temperature and may also serve as a highly sensitive molecule detectors. ■



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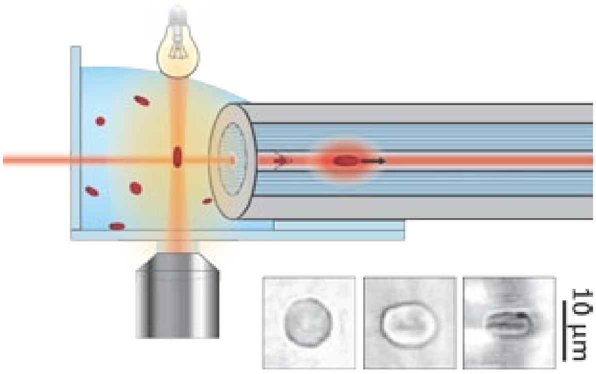
Reference: C. Tessarek et al., Opt. Express **21**, 2733-2740 (2013).

LASER PROPULSION AND DEFORMATION-MONITORING OF CELLS IN OPTOFLUIDIC PHOTONIC CRYSTAL FIBRE

We have developed a new way to study the biomechanical properties of single cells. These properties are important since they are directly linked to the state of health of the cells. The approach is based on laser-propulsion in optofluidic hollow-core photonic crystal fibre (HC-PCF), the hollow core acting as both waveguide and microfluidic channel. Light is guided in a well-defined single optical mode, resulting in highly uniform optical trapping and propulsive forces in the liquid-filled core. Individual red blood cells were laser-propelled over record distances of 10s of cm. The cells propagate along the centre of the core without touching the glass interface, thus avoiding adherence effects. The confined HC-PCF geometry enhances both the optical and viscous forces, permitting cell-mechanical studies at much reduced laser powers compared to existing approaches. Strikingly, the red blood cells were observed to stretch and fold during propagation through the core (see figure). These shape changes were monitored by measuring the related cell speed using a non-imaging Doppler velocimetry technique. The results suggest that HC-PCF will be useful as a new tool in the study of single-cell biomechanics. ■



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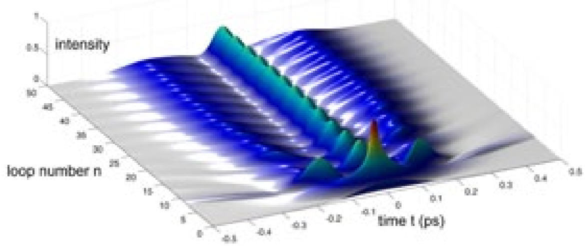
Reference: S. Unterkofler et al., J. Biophoton. DOI: 10.1002/jbio.201200180 (2012).

NONLINEAR DYNAMICS IN THE SUPERCONTINUUM GENERATION REGIME

The possibility of improving noise characteristics via feedback has been demonstrated for example in synchronously pumped resonators such as optical parametric oscillators and mode-locked lasers. Using fs pulses to pump a passive ring-cavity containing a nonlinear dispersion-tailored photonic crystal fibre, we have extended this concept to the regime of supercontinuum generation. We have numerically found that the influence of timing-jitter on cavity dynamics increases for shorter pump pulses and becomes dominant for pulse durations below 200 fs. Timing jitter induces a temporal mismatch between the pump pulse and the pulse circulating inside the cavity, strongly affecting the pulse shape emerging from the combining beam-splitter and being more pronounced for shorter pulses. We have verified this phenomenon by experimentally investigating the bifurcation diagram of the system and have also developed an abstract model of this phenomenon, predicting the existence of several different dynamical regimes (such as the stable high periodicity regime shown in the figure). This model also allows for semi-analytical investigations of the cavity dynamics, which could be used to tailor a specific cavity output. ■



