MAX PLANCK INSTITUTE

for the science of light

Newsletter

n°8 | January 2015

ALL CHANGE IN INFRASTRUCTURE

Our much-valued administrator Sabine König left us in October 2014 to become Kanzlerin at the newly established Wilhelm Löhe Hochschule in Fürth. She was a key actor in the successful creation of MPL since its beginnings as a Max Planck Research Group in 2002. We thank her for all her great contributions over the years and wish her every success in her new position. We are happy to announce that Marco Neisen has joined us as the new Head of Administration. Adam Käppel, highly valued technician in MPL's Electronics Workshop since 2004, retired in August 2014. Hildegard Porsch, head of the travel department, retired in December 2014. We thank both of them for their contributions to MPL and wish them well in the future. Alexandra Seeger joined MPL in December 2014 as head of the travel department. Nina Haas has completed her apprenticeship and joined the accounting team. She is responsible for asset accounting, receipt of goods and customs matters. Manuel Dötzer joined the Mechanical Workshop in September 2014. ■

Inside THIS ISSUE

BERTHOLD LEIBINGER ZUKUNFTSPREIS 2014

In September 2014, at a ceremony held at the Trumpf company headquarters in Ditzingen near Stuttgart, Philip Russell was awarded the Berthold Leibinger Zukunftspreis 2014 for his invention of photonic crystal fibre, to quote: "This new class of optical fibre, which he proposed in the early 1990s, has not only opened up a whole new field of science, but has also found important commercial applications". He has also been honoured with the 2015 IEEE Photonics Award, which will be presented in October 2015 at the IEEE Photonics Conference, to be held in Reston, Virginia. 2015 looks set to be a very busy year for him, with many demands on his time as President of the Optical Society (OSA) in the International Year of Light. ■

Website: http://www.leibinger-stiftung.de

Message FROM THE DIRECTORS

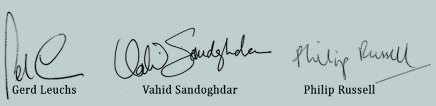
The second half of 2014 was very eventful at MPL. A traditional topping out ceremony in November celebrated the completion of the new building roof, although it will be another year before we can move in. We are happy to report the approval of a fifth MPL division, which will form part of a new Center for Physics and Medicine to be run jointly by MPG and the Friedrich Alexander University. An initial funding of € 61M has been generously provided by the State of Bavaria.

Private circumstances unfortunately did not allow Oskar Painter to unfold his plans at MPL. He has returned to Caltech but continues to run a small group at MPL. Meanwhile we are gearing up to appoint a new theory director along the lines of MPL's original plan.

Another noteworthy item of news is that MPL's founding administrator, Dr. Sabine König, has moved on to become Kanzlerin of a new Hochschule for Applied Sciences in Fürth. We wish her all the best in her challenging new position. We are pleased, though, to welcome Marco Neisen as the new Head of Administration.

In 2015 MPL will play host to the second Siegman International Summer School on Lasers (sponsored by OSA and MPL), to be held in Amberg, August 2 to 8.

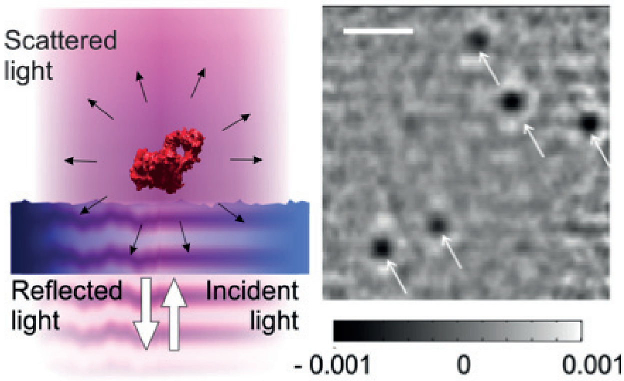
Finally, we look forward to an active and exciting International Year of Light (IYL). MPL already started its activities for IYL in December 2014 with the first of a series of public lectures on the streets of Erlangen and surrounding cities.



