MAX PLANCK INSTITUTE
for the science of light

Newsletter

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NEW BUILDING OPENING CEREMONY

On October 5, 2016 MPL celebrated the opening of its new building in Staudtstrasse, close to the southern campus of Erlangen's Friedrich-Alexander University (FAU). The ceremony began with a welcoming speech by Gerd Leuchs, 2016 Managing Director of MPL. This was followed by greetings from Prof Dr Martin Stratmann, President of the Max Planck Society, Frau Ilse Aigner, Bavarian State Minister of Economic Affairs and Media, Energy and Technology, Prof Dr Joachim Hornegger, President of FAU and Dr Florian Janik, Bürgermeister of Erlangen. In a wonderful and memorable occasion the new MPL building was officially handed over—in style. ■

Inside THIS ISSUE

SYMPOSIUM ON SYSTEMS NEUROSCIENCE

On January 2017, a symposium on Systems Neuroscience was held at MPL, organized in association with FAU's Institute of Physiology and Pathophysiology and the planned Erlangen-based Max Planck Centre for Physics and Medicine. Over the past decade dramatic developments in optical and electrophysiological methods have opened a new window into the brain, making it possible to study core questions in neuroscience. The symposium focused on the use of physical methods and novel stimulation and recoding techniques to manipulate and resolve cellular and subcellular events in defined brain circuits. Ten international invited speakers and over 150 scientists from Erlangen attended the event, engaging in lively discussions. ■

Message FROM THE DIRECTORS

Finally we have been able to move to the new building! Roughly three years after the ground-breaking ceremony in July 2013, the official inauguration took place on October 5, 2016. During that memorable event, dignitaries from politics and science were present, including the MPG president Martin Stratmann and the Bavarian Minister of Economic Affairs, Ilse Aigner. The lab moves were successfully completed before the end of the year, and we are now ready to do science again.

The new building offers great facilities, including those for visitors, many of whom are enjoying the modern guest rooms on the roof. Its first scientific workshop took place in January, dedicated to "systems neuroscience", a topic connected to the upcoming Erlangen Centre for Physics and Medicine. We have also restarted the Distinguished Lecturer Series after a break related to the move. A new cafeteria provides catering for MPL events as well as tasty food and an everyday meeting place for the whole institute.

The general public got a taste of our research in a Saturday morning lecture delivered by Gerd Leuchs, which was extremely well attended with some 250 visitors, the crowd spilling out into the foyer. We have launched a series of events dedicated to strengthening the communication within the institute, including a TDSU workshop, an MPL general assembly, an institute-wide Christmas party, a weekly Thursday tea-time and an institute-wide program of internal seminars.

We are happy to report the arrival, in January, of the MPRG junior group led by Claudiu Genes. Finally, in November 2016 we received the good news that IMPRS-PL will be renewed for another six years, starting 2018! Right now, we are looking forward to the evaluation of MPL by our scientific advisory board, which will take place in March.

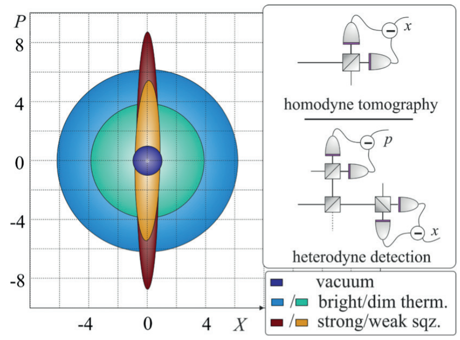
GERD LEUCHS | PHILIP RUSSELL

VAHID SANDOGHDAR | FLORIAN MARQUARDT

RESEARCH *articles*

OVERCOMING VACUUM NOISE BY QUANTUM HETERODYNE DETECTION

Homodyne and heterodyne detection are two well established measurement schemes that are applied widely in the radio and telecom domains as well as in fundamental science. Homodyne detection projects a quantum state onto a single field quadrature, whereas heterodyne detection provides information about two conjugate quadratures simultaneously. Following from Heisenberg's uncertainty principle, such a measurement is necessarily corrupted by an additional unit of vacuum noise. As a consequence, it was widely conjectured that the estimation of a quantum state from heterodyne data would be less accurate than an estimation based on homodyne detection. We have been able to refute this conjecture from theoretical considerations, and have confirmed this experimentally. We find the intriguing result that for all Gaussian states (apart from a small subset of states close to the vacuum state), state estimation via heterodyne detection is actually more accurate. The message is clear and general: as long as there is no prior knowledge about the measured Gaussian states, heterodyne detection is clearly advantageous over homodyne techniques. ■