Contact: michael.schmidberger@mpl.mpg.de
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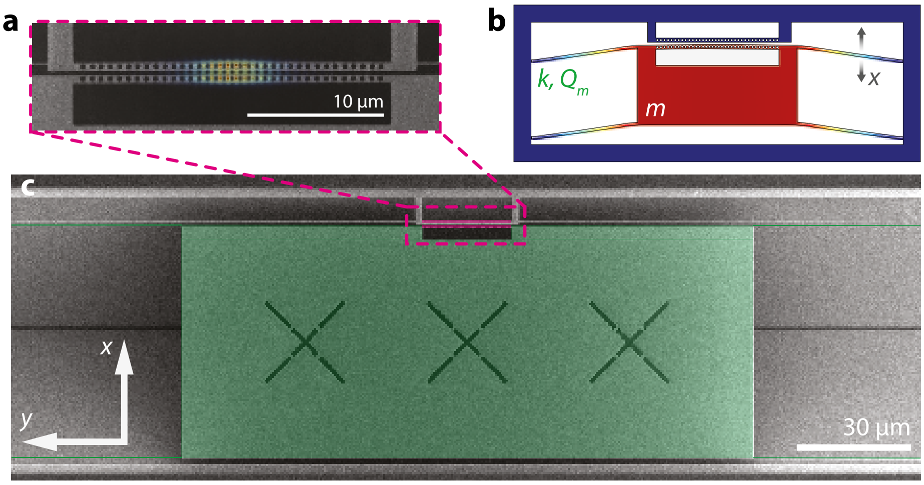
Reference: M. Schmidberger et al., Opt. Lett. **37**, 3576–3578 (2012).

A MICROCHIP OPTOMECHANICAL ACCELEROMETER

Although the average person may not notice them, microchip accelerometers are quite common in our daily lives. They are used in vehicle airbag deployment systems, in navigation systems, and in conjunction with other types of sensors in cameras and cell phones. They have successfully moved into commercial use because they can be made very small and at low cost. In general, accelerometers work by using a sensitive displacement detector to measure the motion of a flexibly mounted mass, called a proof mass. Typically, detection of the motion of the proof mass is performed with an electrical read-out circuit. Electrical circuits inherently suffer from thermal (Johnson) noise. A simple laser and balanced pair of photodetectors, on the other hand, can straightforwardly realize shot-noise-limited detection over relevant bandwidth ranges. In recent work we have demonstrated such a shot-noise-limited optomechanical accelerometer, formed from a silicon microchip and using a specially designed photonic crystal optical cavity (see figure). The photonic crystal cavity used in our work consists of two silicon nitride nanobeams, situated like the two sides of a zipper, with one side attached to the proof mass. When the proof mass moves, it changes the gap between the two nanobeams, resulting in a change in the resonance frequency of the "zipper" cavity.

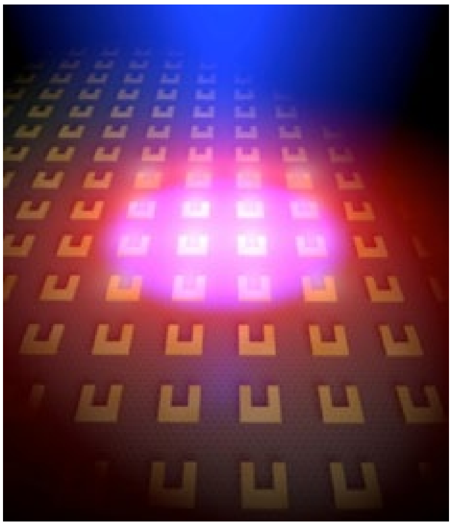


With such a device, displacements of a few femtometres (roughly the diameter of a proton) can be probed on a timescale of a second and for a laser power of only ~ 100 microWatts. Independent of how low-noise one makes the read-out circuit, an accelerometer's resolution is ultimately limited by the thermal Brownian motion of its proof mass. An interesting aspect of the zipper cavity sensor is that the probe laser light used to read-out the proof mass motion, also applies a force that tends to reduce the thermal motion of the proof mass. This cooling down to 3 Kelvin in the current devices dramatically increases the dynamic range of the sensor to over 40 dB. Due to the recent investment into silicon photonics by companies such as Intel and IBM, ultimately we envision these sort of optical accelerometers being integrated with lasers and detectors in a monolithic silicon platform. Beyond consumer electronics, such sensors might also find application in harsh, noisy environments where more conventional sensors fail, such as in oil and gas exploration. ■

Contact: oskar.painter@mpl.mpg.de
Group: *Painter Division*
Reference: A. G. Krause et al., Nature Phot. **6**, 768-772 (2012).