Gerd Leuchs   Vahid Sandoghdar   Philip Russell

RESEARCH *articles*

OPTICAL BIOSENSING AT ITS LIMIT



More than twenty years ago, scientists succeeded in extending the limits of optical detection to single molecules using fluorescence. This breakthrough has revolutionized biophysical measurements, but restrictions in photophysics and labeling protocols have motivated many efforts to achieve fluorescence-free single-molecule sensitivity in biological studies. Recently, we have succeeded for the first time to observe single proteins in real time without the need for any fluorescent label, optical nanostructure or microcavity. Our detection scheme relies on the natural elastic scattering of light by the protein molecule, which we measure using interferometric detection of scattering (iSCAT - see figure for image of fibrinogen molecules). Because our method is not limited to confined optical fields, we can count all proteins that adsorb within a large field of view. Moreover, the approach is compatible with a wide range of functionalization methods and provides nanoscopic spatial information of binding events. Considering its ease of instrumentation, iSCAT sensing may become a powerful new method in molecular biology, e.g. for detecting extremely low concentrations of disease-related biomarkers. ■

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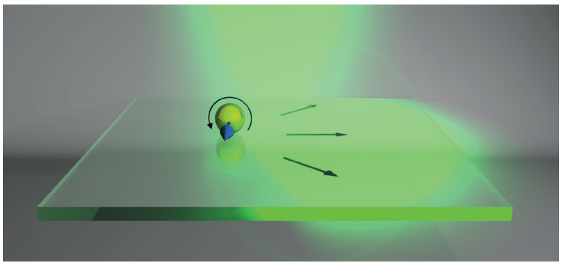
Group: *Sandoghdar Division*
Reference: M. Piliarik et al., Nature Comm. **5**, 4495 (2014).

A LIGHTHOUSE ON THE NANOSCALE: POLARIZATION-CONTROLLED DIRECTIONAL EMISSION AND COUPLING



Directional emission of nanoscopic antennas is of fundamental importance for on-chip integrated photonic circuits. Such antennas may provide a versatile means of achieving all-optical signal routing at the nanoscale, especially when the directionality can be tuned, for example by the polarization state of the excitation field. In a recent experiment, we demonstrated exactly this. The directionality of emission from a single dipole-like plasmonic antenna (a gold nanoparticle) sitting on the interface with an optical denser medium was controlled by tailoring the polarization state of the excitation beam. A prerequisite for directional emission in this scheme is the excitation of a dipole in the nanoantenna, spinning around an axis parallel to the interface. Taking advantage of the phase relation and symmetry of the longitudinal and the transverse field components in tightly focused radially polarized light, the dipole moment can be controlled via careful positioning of the nanoantenna relative to the axis of the excitation beam incident normal to the substrate. The emission direction then depends on the azimuthal position of the particle. As an application, we used this concept for selective directional coupling into a dielectric waveguide (see figure). ■

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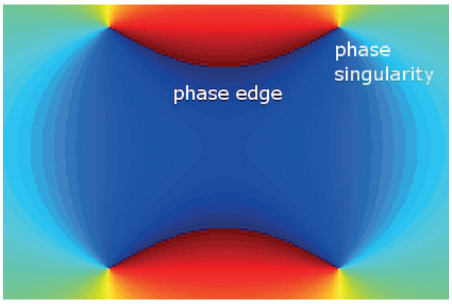
Group: *Leuchs Division*
Reference: M. Neugebauer et al., Nano Letters **14**, 2546-2551 (2014).

PHYSICAL REDUCTION OF PHASE SINGULARITIES IN SPECKLE-SHEARING INTERFEROMETRY

Speckle-shearing interferometry is routinely used to carry out deformation measurements of rough objects due to its robustness against external disturbances. Like most other speckle techniques, however, speckle-shearing interferometry suffers from phase singularities joined by phase edges, which impair the phase unwrapping process. While sophisticated software algorithms have been developed to extract the desired unwrapped phase maps, it would be preferable to reduce the number of phase singularities by physical means. In this work, we adapt an experimental scheme using incoherent averaging of speckle fields from different, mutually incoherent light source points to speckle-shearing interferometry. In order to obtain high contrast fringes, we proposed to use a periodic light source with the period matching the shear distance. However, although initially promising, it turned out that incoherent averaging has a serious drawback. By investigating the mechanism behind the averaging process, we could show that the physical reduction of singularities in speckle interferometry will only be possible in the sense of a compromise: If the number of averages is too high, the deformation phase will be affected. Experimentally, a reduction of about 20% is possible. ■



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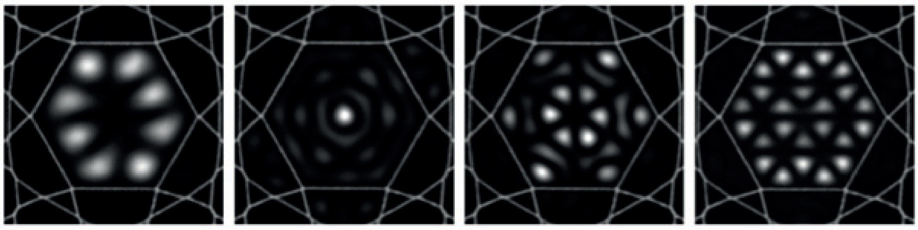
Group: *TDSU: Optical Technologies/Interferometry*
Reference: K. Mantel et al., Opt. Lett. **39**, 4510-4513 (2014).