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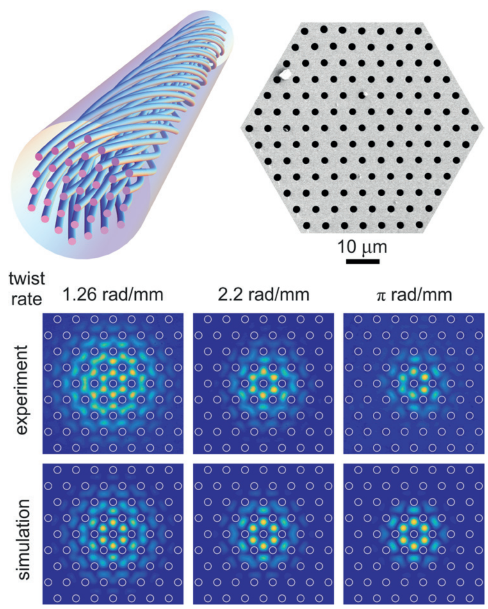
Group: *Leuchs Division*
Reference: C. R. Müller et al., Phys. Rev. Lett. **117**, 070801 (2016).

TWIST-INDUCED GUIDANCE IN CHIRAL PCF WITH NO CORE

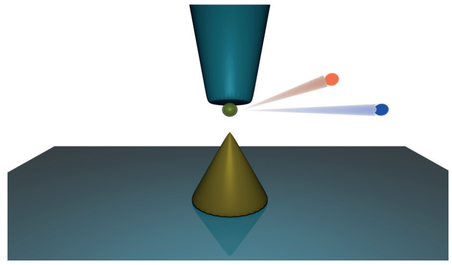
We have discovered a new mechanism of light guidance, in a helically twisted coreless photonic crystal fibre. Guidance arises from the geometrical increase in optical pathlength with the square of the radius, which raises the periodic refractive index profile quadratically with radius. As a result, rays of light refract outwards from the axis, following curved geodesics, until they reach the radius at which they encounter a photonic bandgap, when they are reflected back towards the axis. Using mathematical tools from general relativity (although there seems to be no astronomical equivalent of helically twisted space), we show that the light rays follow closed spiral paths within the chiral channel, forming modes that carry orbital angular momentum and whose effective area falls with increasing twist rate. Unlike in conventional index-guiding fibres, where the guided mode shifts towards the outside of the bend ("normal cornering"), this extraordinary mode shifts inwards ("anomalous cornering"). Hamiltonian optics shows that the mode has negative effective mass, so that it moves in the opposite direction when subject to bend forces. ■



Contact: gordon.wong@mpl.mpg.de
Group: *Russell Division*
Reference: R. Beravat et al., Science Adv. **2**, e1601421 (2016).

BIEXCITON EMISSION STRONGLY ENHANCED BY PLASMONIC NANO-CONE

Semiconductor quantum dots (Q-dots) are desirable in many applications because they can emit multiple photons for each excitation pulse via the generation of multiple excitons. In practice, however, multi-excitonic emissions are hampered by fast nonradiative decay-channels such as Auger recombination. By making use of the large radiative enhancement in the near-field of a gold nano-cone antenna, we have demonstrated a significant improvement in Q-dot biexciton emission efficiency. The nano-cone was fabricated by focused ion beam milling and a single Q-dot was positioned in its near-field with nanometer accuracy using scanning probe technology. A careful and thorough measurement of the fluorescence emission rate, lifetime, and second-order autocorrelation function, at various excitation powers and separations between the Q-dot and the nano-cone, allowed us to determine a radiative enhancement factor of about 100 for both the excitonic and biexcitonic emission channels. This resulted in more than an order of magnitude improvement in biexciton emission efficiency. The findings are in good agreement with theoretical calculations, which suggest that the current enhancement factors are limited by the finite size of the Q-dot. ■



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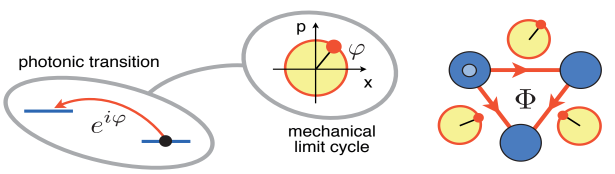
Reference: K. Matsuzaki et al., Scientific Rep. **7**, 42307 (2017).

DYNAMICAL GAUGE FIELDS IN OPTOMECHANICS

Photons do not carry charge and do not feel real magnetic fields. Nonetheless, in the past few years researchers have suggested ways to engineer artificial magnetic fields for photons, for example using time-dependent modulation acting on a photon that tunnels between two coupled optical modes. We have recently discovered how these artificial static gauge fields can be turned into dynamic gauge fields, by exploiting the optomechanical coupling between photons and phonons. In our approach, the value of the gauge field is determined by the oscillation phase of a mechanical vibration. This phase in turn will evolve in time. Therefore, in such a system there is a dynamical interplay where the gauge field (mechanical oscillations) determines the flow of light, and conversely the light modifies the spatial distribution of the gauge field. The resulting dynamics can already show very rich nonlinear phenomena even for a small system with three coupled optical modes. First implementations in smaller structures seem feasible given some recent experimental advances, where static gauge fields were implemented in a set-up that is close to the geometry needed here. ■



