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Abstract Book

Laser, Optics & Photonics Virtual

March 05-06, 2021 | GMT 07:00 – 12:00

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PLENARY FORUM

DAY 1

Laser, Optics
&
Photonics Virtual

APRIL
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V-Laser2021

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Photonic crystals from the definition to the future applications

Photonic crystals attracted the most authors in the last years due to their many applications. We will present about the photonic crystals based on its unique property which is called the photonic band gap. We have studied many applications based on photonic crystals like, smart windows, desalination, salinity, biosensors, filters …etc. We have published many papers about these applications based on the photonic crystals properties.

Biography

Arafa H Aly holds a doctoral degree in physics from University of Cairo, Egypt. Prof Arafa Aly joined Cairo University, Beni-Suef branch, physics department in January 1995 as an assistant lecturer of physics. He was a lecturer from 1999 to 2007, and associated professor from 2007 to 20012. In 2012 he became full professor in physics; In 2012 Professor Arafa was elected as the chair of the Department of Physics till now. Professor Arafa was a postdoctoral fellow of physics at ICTP, Trieste, Italy 2001, Seoul national university, South Korea 2004 and 2005 in AUB, Lebanon. In 2006-2008 was a research professor in Chonnam national university in Korea. Within 2008 was a research professor in Zaragoza University in Spain. Also Prof Arafa was a research professor part time in American University of Cairo from 2009-2014. He has a distinguished 22-years career in mesoscopic systems, photonic crystals, phononic crystals, solar energy, materials and photonics research. He attended and organized more than 35 conferences from 2001 till now. He has published more than 110 technical papers and reports in good review journals and good impact factors.

Yoshiharu Morimoto[1], Mona Yadi[2], Masaki Ueki[3]

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Vibration Distribution Measurements using Grating Projection Method with OPPA Method and using Sampling Moiré Method

Vibration analysis is important to solve vibration problem. However, the analysis is mainly analyzed using one point measurement sensor such as accelerometer and laser displacement sensor. It is difficult or time-consuming for one-point sensor to obtain the vibration mode which shows the amplitude and phase distributions of the vibration

We have already developed One-Pitch Phase Analysis (OPPA) method which can analyze 3D shape and out-of-plane displacement distribution by projecting a grating on an object. By using the OPPA method, we developed a real-time motion capture system and an out-of-plane vibration analysis system using a line light source with LEDs and optical fibers.

We also developed a real-time displacement and strain distribution analysis system using the sampling moiré method. Using the sampling moiré method, a vibration distribution analysis system of in-plane vibration has been also developed.

The modal analysis of vibration can be performed easily by using the developed systems.

In this study, the OPPA method is applied to measure out-of-plane vibration distribution of a car using a commercially available liquid crystal projector in the market instead of the above-mentioned line light source using LEDs and optical fibers. and also, the sampling moiré method is applied to in-plane vibration distribution of a tuning fork using a camera.

Biography

Morimoto received his PhD from Osaka University, Japan. He was a researcher at Komatsu Ltd, Osaka University and Wakayama University, Japan. He established Moiré Institute Inc. in 2009, and 4D Sensor Inc. in 2012. Both are venture companies originated from university. He is currently CEO of 4D Sensor Inc. He is developing high-speed and high-accuracy measurement systems of shape, deformation and vibration. He is Fellow members of SEM and JSME. He was also the former President of JSEM, the former Chairman of ASEM and former Executive Board of SEM. He received awards from SEM, JSME, JSNDI, JSEM etc.

Dao Hua ZHANG

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Metasurface enhanced optical sensing

Metasurfaces have been attracting great attention due to their novel properties such as light confinement. With the innovated process, we demonstrated various metasurfaces which could resonate in different spectra ranging from near violet to long-infrared waves. The structures can be used for biochemical sensing and different refractive index sensors have been realized. By integrating a metaface with a semiconductor device, we have demonstrated strong enhancement for photon emission and photodetection. Our hybrid mid-infrared photodetectors show a room temperature specific detectivity of 2x1010 Jones and the millimeter wave photodetectors we invented based on new mechanism show a noise equivalent power of 1.5x10-14 W Hz-1/2. Our works make the infrared and terahertz sensing system possible for room temperature operation.