SELECTIVE SIDE-EXCITATION OF HIGHER ORDER MODES IN PCF

We have been able to precisely excite a whole menagerie of complex higher order modes in the core of a kagomé-style hollow-core photonic crystal fibre (PCF). These modes are very difficult to excite using conventional end-fire coupling methods. Instead, we launch the light into the kagomé-PCF core by side-coupling through the micro-structured cladding. The beam to be coupled is directed at a certain angle on to a prism pressed against the side of the fibre. Since the kagomé-PCF cladding does not feature a full photonic bandgap, light is able to refract into the hollow fibre core. A mode can thus be excited if the axial propagation constant of the coupled beam matches the modal propagation constant. By carefully choosing the in-coupling angle of the light, arbitrary higher order modes can be selected. Furthermore, the effective indices of the excited modes can be determined accurately, showing a very good agreement with the results of finite element modelling. This allows direct measurement (for the first time) of the wavelength-dependence of the modal refractive index, which is crucial to many applications in linear and nonlinear optics. ■



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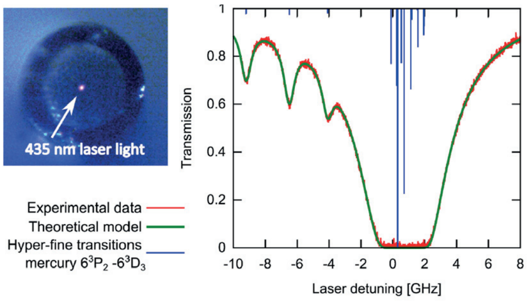
Group: *Russell Division*
Reference: B. M. Trabold et al., Opt. Lett. **39**, 3736-3739 (2014).

ATOMIC MERCURY VAPOR INSIDE A HOLLOW-CORE PHOTONIC CRYSTAL FIBRE

Strong nonlinear optical effects can be obtained at low light levels by confining the optical field tightly and using media with very large optical nonlinearities. This may be achieved by using the nonlinearity of strong atomic transitions combined with tight transverse confinement of light in a hollow-core photonic crystal fibre (HC-PCF). In such a setup, both atoms and light are confined to a small core diameter that can be in the order of the used wavelength over essentially an unlimited Rayleigh length. In previous approaches, where such systems have been realized using alkali vapour, experiments suffered strongly by the unwanted binding of the alkali atoms to the fibre structure. We recently demonstrated that the use of atomic mercury vapour allows for a drastically improved loading of hollow core fibres, leading to high and constantly available vapour pressure inside the fibre. We use kagomé-style hollow core photonic crystal fibres, which have a different guiding mechanism for light compared to standard photonic crystal fibres, allowing for broad transmission windows of several hundred nm. The use of hollow-core PCF filled with Hg vapour may provide strong nonlinearities at the single photon level, permitting for example single photon all-optical switches and near-deterministic phase-gates for single photons. ■



Contact: ulrich.vogl@mpl.mpg.de
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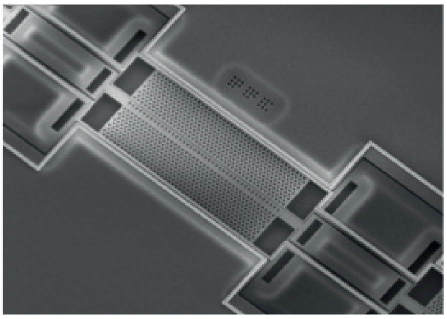
Reference: U. Vogl, et al., Opt. Express **22**, 29375-29381 (2014).

MULTIMODE OPTOMECHANICS



The generic picture of multimode optomechanics is the so-called membrane-in-the-middle where a movable dielectric membrane splits a cavity into two coupled cavities. The resulting dispersion of the cavity modes as a function of the displacement is quadratic around the equilibrium position. Such nonlinearities are interesting connection with of quantum non-demolition measurements of a mechanical resonator. It has been shown that the nonlinearities are inversely proportional to the coupling of the cavity modes and can diverge for very small coupling strengths. We recently demonstrated that the sign of the coupling can be inverted in coupled photonic crystal structures. The coupling can therefore be made arbitrarily small. Our current efforts are to fabricate structures to measure direct evidence of nonlinear optomechanical interactions. ■