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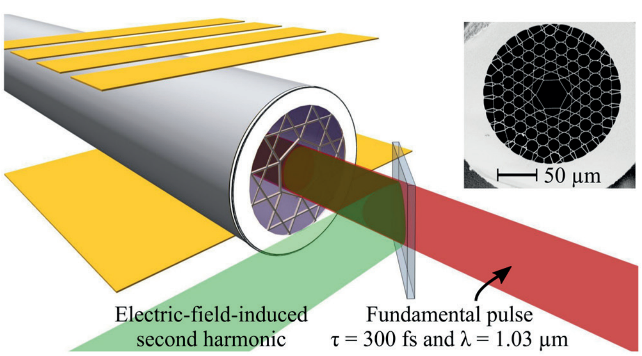
Reference: S. Walter et al., New J. Phys. **18**, 113029 (2016).

ELECTRIC-FIELD-INDUCED SECOND HARMONIC IN HOLLOW-CORE PCF

It is well known that optical media such as glasses and gases are centrosymmetric and so do not exhibit second-order nonlinear effects. But this rule can be overcome if a dc electric field is used to break the centrosymmetry and induce an effective second-order nonlinearity. We have demonstrated this effect by placing a gas-filled kagomé-style hollow-core photonic crystal fibre (kagomé-PCF) between two electrodes and monitoring the electric-field-induced second harmonic generation. We take advantage of the tunable dispersion of these fibres (via an adjustable gas pressure) to optimize intra-modal phase-matching conditions. When femtosecond pulses are launched in the fundamental LP_{01} mode, SH can be generated in the LP_{02} mode with a conversion efficiency of 18%/mJ. Also, using a customized periodic electrode to create quasi-phase-matching, we demonstrated generation of SH directly in the low-loss LP_{01} mode. The tunability of the system, together with the broadband guidance of kagomé-PCF, makes it highly promising for three-wave mixing with femtosecond pulses in difficult-to-access regions of the electromagnetic spectrum, such as the ultraviolet and the terahertz. ■



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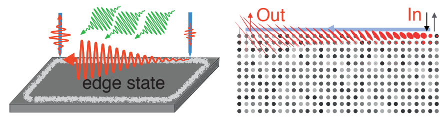
Reference: J.-M. Ménard et al. Opt. Lett. **16**, 3795-3798 (2016).

TOPOLOGICAL QUANTUM FLUCTUATIONS AND TRAVELLING WAVE AMPLIFIERS

Topologically protected transport of various kinds of physical excitations (electrons, photons, atoms, phonons, etc.) has received a lot of attention in recent years. The defining characteristic of such systems are chiral (or helical) edge channels propagating near the sample boundary. These edge channels do not suffer backscattering even if disorder is introduced, making them more attractive than standard waveguides for applications. A novel regime is entered when the interplay of topology with nonlinearity is considered. By investigating topological transport in a nonlinear optical system, we have found that the chiral edge channels can be turned into a unidirectional amplifier. Such an amplifier could be very useful, as it completely decouples the fragile signal source from the fluctuations of the subsequent amplifier stages. At the same time, this amplifier is of the travelling-wave variety and therefore does not suffer the constraints on gain and bandwidth that are typically found in resonant systems. Our work is also the first where nontrivial behaviour of bosonic quantum fluctuations (e.g. squeezing) is discussed in the context of topological transport. ■



Contact: florian.marquardt@mpl.mpg.de
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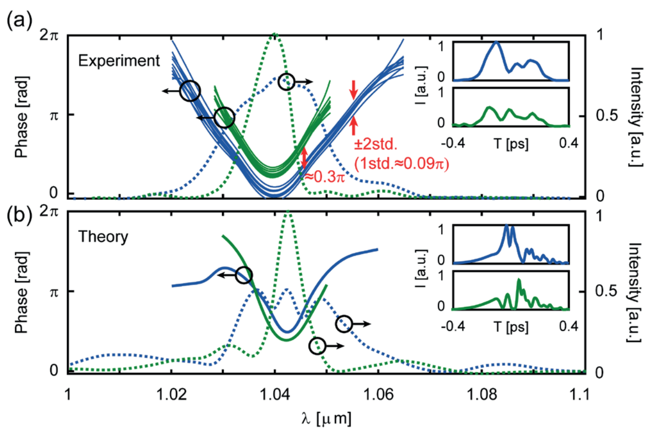
Reference: V. Peano et al., Phys. Rev. X **6**, 041026 (2016).