Biography

Dao Hua Zhang received his MSc degree from Shandong University, and PhD degree from the University of New South Wales. He joined the School of Electrical and Electronics Engineering, Nanyang Technology, Singapore in 1991 and is currently a professor, Deputy Director of Centre of Excellence for Semiconductor Lighting and Displays, Program Director of Photonic Nano- Structures and Applications. Professor Zhang's main research interests include semiconductor materials, devices and technology, photonic metamaterials and applications. He has published over 530 papers in international journals and 7 books/proceedings and filed 7 patents. He is Fellow of Institute of Physics, and Fellow of Institution of Engineering and Technology.

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Wan Zakiah Wan Ismail and Khairul Nabilah Zainul Ariffin

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Developing a promising optical sensor for biomedical application

Laser is an optical device used in medical and sensing application. Laser depends on optical gain to provide light amplification and a cavity as a feedback. When the gain exceeds the loss, lasing occurs. A random laser needs multiple light scattering to scatter the light while the light is amplified in the optical gain. sufficient light scattering is crucial instead of cavity to provide the feedback mechanism. The characteristics of random laser is similar with other conventional lasers such as; narrow emission peaks, lasing threshold and coherence. A random laser sample consists of material (particle) which can scatter the light and an optical gain (dye) to amplify the light. The sample is excited by a Q-Switch laser source and the emission light from the sample is collected by a spectrometer. If lasing occurs, a narrow or multiple emission peaks will appear on top of the fluorescence emission. The emission light of the random laser is less coherence with high intensity, suitable as a laser source for optical coherence tomography. The laser can be used as a biosensor to detect lipid emulsion, pH and dopamine. In the dopamine sensing based random laser, dopamine stimulates the aggregation of gold nanoparticles in a dye solution. The sensing is achieved based on lasing threshold, emission linewidth and signal to noise ratio. Study on random laser is continued in the optical fiber where air-filled and filled cladding for different fiber diameter are developed. Fiber with air-filled cladding produces random lasing compared to the filled cladding fiber. Random laser is not only cheap and simple to set up but also beneficial for medical and biosensing application. Thus, study in this field is important and highly needed for current and future medical and sensing application.

Biography

Wan Zakiah Wan Ismail is a senior lecturer in Faculty of Engineering and Built Environment (FKAB), Universiti Sains Islam Malaysia (USIM). She is currently the deputy dean of research and innovation in FKAB. She has published more than 30 peer-review journals and conference proceeding and 10 book chapters and 1 book in her field. She is a member of Optical Society of America (OSA), member of Institute of Electrical and Electronics Engineers (IEEE) and a Technology specialist (Ts), professional member of Malaysia's Board of Technologist (MBOT). She took undergraduate study in Multimedia University, Malaysia and pursued her Master and PhD in Melbourne University and Macquarie University. She was the recipient of Prime Minister's Australia Endeavour award and Universiti Sains Islam Malaysia (USIM) fellowship in 2012. Her PhD study focuses on optical device specialized in laser engineering. Her expertise including optics and laser, image processing, biosensing and material science.

Xin Li[1], Yongjiu Yuan[1], Chenyang Xu[1], Xioazhe Chen[1] and Misheng Liang[1]

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Temporally and Spatially Shaped Femtosecond Laser High Precision and High Efficiency Fabrication and its Applications