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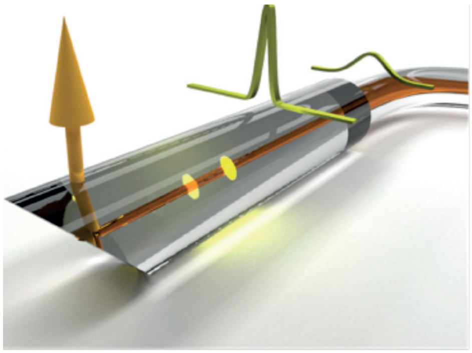
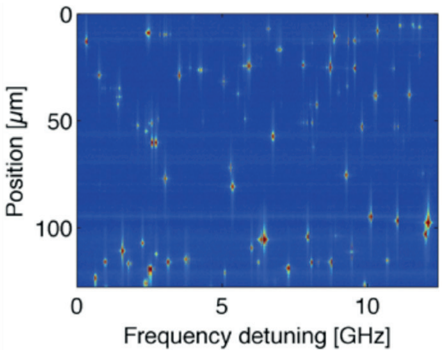
Group: *Painter and F. Marquardt Research Groups*
Reference: M. Ludwig et al, Phys. Rev. Lett. **109**, 063601 (2012).

EFFICIENT COUPLING OF LIGHT TO SINGLE MOLECULES IN A NANOGUIDE

Many of the experiments currently pursued in quantum optics would greatly benefit from strong interactions between light and matter. While a great deal of effort has been devoted to using microcavities for reaching this goal, several experiments at MPL develop efficient cavity-free coupling between photons and quantum emitters. In a new project, we have now extended our previous work on strong focusing to one-dimensional waveguides. We use an organic crystal with an index of refraction higher than glass to fill a capillary with an inner radius of 300 nm, forming a subwavelength waveguide that supports a tightly confined optical mode.





By doping the core with a small concentration of dye molecules, we have devised a system in which a controlled number of quantum emitters can be coupled to propagating photons in an efficient manner. By combining extinction, fluorescence excitation and resonance fluorescence spectroscopy with microscopy, we have recorded high-resolution spatio-spectral data on a very large number of single molecules (see fig.). This work paves the way for exploring intriguing many-body effects based on the cooperative behavior of polaritonic excitations in one dimension. ■

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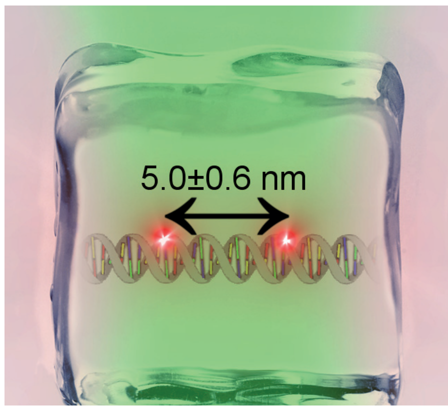
Group: *Sandoghdar Division*
Reference: S. Faez et al., Phys. Rev. Lett. **113**, 213601 (2014).

ANGSTROM OPTICAL RESOLUTION VIA CRYOGENIC LOCALIZATION MICROSCOPY

The dawn of super-resolution microscopy at the turn of the century has enabled light microscopy to advance beyond the diffraction-barrier. One popular method for obtaining super-resolution finds the positions of single fluorophores by determining the center of their point-spread functions. The localization precision can be arbitrarily high, depending on the available signal-to-noise ratio. Since the emission of a fluorophore is limited by photobleaching at room temperature, the typical localization precision achieved is of the order of tens of nanometers. We have recently demonstrated Angstrom localization precision by taking advantage of the substantial improvement in molecular photostability at liquid helium temperatures. As proof of principle, we have resolved two fluorescent markers at nanometer spacing on the backbone of a double-stranded DNA (see figure). By measuring the separations of fluorophore pairs placed at different design positions, we verified the feasibility of cryogenic distance measurements with sub-nanometer accuracy. We plan to use this technique to study features of protein structure, arrangements of subunits in compound biomolecules, protein-protein interactions, and the exact location of light emission in multichromophore systems. ■