ULTRAFAST PHASE RETRIEVAL USING SPECTRAL INTERFEROMETRY

Dispersive Fourier transformation (DFT) provides a means of mapping the spectral content of a laser pulse to the temporal domain. It has long been used to rapidly access the spectrum of ultrashort pulses at high-repetition rates and, for example, to study the fast evolution of supercontinuum generation. In recent work we combined DFT with Fourier transform spectral interferometry so as to reconstruct the spectral amplitude and phase of a pulse travelling in a synchronously-pumped fiber ring cavity at a repetition rate of 80 MHz. Depending on the precise temporal overlap between the pulse travelling in the ring cavity and the fs-pump we show that both the spectral content and the phase of the circulating pulse change rapidly at every cavity round trip. We focused on two dynamical regimes: a period-two and a highly complex regime. Although the technique is particularly suitable for studying the ring cavity, it can easily be adapted to other experiments where rapid pulse-to-pulse dynamics are to be monitored. ■



Contact: nicolas.joly@mpl.mpg.de
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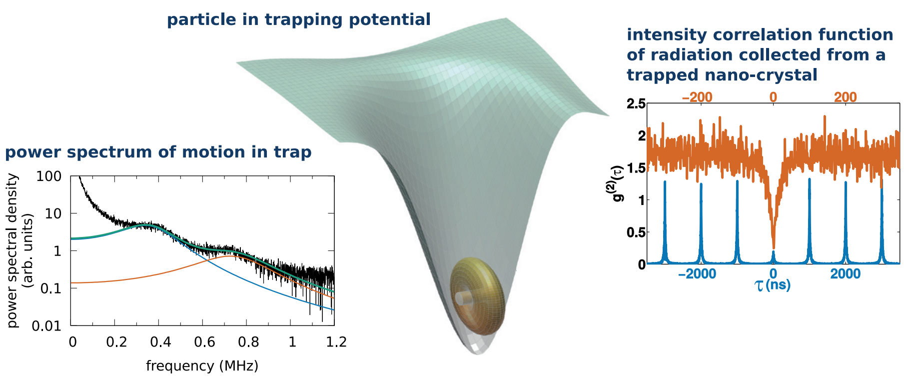
Reference: J. Hammer et al., Opt. Lett. **41**, 4641–4644 (2016).

OPTICAL TRAPPING OF NANO-CRYSTALS IN A PARABOLIC MIRROR

Tight focusing of light by a deep parabolic mirror provides a promising means of efficiently interfacing photons and quantum targets. For solid state objects, the use of solid materials to mount the target in the focal region is highly detrimental to tight focusing. Employing optical tweezers, exploiting the focusing of a suitably shaped mode by the parabolic mirror, is an elegant way to circumvent such issues and to trap a particle 'in place'. We have established such optical tweezers, trapping colloidal dot-in-rod nano-crystals inside a parabolic mirror at ambient pressure. These crystals are currently investigated as room-temperature single-photon sources. The results open up the possibility of efficiently collecting the photons emitted by these crystals and readily applying the toolbox we have developed (in experiments with atomic ions) to the efficient coupling of light and solid-state quantum systems. As a further benefit, an optical trap based on focusing from a full 3π solid angle has the tightest and deepest trapping potential obtainable in free-space focusing, making the set-up attractive for opto-mechanical experiments. ■



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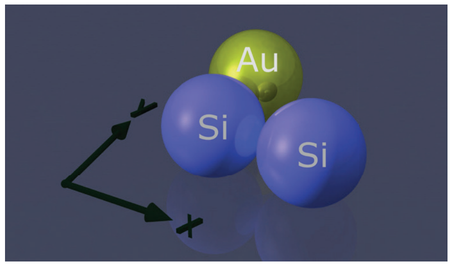
Reference: V. Salakhutdinov et al., Optica **3**, 1181-1186 (2016).

CHIRAL OPTICAL RESPONSE OF NANOPARTICLE ENSEMBLES

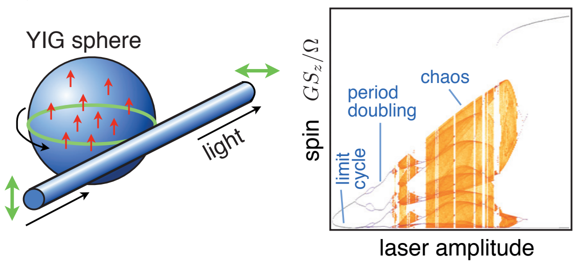
Chiral light-matter-interactions are intriguing phenomena, linking the geometry and symmetry of certain molecules or nanostructures with their ability to sense the handedness of light. Recently, numerous concepts for designing chiral nanostructures have been proposed. It was also shown that even planar structures can exhibit a chiral optical response if they lack mirror symmetry in 2D. In all the cases reported so far, the chiral optical response is the result of a chiral or asymmetric geometry. We now have shown for the first time that a heterogeneous material composition of a 2D nanostructure can result in chiral optical response, even though the structure might be geometrically symmetric. We investigate this novel concept experimentally and numerically, using a single geometrically mirror-symmetric 2D nanostructure assembled from achiral building-blocks made from different materials (see figure). The observed chiral effect is caused by the resonance behaviour of the equally sized and shaped constituents, with the heterogeneous material selection breaking the symmetry of the system. The concept opens up a new avenue for designing chiral media at the nanoscale. ■



Contact: peter.banzer@mpl.mpg.de
Group: *Leuchs Division*
Reference: P. Banzer et al., Nat. Comm. **7**, 13117 (2016).