ENHANCED RAMAN SCATTERING OF GRAPHENE USING ARRAYS OF SPLIT RING RESONATORS

Graphene plasmonics, the combination of graphene with plasmonic nanostructures, has recently attracted great interest in research fields such as biochemical sensing, optical detectors and photovoltaics. We have recently demonstrated a novel and tunable platform consisting of graphene monolayers transferred on to arrays of nanometer-sized split ring resonators (SRRs) exhibiting resonances in the visible range. The system is suitable for high sensitivity biochemical detection based on surface-enhanced Raman scattering (SERS). SERS enhancements of up to 75-fold have been measured for graphene, confirming the existence of strong plasmonic coupling between graphene and the SRR



resonances. Distinct resonances resulting in different SERS can be excited by the incident laser light, the photoluminescence signal emitted by the SRR arrays, and the Raman scattered light from graphene. This observation advances our basic understanding of the SERS mechanism and provides new experimental ways for engineering the Raman enhancement in such hybrid structures. Moreover, our advanced SERS substrate is ideal for making controlled contact between the SRR near-field and the molecules to be detected, which would be attached to graphene in future near-field sensing devices. ■

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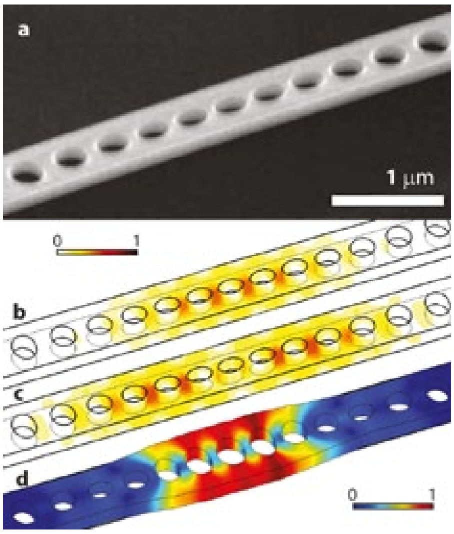
Reference: G. Sarau et al., Adv. Optical Mater. **1**, 151-157 (2013).

COHERENT OPTICAL WAVELENGTH CONVERSION VIA CAVITY-OPTOMECHANICS

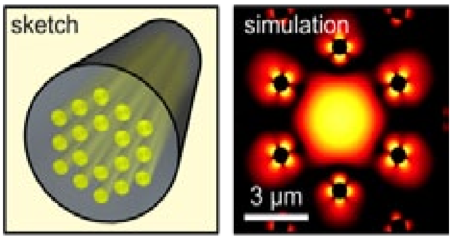
The ability to coherently convert photons between disparate wavelengths has broad technological implications, not only for classical communication systems but also future quantum networks. Most experiments to date demonstrating both classical and quantum wavelength conversion have utilized intrinsic optical nonlinearities of materials. The nonlinear interaction of light with acoustic or molecular mechanical vibrations of materials, for instance, enables a great many optical functions used in high-speed optical communication systems today. In a recent article appearing in Nature Communications, we demonstrate optical wavelength conversion utilizing a simple hybrid optomechanical system (see figure) consisting of an acoustic and optical resonator formed from the top silicon device layer of a silicon-on-insulator wafer typically used in the microelectronics industry. The extreme localization of both acoustic and optical energy in this structure results in a strong radiation pressure interaction between both optical modes and the mechanical motion of the resonator. Optical wavelength conversion is demonstrated over the 1.5MHz bandwidth of the mechanical resonance at a peak internal efficiency exceeding 90%, and with a thermally-limited noise of only 6 quanta, well above the quantum-limited noise of 4×10^{-3} quanta. ■



Contact: oskar.painter@mpl.mpg.de
Group: *Painter Division*
Reference: J. T. Hill et al., Nat. Commun. **3**, 1196 (2012); doi: 10.1038/ncomms2201.