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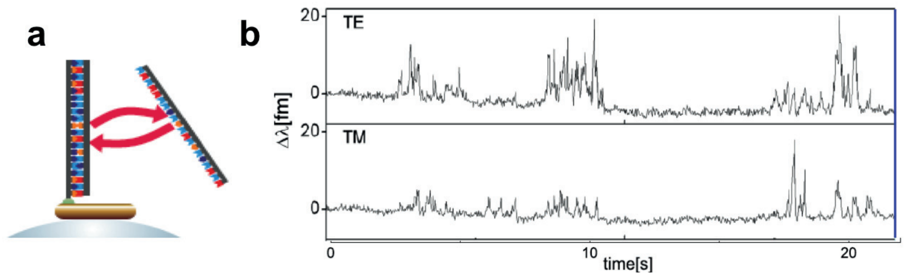
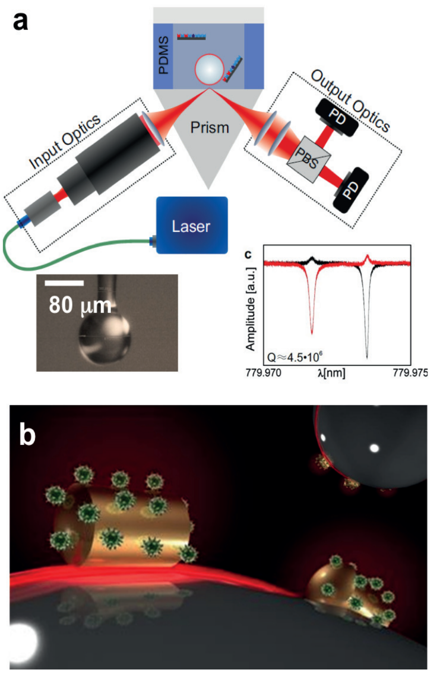
Group: *Sandoghdar Division*
Reference: S. Weisenburger et al., ChemPhysChem. **15**, 763 (2014).

SINGLE MOLECULE DETECTION WITH OPTICAL MICROCAVITIES

Detecting single biomolecules and their interactions is the dream of biochemists since it allows the fundamental study of biochemical reactions. Furthermore, single molecule biosensors can have important applications in health care and environmental monitoring. In November 2010 Frank Vollmer joined MPL with the goal of taking detection to the single molecule level. His laboratory has now succeeded in reaching this limit with light [1]. Using an optical microcavity and gold nanorods, he has amplified the interaction of light with DNA to the extent that he can now track interactions between individual DNA molecules. His group's plasmon-enhanced and label-free microcavity biosensing platform exhibits unprecedented sensitivity in the optical domain. In addition, he monitors molecular interactions transiently, without permanent binding of target molecules to the receptor. This approach extends both the lifetime and the nature of the sensing, since the bonds formed between molecules and nanomachines are fleeting. Thanks to this new method, it will be possible to explore such natural kinetics in greater detail. The detection method is based on the precise measurement of the optical frequency of a high-Q whispering gallery mode (WGM) in a glass microsphere ~80 μm in diameter [2] (Fig. 1a). The WGM frequency shifts as biomolecules bind to the high Q microcavity [3]. In addition, Vollmer has devised a mechanism for boosting the frequency shift using a plasmon resonance [4,5] (Fig. 1b). By attaching gold nanorods (length 40 nm, diameter 12 nm) to the microcavity, hotspots of high field intensity are generated. When biomolecules bind within these hotspots, the frequency shift is amplified more than 1000 fold, in proportion to the enhanced field intensity. This enables specific detection of single DNA molecules in solution, after modification of the nanorods with molecular receptors – here custom oligonucleotides (Fig. 2a). Single molecule interactions with the receptor molecules now appear as spikes in the WGM frequency or wavelength trace (Fig. 2b). The spikes appear often in rapid succession, a hallmark of single molecule interactions. Based on the duration and rate of the measured interactions, it should be possible to detect specific DNA segments, and differentiate single nucleotide mismatches. ■



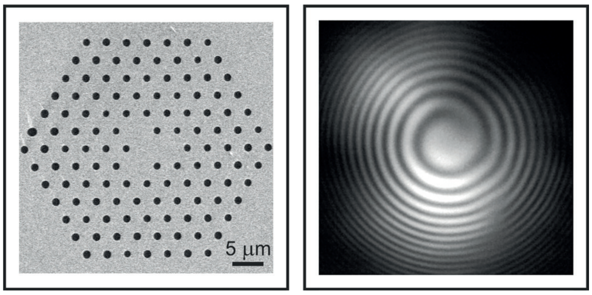


Contact: frank.vollmer@mpl.mpg.de
Group: *Biophotonics and Biosensing (MPRG)*
References:

1. M. D. Baaske et al, Nature Nanotechnology, Vol. **9**, 933-939, Nov. 2014
2. M. R. Foreman et al, Opt. Express **22**, 5491-5511 (2014).
3. F. Vollmer et al., Appl. Phys. Lett. **80**, 4057-4059 (2002).
4. M. A. Santiago-Cordoba et al., Appl. Phys. Lett. **99**, 073701 (2011).
5. M. R. Foreman et al., New J. Phys. **15**, 083006 (2013).