COUPLED SPIN-LIGHT DYNAMICS IN CAVITY OPTOMAGNONICS

Historically, the ability to manipulate magnetization has been of crucial importance in information processing. Classically, magnetization couples to light via the Faraday effect. The polarization angle of the light rotates due to the magnetization, whereas the light produces a (small) effective magnetic field on the spins. Very recently, experiments have started exploring this coupling for quantum information processing. At the end of 2015, coherent coupling between optical photons and magnons (the elementary excitations of a magnetically ordered material) was demonstrated in YIG for the first time. This material serves both as a host for the magnons and as a cavity for the photons. In recent work, we have derived the generic Hamiltonian for cavity optomagnonics, showing that the magnetic dynamics can be controlled by tuning the intensity or frequency of an applied laser. The system is highly nonlinear, and different dynamical regimes can be achieved: from magnetization switching (analogous to flipping an information bit) to chaotic behaviour (see figure). Optomagnonic systems show great promise for future quantum devices, and our work is a first step in the study of their capabilities. ■



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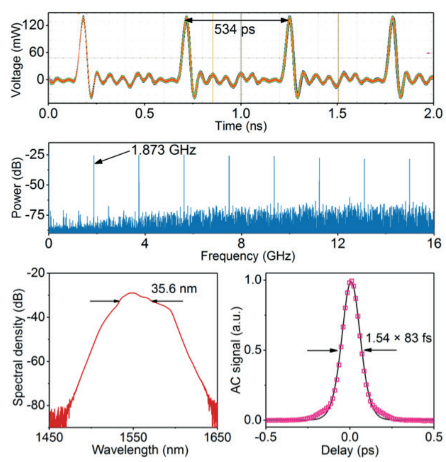
Group: *Marquardt Division*
Reference: S. V. Kusminskiy et al., Phys. Rev. A **94**, 033821 (2016).

FEMTOSECOND FIBER LASERS REACH GHZ REPETITION RATE

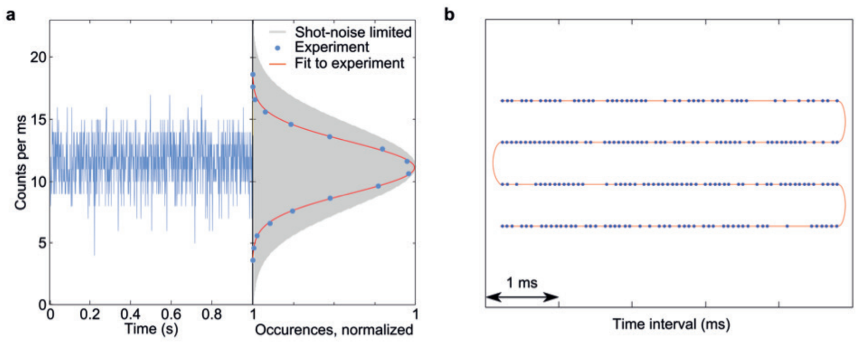
Pulsed fibre laser sources that simultaneously offer GHz repetition rates and ultrashort pulse durations have proved very difficult to achieve. Current pulsed fibre lasers capable of delivering sub-100-fs pulses require intracavity pulse energies in the nanojoule range, so that scaling these lasers to GHz rate necessitates a very high average power level and complex cladding-pumped configurations. We have recently developed a GHz-rate ultrafast Er-fibre laser with only tens of pJ intracavity pulse energy, enabled by a unique "stretched-soliton" laser design. In the laser cavity, strong dispersion-management dramatically reduces the intracavity Kerr-nonlinearity. The weak residual anomalous dispersion is perfectly balanced by the low Kerr-nonlinearity, resulting in the formation of temporally stretched, soliton-like pulses, while a lumped wavelength-dependent attenuator compensates for the effects of the gain filtering in the Er-doped fiber on the pulse spectrum, ensuring laser pulse self-consistency. This "stretched-soliton" design, combined with a harmonic mode-locking technique based on intense opto-acoustic interactions in solid-core photonic crystal fibre, has yielded for the first time a low-cost, all-fibre laser delivering 85 fs, dispersive-wave-free pulses at 1.872 GHz repetition rate. The system is long-term stable—we have run the laser for weeks without any sign of instability. ■



Contact: wenbin.he@mpl.mpg.de
Group: *Russell Division*
Reference: W. He et al., Optica, **3**, 1366-1372 (2016).