POLARISATION-RESOLVED NEAR-FIELD MAPPING OF A COUPLED GOLD NANOWIRE ARRAY

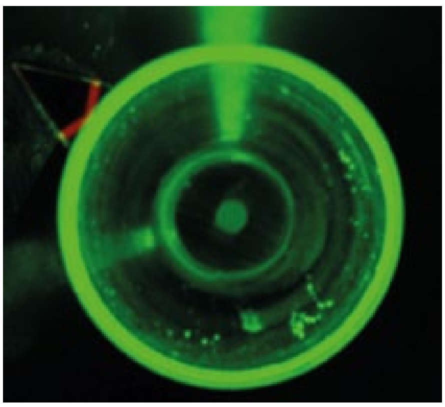
Scanning near-field optical microscopy (SNOM) is a powerful tool for resolving optical features on the nanoscale. We have used SNOM to measure a transverse 2D near-field distribution and have developed a fibre-based calibration technique to measure the local polarisation state of surface plasmon polariton (SPP) modes. The SPPs are guided on a hexagonal array of gold nanowires incorporated into the cladding of a solid-core fused silica photonic crystal fibre (PCF). Because of the close proximity of the nanowires, the individual guided SPPs are coupled to their nearest-neighbours, forming plasmonic supermodes which are excited by launching light into the glass core of the PCF. The guided SPPs show a quadrupolar intensity distribution whose orientation depends on the polarisation of the launched core light. Their local polarisation state is radial, which we were able to resolve using a polarisation-sensitive near-field probe in light-collection mode. All the experimental results were in good agreement with finite-element modelling and coupled-mode-theory. The polarisation-sensitive near-field technique developed is likely to be useful in many areas of nanophotonics. ■



Contact: patrick.uebel@mpl.mpg.de
Group: *Russell Division*
Reference: P. Uebel et al., Opt. Exp. **20**, 28409 (2012); highlighted in Virt. J. of Biomed. Opt. **8** (2013)

SINGLE PHOTONS FROM A WHISPERING GALLERY RESONATOR

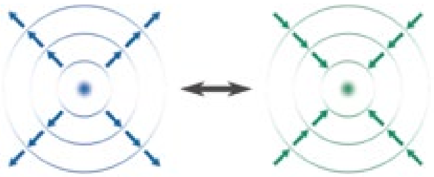
The quantum state of a single photon is among the most fundamental and intriguing manifestations of quantum physics. The implementation of a source of single photons with adjustable spectral properties is pursued by many physicists around the world. Such a source could be used to carry out experiments on the single-photon level on interactions with atoms and molecules, as well as with other single photons. We have experimentally demonstrated a versatile single photon and photon-pair source based on the physics of whispering gallery resonators. A disk-shaped lithium niobate resonator, monolithic and intrinsically stable, generates pairs of entangled photons when excited with green laser light. These photon pairs can be used as a source of heralded single photons. The whispering gallery resonator also allows the central wavelength of the photons to be tuned from the visible to the infrared wavelength regime, and their bandwidth to be varied from 7 to 13 MHz. ■



Contact: josef.fuerst@mpl.mpg.de
Group: *Leuchs Division*
Reference: M. Förtsch et al., Nature Commun. **4**, 1818 (2013).

TIME REVERSAL SYMMETRY IN QUANTUM OPTICS

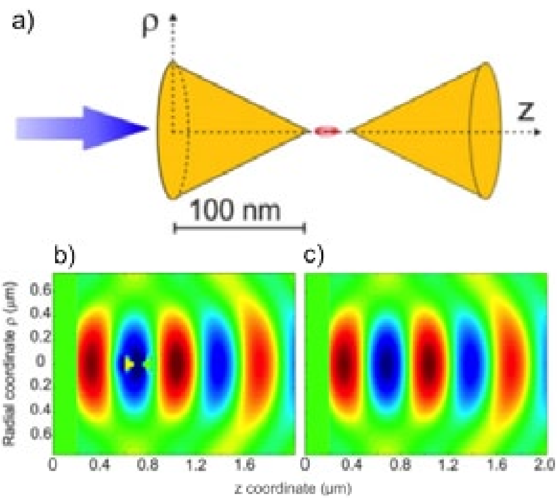
Time reversal symmetry is a powerful concept in physics. It applies to low-energy quantum physics as long as the evolution of the quantum system can be described as unitary. In this sense the spontaneous emission process of a photon by an atom or an atom-like system is a reversible process so long as the photon is not detected. In recent years it has become more and more popular to use time reversal symmetry when planning the implementation of an optics or quantum optics experiment. We review the basic idea underlying time reversal methods, illustrate it with several examples and discuss several implications. The discussion includes an on-going experiment at MPL regarding the demonstration of time-reversed spontaneous emission, i.e., the efficient absorption of a single photon by a single atom. ■