HELICAL PHOTONIC CRYSTAL FIBRE PRESERVES TWISTED LIGHT

We find that two eigenmodes of a helically twisted photonic crystal fiber (PCF) with a special propeller-shaped glass core carry orbital angular momentum (OAM). They are non-degenerate, i.e., scattering between an order +1 mode and an order −1 mode is inhibited; the structure acts like a topological insulator for light. The twisted fibre can be produced in short lengths by thermal post-processing or in much longer lengths (with twist periods of a few mm) by spinning the preform in the drawing tower. When light exiting a 50 m length of fibre is superimposed on an expanded Gaussian reference beam, a spiral-shaped interference pattern is observed (see figure), as expected if the light possesses a helical phase front. A simple analytical theory for the effect, based on a helicoidal extension to Bloch wave theory yields results that are in excellent agreement with full finite element simulations. To our knowledge this is the first example of a fibre that is able to preserve the chirality and magnitude of the OAM. The results may be of interest for boosting information-carrying capacity in optical communications. ■



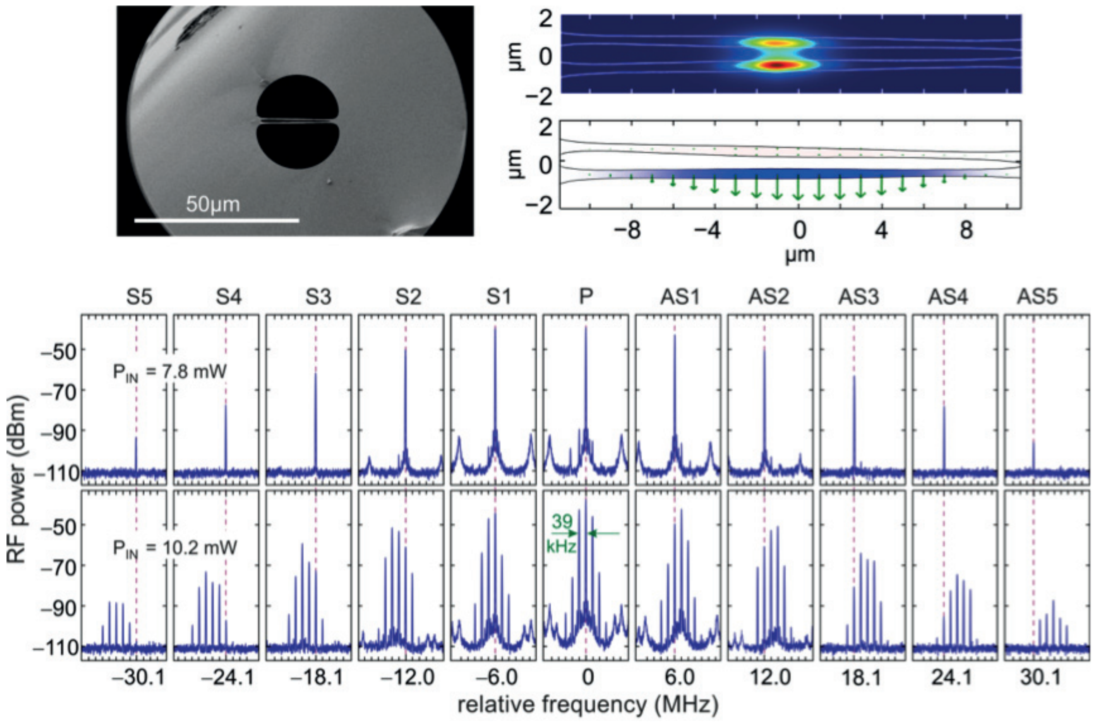
Contact: gordon.wong@mpl.mpg.de
Group: *Russell Division*
Reference: X. M. Xi et al., Optica **1**, 165–169 (2014).

DISTRIBUTION OF SQUEEZED STATES THROUGH AN ATMOSPHERIC CHANNEL

Quantum squeezing and continuous variable quantum states in general are versatile resources in quantum information processing and quantum communication. Although continuous variable quantum states are easy to generate, manipulate and are efficiently detectable, they are also known to degrade with loss and excess noise. Recently, we have succeeded in distributing continuous variable squeezed states through a 1.6 km atmospheric channel in the urban environment of Erlangen. In order to test the preservation of squeezing after transmission through this turbulent free space link, we used polarization encoding and a post-selection protocol taking into account the fluctuating received intensity. We accentuated the successful state distribution by tomographic measurement and state reconstruction using a maximum likelihood algorithm. Quantum communication based on squeezed states has the potential to improve the robustness of quantum key distribution protocols. Moreover, this experiment paves the way for further investigations on atmospheric quantum communication using continuous variable quantum states, aiming at satellite based space to ground links (see news article "Visit of Bavarian State Government"). ■

Contact: christian.peuntinger@mpl.mpg.de
Group: *Leuchs Division*
Reference:C. Peuntinger et al., Phys. Rev. Lett. **113**, 060502 (2014).