INTENSITY-SQUEEZED LIGHT FROM A SINGLE-MOLECULE PHOTON GUN

Generation of light with intensity fluctuations below the shot-noise limit has been one of the most important challenges in quantum optics. An elegant approach was proposed in the 1980s: through excitation of a two-level atom, a stream of single photons is generated, ideally with no photon number fluctuations. Experimental realizations of such a deterministic single-photon source (SPS) have been hindered by large losses. Using a planar metallo-dielectric antenna applied to an organic molecule, we have now demonstrated the most regular single photon stream reported to date. A metallo-dielectric antenna re-shapes and directs the emission of an emitter into a solid angle that is small enough for collection by a conventional microscope objective. Figure (a) shows the measured sub-Poissonian nature of the SPS. The intensity noise is reduced by 40% (blue) relative to a shot-noise limited source (grey), equivalent to 2.2 dB of intensity squeezing. The remarkable regularity of the SPS is shown in Fig. (b), where individual photon detection events are portrayed. Such an intensity-squeezed SPS would be desirable in quantum imaging, sensing, precision measurements and information processing. ■



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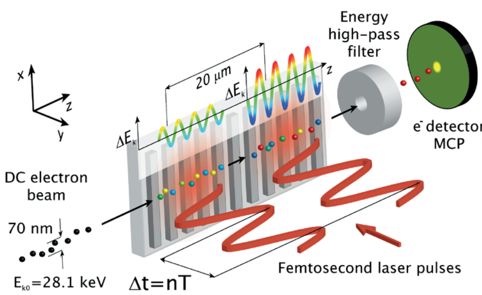
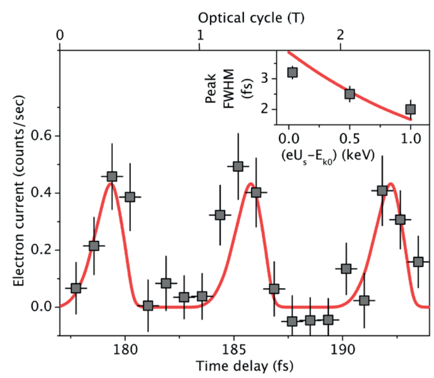
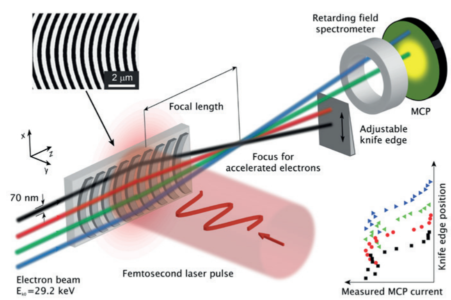
Group: *Sandoghdar Division*
Reference: X.-L. Chu et al., Nat. Phot. **11**, 58-62 (2017).

REVIEW: SMALL-FOOTPRINT PARTICLE ACCELERATOR OF THE FUTURE





Particle accelerators have become essential scientific tools over the last century, enabling experiments that probe high energy physics, study ultrafast phenomena and utilize powerful coherent x-ray sources. To increase the availability and decrease the cost of these exciting devices, novel acceleration schemes have recently received extensive attention from researchers. One such novel design is the dielectric laser accelerator (DLA) that is being developed by the Hommelhoff group. DLAs operate via the interaction of electrons travelling across optical near-fields excited by ultrafast laser pulses incident on dielectric nanostructures. The gigavolt per meter field gradients of these near-fields enable acceleration gradients that are 10-100 times larger than those in classical RF accelerators, allowing for the miniaturization of accelerators as research tools. Spearheaded by the proof-of-concept work of the Byer group at Stanford with relativistic electrons [1], and the Hommelhoff group with non-relativistic electrons [2], the field of DLAs has made great experimental progress recently. In combined efforts, the groups have jointly shown DLA-based acceleration of sub-relativistic (25 keV) electrons with gradients exceeding 200 MeV/m and energy gains exceeding 10% of the initial electron energy, phase-controlled staging of acceleration with multiple laser pulses, transverse focusing of electrons with DLA-based elements, and attosecond gating and streaking of electrons with DLAs [3,4]. Additionally, collaborating groups at Stanford University, UCLA, and the SLAC Linear Accelerator have demonstrated DLA-based acceleration of relativistic (8 MeV) electrons with gradients exceeding 700 MeV/m. This work is not only the foundation of a blossoming field of study but also of the recently started ACHIP (Accelerator on a Chip International Program) collaboration funded by the Gordon and Betty Moore Foundation. In addition to the aforementioned groups, participating institutions include TU Darmstadt, DESY, the Paul Scherrer Institute, Purdue University, and the Tech-X Corporation. ■



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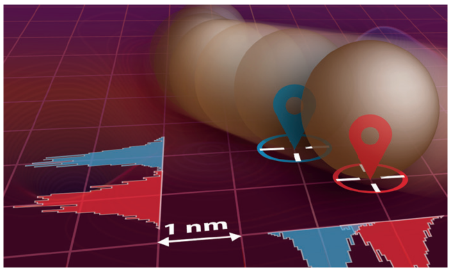
[1] J. Breuer et al., Phys. Rev. Lett., **111**, 134803 (2013).
[2] E. A. Peralta et al., Nature **503**, 91-94 (2013).
[3] M. Kozák et al., Nat. Comm. **8**, 14342 (2017).
[4] M. Kozák, et al., Opt. Lett. **41**, 3435-3438 (2016).