The high precision and high efficiency maskless laser patterning is cutting-edge of micro/nano fabrication and one of the most challenging research. For example, in the field of energy storage, the trend of miniaturization, flexibility and integration of electronic devices puts forward clear requirements for the miniaturization and integration of supercapacitors. i) The existing patterning resolution is in the range of 500μm~5μm [*Nat. Nanotechnol. 2017,12:7*]. It is necessary to further improve the fabrication precision on the basis of ensuring the supercapacitor performance. ii) Laser direct writing realizes maskless patterning by controlling the scanning path and scanning speed of Gauss beam, which has limited the fabrication efficiency. In the last few years, we proposed novel methods and mechanisms to prepare high electrochemical performance micro-supercapacitors by using temporally and spatially shaped femtosecond laser, including the following aspects: i) Miniaturized high-performance metallic 1T-Phase MoS_2 micro-supercapacitors are fabricated by temporally shaped femtosecond laser through controlling transient electron temperature and 1T→2H MoS_2 phase transition. The sub-micron resolution (~800nm) is achieved which leads to the ultrafast ion diffusion rate and enables high performance (power density:14kWcm^{-3}, energy density:15.6mWhcm^{-3}, areal capacitance: 36mFcm^{-2}). ii) One-step patterning of laser-induced graphene/MnO_2 flexible micro-supercapacitors are fabricated by a single pulse laser photonic-reduction stamping. By spatially shaped femtosecond pulses with Gauss distributions into various supercapacitor-shapes distribution, Graphene based supercapacitors are fabricated with high precision (narrow gap: ~500nm) and high efficiency (30,000 micro-supercapacitors/10minutes) for high performance (capacitance: 128mFcm^{-2} and 426.7Fcm^{-3}). Our proposed methods may provide an important avenue for miniaturization and integration of new energy devices.

Biography

Xin Li has completed her PhD from Tsinghua University, China and postdoctoral studies from Beijing Institute of Technology, China. She is awarded with national excellent young-scientist award of NSFC (2019) and the program for new century excellent talents in university (2013). She is honored with the second prize of national natural science award of China (2016) and the first prize of natural science award from Ministry of Education of China (2015). She has published more than 60 papers in reputed journals.

Francesco Antolini[1], Francesca Limosani[1]

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Direct Laser Patterning as possible route for regio-selective synthesis of semiconductor quantum dots in film

In this work, the advances on Direct Laser Patterning (DLP) for the synthesis of photo-luminescent semiconductor quantum dots (QDs) is reported. Two types of materials are investigated as QDs precursors for DLP: CdSe and CdTe precursors.

The study of the direct laser process started with the suitable precursors synthesis, their combination with the polymer and then their thermal decomposition. Then the nanocomposites formation is examined by means of several physico-chemical techniques such as absorption, fluorescent spectroscopies and fluorescent microscopy.

The results show that the laser patterning can modulate the QDs size as a function of the laser fluence. The analysis of the photoluminescence (PL) spectra indicate that is possible to form QDs of different size. In particular, the CdTe QDs generated through the laser showed the PL spectra in the red and green region of the visible spectra by modulating the laser power and pulse frequency.

Acknowledgments

This work is supported by European Union Horizon 2020 research and innovation programme under Grant Agreement n 779373, project MILEDI (MIcro quantum dot Light Emitting diode and organic light emitting diodes DIrect patterning) and Photonics21 PPP.

Biography

Francesco is graduated in Chemistry and held is Ph.D in Biophysics on protein thin film technology and surfaces modification. Since 2000 he worked in the field of Material Science studying in the research area of nanostructured material synthesis and thin films technology. In the last years in the ENEA Agency he is involved in the chemical synthesis and photo-physical characterisation of nanostructured materials for lighting purposes and sustainable development. He has coordinated some EU projects in the field of nanomaterials synthesis and photonics.

Xiao Lin

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Exotic near-field photonics from moving & static complex dipoles

Controlling the directional flow of light at the subwavelength scale is of fundamental importance to many on-chip applications, including the integrated information processing, light energy harvesting, bio-photonics and chiral quantum optics. Here we reveal several exotic phenomena of near-field directionality [1-6], originating from the spin-orbit interactions of light between nanophotonic waveguides and moving & static complex dipoles. As typical examples, these complex dipoles can be circularly polarized dipoles, Janus dipoles and Huygens dipoles. First, an inverse Doppler frequency shift of light, namely the superlight inverse Doppler effect [1-2], is shown possible when a dipole moves in the homogeneous positive-index media. This counterintuitive Doppler shift also occurs for the excited surface plasmon polaritons, and we show an example with graphene plasmons. Remarkably, we find the superlight inverse Doppler effect can introduce some new unique features for the near-field directionality. Second, the active control of near-field directionality [3-4], such as flipping the coupling and non-coupling faces of Janus dipoles, is achieved via tailoring the polarization of surface waves for example in the hybrid graphene-metasurface waveguide. Moreover, the hidden correspondence between circular polarized dipoles and Huygens Dipoles in the near-field directionality is revealed. Third, we find the near-field directionality can also be efficiently tailored via twisted van der Waals heterostructures, such as twisted α-MoO_3 slabs [5], twisted bilayer graphene [6], and tilted hyperbolic metamaterials [7].