OPTOMECHANICAL RAMAN-ACTIVE "MOLECULE"



A mechanically highly compliant waveguide structure, consisting of two very thin and closely-spaced glass nanowebs mounted inside a capillary fiber, experiences strong optical gradient forces when light is launched into it. The resulting mechanical deformation leads to a large increase in modal refractive index, i.e., a giant optomechanical nonlinearity. Recently we observed generation of an optical frequency comb in an evacuated dual-nanoweb fiber upon single-pass excitation with unmodulated CW light. Above a few-milliwatt threshold the transmitted signal began to oscillate in intensity and more and more Stokes and anti-Stokes sidebands, spaced by the mechanical frequency of ~6 MHz, appeared in the optical spectrum as the launched power was increased. Unlike in high-Q microresonators, where frequency combs are generated via the electronic Kerr nonlinearity, the underlying mechanism in our case is stimulated Raman-like scattering (SRLS), mediated through optical gradient forces and initiated by thermally excited phonons. This is the first demonstration of noise-seeded, optomechanical SRLS – a scattering process with an unprecedentedly high gain of 4 $mm^{-1}mW^{-1}$. The dual-nanoweb structure acts on light like a Raman-active molecule. ■

Contact: anna.butsch@mpl.mpg.de
Group: *Russell Division*
Reference: A. Butsch, et al., Optica **1**, 158-164 (2014).

TOPPING OUT CEREMONY

On November 27th 2014 MPL celebrated the topping-out ceremony of its new building. Dieter Grömling, head of the building department at the Max Planck Society, opened the proceedings with a welcome speech. This was followed by greetings from Vahid Sandoghdar, Prof. Karl-Dieter Grüske, President of FAU, Dr. Florian Janik, Oberbürgermeister of the city of Erlangen, Joachim Herrmann, Bavarian Minister of the Interior and Leo Fritsch, the building's architect. ■

PAINTER LABS

After nine months of building up, the Painter Research Group is now operational and is producing its first measurements of optomechanical interactions. The lab now features a tapering rig and an optical setup to measure photonic chips. In the tapering rig, we pull fiber tapers and slightly alter their shapes in order to be able to probe selectively single devices of only a few micron size. This method is particularly useful to measure dense arrays of such devices. In our experiments, we analyze the response of an optical cavity field to the vibrational modes of the cavity itself and show how the optical field can in turn be used to control these vibrations. Our efforts are directed towards realizing the building blocks of optomechanical circuits. To this end, it is important to construct photonic crystal structures where both optical modes and mechanical modes as well as their interactions can be controlled, which we intend to demonstrate by combining MEMS technology and multimode optomechanics. ■

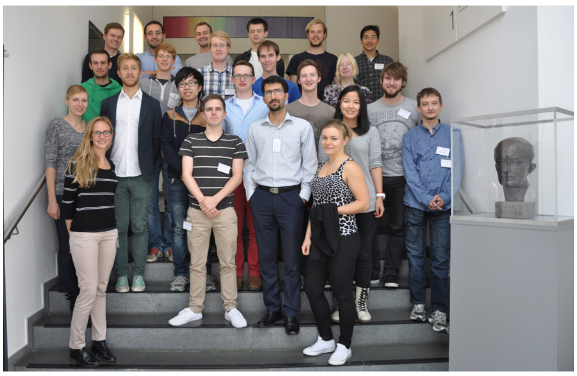
FIFTH IMPRS ANNUAL MEETING

The fifth Annual Meeting of IMPRS Physics of Light took place in Egloffstein September 22-25, 2014. Invited lectures were given by Prof. Monika Ritsch-Marte (Medical University of Innsbruck), Prof. Michael Downer (University of Texas), Prof. Markus Aspelmeyer (University of Vienna) and Kobus Kuipers (FOM Institute AMOLF). The programme also included block lectures by MPL's Prof. Stephan Götzinger and Frank Vollmer, as well as talks and poster presentations by the IMPRS students. The best talk award went to Georg Epple, and Roland Lauter received the prize for the best poster. ■

OSA STUDENT CHAPTER: FIELD TRIP TO ZEISS AND TRUMPF

A highlight of the OSA Student Chapter's activities this year was a field trip to the optics companies Carl Zeiss SMT and Trumpf, organized in cooperation with SAOT. The 40 participants had to get up early but a Weisswurst breakfast halfway to Oberkochen lifted the spirits. At Zeiss we enjoyed a presentation about optical lithography in the semiconductor industry and were introduced to the next generation of EUV lithography. During a tour through the production facilities, we learnt how microscope objectives for wafer illumination are assembled. In the early afternoon, we arrived at Trumpf in Ditzingen. Among the world market leaders in sheet metal fabrication and industrial laser systems, Trumpf provided an impressive demonstration of their metal punching and laser welding machines and gave detailed insights into their management strategy. After the guided tour through the production facilities, a research engineer gave a fascinating talk about the development of an EUV light source for lithography. The field trip ended with a get-together at a local restaurant in Stuttgart where everyone had a chance to continue the discussions in a nice atmosphere. ■