ÅNGSTRÖM LOCALIZATION OF A SINGLE NANOPARTICLE

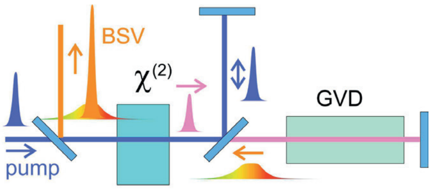
To advance the science and technology of modern nanometrology, medicine and biophysics, novel methods for precise positioning of nanoparticles are required. In this context, scientists have achieved localization precision down to few nanometres. Nonetheless, this requires complex experimental arrangements in the majority of cases. In recent work, we have succeeded in achieving localization precision down to a few Å in an all-optical set-up operated under normal laboratory conditions. To realize this precision, we made use of an inhomogeneous electromagnetic field distribution, tailored on the nanoscale, to probe a dielectric nanoparticle made from silicon. Such silicon nanoparticles, due to their high refractive index, feature a rich resonance behaviour in the visible spectral range. Depending on the position of the particle relative to the tailored field distribution, multiple particle modes can be induced simultaneously. Interference of such modes influences the far-field intensity distribution, the position of the particle being precisely encoded in the directionality of the scattering pattern. The localization precision can be further improved by optimizing the wavelength and further tailoring the focal fields. ■

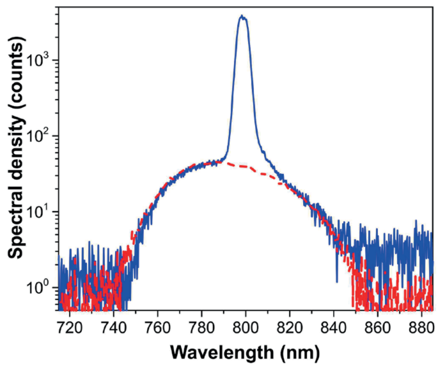


Contact: peter.banzer@mpl.mpg.de
Group: *Leuchs Division*
Reference: M. Neugebauer et al., Nat. Comm. **7**, 11286 (2016).

TAILORING SQUEEZED VACUUM IN A NONLINEAR INTERFEROMETER

A nonlinear interferometer may be constructed from two nonlinear couplers in which the first coupling event can be enhanced or suppressed by the second. Recently we used a Mach-Zehnder-type nonlinear interferometer to tune the spectral bandwidth of bright squeezed vacuum (BSV) from 60 to 2 nm, and the number of frequency modes from 50 to 1.8. The interferometer was constructed so that a broadband BSV produced in a $\chi^{(2)}$ crystal (first figure) was separated from the pump pulse using a dichroic mirror. Both pulses were then recombined in the same crystal, the BSV after passing through a dispersive material, where it acquires a time stretch and a frequency chirp. For the dispersive material we used rods of Schott SF6, SF57, and LLF1 glass. The end result was that only a narrow spectral band was amplified as it meets the pump pulse on the way back. The narrow spectrum in the second figure (blue line) was obtained using a 18.3 cm thick piece of SF6 glass, which the light pulse traverses twice. The red line shows the spectrum of a single crystal without the interferometer. ■





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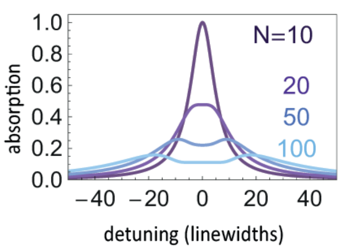
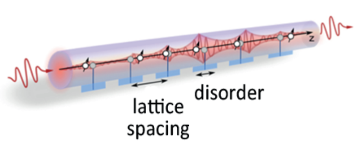
Reference: S. Lemieux et al., Phys. Rev. Lett. **117**, 183601 (2016).

CAVITYLESS POLARITONIC NORMAL-MODE SPLITTING AND COLLECTIVE EFFECTS

Hybridized excitations arising from strong coupling between a cavity mode and a quantum emitter have become a cornerstone of modern quantum optics. Over the years, these phenomena have also been extended to ensembles of emitters, where light can couple to collective dipoles, leading to very large mode splitting. We now show that a propagating light field can undergo spectral splitting even without a cavity, simply by traversing a collection of quantum emitters in a one-dimensional nanoscopic dielectric waveguide. In this case the feedback arises from multiple scattering by the quantum emitters themselves. We find that such a polaritonic mode splitting is visible in the absorption signal, increases with the particle number (N) and shows substantial robustness towards spectral broadening. To achieve this effect, one requires high densities of emitters, which can be reached for dye molecules inside a nanocapillary or rare earth ions in waveguides. Our study of the impact of density and disorder also show that disorder induces longitudinal polariton confinement (similar to Anderson localization), which persists despite photon loss to the three-dimensional environment. ■

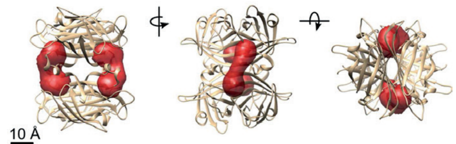




Contact: vahid.sandoghdar@mpl.mpg.de
Group: *Sandoghdar Division*
References: H. R. Haakh et al., Phys. Rev. A **94**, 053840 (2016).