Contact: markus.sondermann@mpl.mpg.de
Group: *Leuchs Division*
Reference: G. Leuchs et al., Physica Scripta **85,** 0581001 (2012); selected by the editors of Physica Scripta as a 'Highlight of 2012'

CLOAKING A LARGE NANOSTRUCTURE BY A SINGLE QUANTUM EMITTER

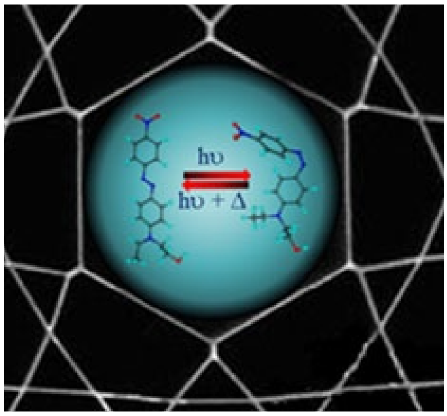
The past decade has witnessed a growing fascination with the effect that metallic structures have on the optical properties of atoms and molecules. In the cases studied, the metallic structure usually acts as an optical antenna either to modify the spontaneous emission, to open new non-radiative channels or to enhance the Raman cross-section. We have now asked the question how a single quantum emitter could affect the optics of a metallic structure. In particular, we have examined two extreme regimes: very small particles whose optical properties are dominated by absorption, and "large" nanoparticles dominated by scattering. To treat the coherent interaction of incident light with a composite of a metallic particle and a quantum emitter (part (a) of figure), we have developed a general theoretical platform based on quantized radiation in absorptive and inhomogeneous media and have examined the response of the composite as a function of the structure size and separation from the emitter. In the case of larger structures, we show that a single atom or molecule can eliminate both scattering and absorption so that the metallic structure is cloaked. This is particularly impressive because the metallic structure alone would nearly fully block the incident light! Part (b) of the figure illustrates an example where an incident beam of light goes through the emitter-metallic composite without any distortion. For comparison we show the free-space propagation of the same beam in part (c) of the figure. Since the emitter transition can be manipulated in various ways (Stark effect, photo-switching, optical pumping, etc.), the composite system or a macroscopic array of such structures could act as an active metamaterial, allowing active switching of the beam. ■



Contact: xuewen.chen@mpl.mpg.de
Group: *Sandoghdar Division*
Reference: X. Chen et al., Phys. Rev. Lett. **110**, 153605 (2013).

PHOTOCHEMICAL KINETICS MEASURED WITH SUB-PICOMOLE SENSITIVITY IN HOLLOW-CORE PHOTONIC CRYSTAL FIBRE

Applications of photochemistry are emerging in areas such as photo-medicine, artificial photosynthesis and optically switchable media. This is stimulating work on the synthesis and characterization of novel photoactive compounds. Here we use hollow-core photonic crystal fibre (HC-PCF) as an optofluidic microreactor for the measurement of photochemical kinetics. All the hollow channels in the fibre are filled with the liquid solution, light being tightly guided in the central hollow core. The resulting strong interaction has allowed for the first time measurement of the photoisomerisation quantum yields for "push-pull" azobenzenes in solution at room temperature – challenging because of thermal isomerisation is very rapid. The measured isomerisation rate constants are in excellent agreement with those established previously in conventional cuvette-based experiments. An additional advantage of HC-PCF is that the long path-length allows monitoring of photochemical reactions by absorption spectroscopy to unprecedented sub-picomole sensitivities. This enables measurements in solvents in which the dyes are too insoluble to permit conventional cuvette-based measurements. This work is the result of an on-going collaboration with the group of Dr. Anita Jones in the School of Chemistry at the University of Edinburgh. ■



Contact: tijmen.euser@mpl.mpg.de
Group: *Russell Division*
Reference: G. O. S. Williams et al., Lab Chip **12**, 3356-3361 (2012).