THIRD MPL AUTUMN ACADEMY



The third Autumn Academy took place September 29 to October 1, 2014. As before, the aim of the academy was to introduce BSc and MSc students to the fast moving field of optical sciences. The response was excellent. From more than 70 applications we selected 24 students and invited them to Erlangen for a packed schedule of lectures, laboratory visits and poster sessions. We warmly thank Prof. Jacqueline Bloch (LPN/CNRS), Prof. Klaus Mölmer (University of Aarhus) and Prof. Peter Hommelhoff (FAU Erlangen) for taking the time to visit MPL and deliver inspiring lectures, despite their very busy schedules. The academy's social events were financially supported by a generous donation from Toptica GmbH. Thank you Toptica! ■

VISIT OF BAVARIAN STATE GOVERNMENT

On September 25th 2014 we welcomed Ilse Aigner, Bavarian Minister for Economic Affairs, Media, Energy and Technology and Deputy Minister-President and Joachim Herrmann, Bavarian Minister of the Interior to MPL. This gave us the opportunity to tell them about MPL's free-space continuous variable quantum communication link across Erlangen, which we now plan to extend into space in collaboration with the global leader in optical space communication, Tesat-Spacecom from Backnang, Germany. We very much appreciate the support of this project by the Free State of Bavaria. The two Ministers also visited the site of MPL's new building - two months before its official topping-out ceremony on November 27th. ■

INTERNATIONAL YEAR OF LIGHT 2015

INTERNATIONAL YEAR OF LIGHT 2015

The United Nations General Assembly has declared 2015 the International Year of Light and Light-based Technologies (IYL 2015). The goal of this global initiative is to highlight to the citizens of the world the importance of light and optical technologies in their lives, for their futures, and for the development of society. We are contributing to IYL 2015 by organizing various individual events in cooperation with the Institute of Optics, Information and Photonics at FAU both on a regional level and with international scope. As a prelude to our IYL 2015 activities, we organized a very successful premiere of our central public outreach activity, die.Lichtbühne (Light on Stage) on December 13th 2014 in the Erlangen pedestrian zone. Vahid Sandoghdar's talks and our experiments attracted a large and interested audience of various ages. In addition, we will promote young researchers at different levels, for example within the framework of Jugend forscht and by organizing the International Siegman School on Lasers 2015, which will take place in cooperation with the OSA from August 2-8 in Amberg, Germany. (www.osa.org/siegman/). You are very welcome to visit our website to find out about our planned activities. ■

Website: www.mpl.mpg.de/light2015/

NEWS IN BRIEF

- On September 25th 2014 during his state visit to Canada, the President of the Federal Republic of Germany, Joachim Gauck, visited the new Advanced Research Complex (ARC) at the University of Ottawa, also meeting with Peter Banzer and **Gerd Leuchs**. President Gauck emphasised the importance of the planned scientific partnership between MPL and ARC.

- **Vahid Sandoghdar** has been elected Fellow of the Optical Society (OSA).

- **Silke Christiansen** has been appointed Distinguished Visiting Professor at the South Korean Chonbuk National University.

- An International Office has been newly established to serve international visitors and students at MPL, offering advice and assistance. It will be led by **Vanessa König**.

CENTER FOR PHYSICS AND MEDICINE

This past summer the Max Planck Society approved a fifth division and an independent research group for MPL as part of a joint center with the medical and natural science faculties of the Friedrich Alexander University (FAU) in Erlangen. Supported by a € 61M starting budget from the State of Bavaria, the *Center for Physics and Medicine* will host physicists and mathematicians focusing on solving fundamental problems of medical relevance, complementing the conventional biomedical approaches in cell biology, biochemistry and genetics. In addition to the contributions of MPL, the center will include two FAU chairs (biophysics and biomathematics) and an independent research group from the medical school together with three other research groups supported by third-party funding. Housed in a new laboratory building on the medical campus, the center will provide a broad spectrum of physical techniques for measuring and manipulating mechanical, electrical and chemical interactions in the intercellular microenvironment. A symposium on February 26th and 27th 2015 will serve to gauge the emerging trends in this new area of research. ■

Website: www.mpl.mpg.de/symposium2015

Imprint

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