REVIEW: 3D ÅNGSTROM RESOLUTION IN LIGHT MICROSCOPY

Starting with efforts in scanning near-field optical microscopy in the 1980s, many laboratories around the world have contributed to pushing the resolution of optical imaging beyond the Abbe limit [1]. A particularly fruitful outcome has been the invention of "super-resolution microscopy", culminating in the award of the Nobel Prize for Chemistry in 2014. In one of these approaches, a single fluorescent molecule is imaged and its point-spread function localized with a precision that is limited only by the signal-to-noise ratio of the detection method. The challenge then is to address the individual molecule separately, so the signals of the neighbouring molecules do not overlap. In 2002, an ETH team led by Vahid Sandoghdar demonstrated 3D nanometre resolution of two molecules spaced by about ten nanometres [2]. In that work, individual molecules were selected via their narrow resonances at liquid helium temperature. The results were not however encouraging for biological samples because very narrow transitions occur only in aromatic hydrocarbon molecules, which are not water soluble. Sandoghdar resumed work on cryogenic super-resolution microscopy in 2010. This time, the aim was to use conventional dyes and simply exploit the slower photo-chemistry at low temperatures: reduced bleaching should result in more emitted photons per molecule and thus a higher shot-noise-limited signal-to-noise ratio. While the existing super-resolution methods typically reach a resolution of a few tens of nanometres at room temperature, we aimed at two orders of magnitude improvement down to the Å level. In the first phase of this ambitious MPL-based project, we resolved dye molecules separated by several nanometres on DNA double strands [3]. Finally, in 2015 we reached Å resolution in studying the protein structure. In recent work we examined the conformational state of the cytosolic Per-ARNT-Sim domain from the histidine kinase CitA in collaboration with



Christian Griesinger and his group in Göttingen as well as the four binding sites of biotin in streptavidin (see figure). By employing algorithms from electron tomography, we reconstructed the 3D arrangement of the label molecules from their 2D projections [4], leading to the name "cryogenic optical localization in 3D" (COLD) for this method. COLD brings fluorescence microscopy to its fundamental limit dictated by the size of the label molecule. ■

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Group: *Sandoghdar Division*
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MPL ADMINISTRATION: USER SATISFACTION SURVEY

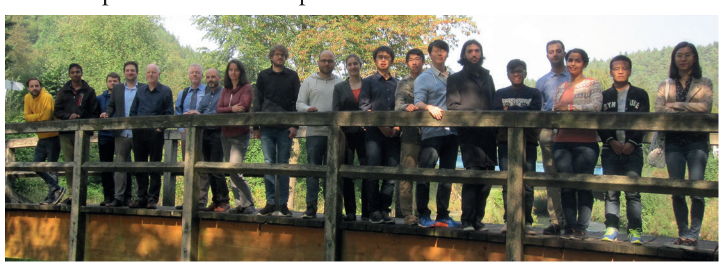
At the end of 2016 a survey was conducted to find out how satisfied the "users" of the MPL administration are with its general performance. Some 50% of MPL's non-administrative staff took part, completing a short questionnaire. The survey focused on the administration's professional expertise, reliability and efficiency, as well as inter-personal relations and transparency. The results were gratifying: more than 90% of the staff surveyed were happy with the infrastructure's performance. ■

GENES MPRG FOCUSES ON QUANTUM PHENOMENA

As of January 2017, Claudiu Genes has taken up his position as the head of a new Max Planck Research Group (MPRG). He joins us from the Institute for Theoretical Physics, University of Innsbruck, Austria. He will be exploring theoretical aspects of quantum optics, particularly at the single photon level. ■

7TH ANNUAL MEETING OF IMPRS-PHYSICS OF LIGHT

This was held in September 2016 in Gößweinstein. We were delighted to have Pierre Berini (University of Ottawa), Sonja Franke-Arnold (University of Glasgow), Romain Quidant (ICFO, Barcelona) and Tomas Cizmar (University of Dundee) as invited speakers. Sivaraman Subramanian won the award for the best student talk and Golnoush Shafiee and Veronika Ludwig (FAU) received prizes for the best posters. ■



NEW PEOPLE IN INFRASTRUCTURE

We warmly welcome Benjamin Mannert, who has joined the Technical Services department; Anna-Lena Zeiler and Alexander Frobenius, who will support the Accounting department; Christoph Dormeier, a new member of the Front Office & Meeting Management team; and Gesine Murphy, Florian Marquardt's new PA. ■

NEW FOREIGN MEMBER OF THE RUSSIAN ACADEMY OF SCIENCES

In October 2016 Gerd Leuchs was elected a Foreign Member of the RAS. He has for many years had connections with several Russian institutes and universities, and has been organizer of the Russian/German Laser Symposium Series as well as chair of the ICONO/LAT conference. ■

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