SILKE CHRISTIANSEN JOINS THE HELMHOLTZ CENTRE BERLIN

On the 1st of January this year, materials scientist and TDSU head Silke Christiansen was appointed to lead the newly founded institute Nano-Architectures for Solar Energy Conversion at the Helmholtz Center Berlin (HZB). Focusing on nano materials, she will be closely involved in supporting HZB's work on thin film photovoltaics and solar fuels. She will maintain a part-time position at MPL, and plans to run a joint research program on nano-materials development at both institutions, supporting many different research projects. Her current TDSU team numbers some 20 scientists, students and technicians, working on the synthesis and analysis of complex nanocomposites and nanostructures grown using techniques such as chemical vapour deposition (CVD), plasma-enhanced CVD, metallo-organic CVD and atomic layer deposition as well as electron beam evaporation and sputtering. We thank her for all the effort she has put into setting up the photonic nanostructures TDSU at MPL, wish her all the best in her future work at HZB and look forward to on-going fruitful collaboration in the years to come. ■

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HUMBOLDT AWARD

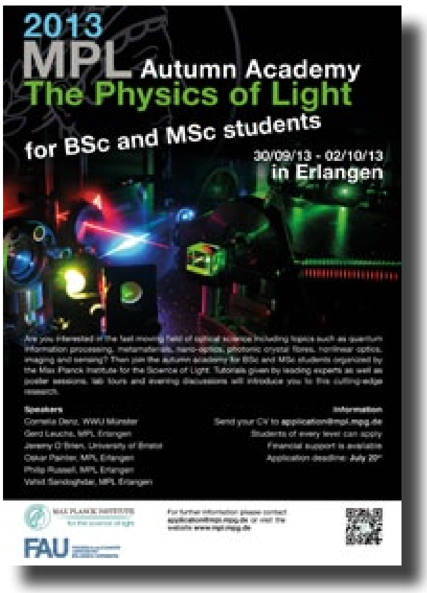
At the award ceremony for Oskar Painter's Humboldt Professorship in Berlin. From left to right: Gerd Leuchs, Philip Russell, Prof. Dr. Karl-Dieter Grüske (President of FAU), Prof. Dr. Johanna Wanka (Bundesministerin für Bildung und Forschung), Oskar Painter, Prof. Dr. Helmut Schwarz (President of the Humboldt Foundation) and Vahid Sandoghdar. ■

Foto: Humboldt-Stiftung/David Ausserhofer

NEWS IN BRIEF

- **Tijmen Euser** (Russell Division) is the new scientific coordinator of the **International Max Planck Research School for the Physics of Light (IMPRS-PL)**.
- **Irene Weinzierl** (Sandoghdar Division) elected equal opportunity commissioner at MPL.
- **Philip Russell** awarded the 2013 European Physical Society Prize for Research into the Science of Light.
- **Oskar Painter** has been awarded an Alexander-von-Humboldt Professorship.

AUTUMN ACADEMY 2013



Preparations have started for MPL's second Autumn Academy. The aim is to introduce BSc and MSc students to the fast moving field of optical sciences including topics such as quantum information processing, meta-materials, nano-optics, photonic crystal fibres, nonlinear optics, imaging and sensing. Tutorials will be given by invited lecturers and MPL directors. Poster sessions, lab tours and evening discussions complete the programme.

The deadline for applications is July 20th and students will be selected according to their qualifications. The number of participants is limited to 25. Interested students should send a curriculum vitae and copies of their high-school/A-level/baccalaureate certificates to application@mpl.mpg.de. University grades (if any) would also be useful, as would a short statement explaining why they would like to attend the Academy. More information will soon appear on the MPL website. ■

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