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Biography

Dr. Lin got his PhD degree from Zhejiang University, China in 2016, was a research fellow at Nanyang Technological University, Singapore between 2017-2020, and visited Massachusetts Institute of Technology between 2015-2016. Now he is a professor at Zhejiang University. As the first/corresponding author, he published >30 papers, including Nature Physics, Nature Materials, PRL, PNAS, Science Advances, and Light: Science & Applications. His work of superlight inverse Doppler effect was selected as editors' favorite paper in the area of optics, from all papers published between 2005-2020 in Nature Physics. He serves as the associate editor of Progress in Electromagnetics Research (PIER).

[1]Victória Regina da Silva Oliveira, [1]Inaeh de Paula Oliveira , [1]Beatriz Magalhães Eng, [2]Daniel Ciampi de Andrade, [2]Manoel Jacobsen Teixeira, [3]Milena Cristina Dias Casalverini, [3]Fernando Quadros Ribeiro, [4]José Pinhata Otoch, [1]Camila Squarzoni Dale

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[2]Department of Neurology of Faculty of Medicine of University of São Paulo – Brazil.
[3]Wound Clinic of the University Hospital of the University of São Paulo – Brazil, 4 Department of Surgery of Faculty of Medicine of University of São Paulo – Brazil.

Photobiomodulation Improves Quality of Life, Wound Healing and Pain of Diabetic Patients from Brazilian Public Hospital

Brazil currently ranks fourth position among the countries with the highest number of diabetics in the world. Diabetic complications such as foot ulcers represents approximately 40-70% of non-traumatic lower limb amputations, resulting in high morbidity and mortality, with great socioeconomic impact and significant losses in patient's quality of life. Photobiomodulation (PBM) demonstrates positive effects in decreasing painful symptoms, favoring tissue repair and promoting wound healing in diabetic patients (DP). Patients were submitted to clinical evaluation, filled pain screening and quality of life questionnaires and were submitted to the quantitative sensory testing. After, they received low level laser therapy (660 nm, 100 mW, 14s per point, 1.4 J/cm^2, 0.35 cm^2 area, 14 applications and 2x⁄week) and were reevaluated. All patients presented changes of sensitivity on feet at first evaluation, the symptoms frequently reported include numbness, burning, tingling and walking pain with worsening of symptoms at night. After PBM treatment, all patients presented an evident improvement of secretion, odor and epithelization of wound. Therefore, it was observed a decrease of 35% in the impact of pain in these patients a fact that reflected directly on the patients' quality of life, with improvement in their motor activity, humor and so, their social relationships. Also, there was a significantly reduction in anxiety symptoms. PBM therapy improved wound quality and, indirectly, in the quality of life and pain screening of DP, reinforcing the use of this adjuvant tool in the clinical treatment of painful symptoms and in the wound healing process in diabetic patients.

Biography

Camila Squarzoni Dale has completed her PhD from University of São Paulo, Brazil, and postdoctoral studies from INSERM, France. She is the head of the Laboratory of Neuromodulation of Pain from the University of São Paulo. She has published more than 40 papers in reputed journals and has been serving as an editorial board member of reputed journals. She has published many papers and book chapters on the effects of laser therapy for the treatment of pain and have been working on laser effects and mechanisms for the last 10 years.

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05-06, 2021

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V-Laser2021

Yukio Tomozawa

University of Michigan, USA.

Rader Propagation, the Physical Metric in General Relativity and Size of Black Holes and Neutron Stars

Schwarzschild[1] found an infinite number of exact solutions of Einstein equation. However, the simplest solution, so called the Schwarzschild metric does not fit the time delay experiment of the solar system, using rader communication[2], [3]. By making Newtonian approximation, one can fit the data. The author found the exact solution of Einstein equation that fits the time delay observation[4]. The condition for such a metric is that the speed of light in angular direction is that in vacuum. The angular direction is perpendicular to the direction of gravity, which is the radial direction. Thus this metric is called physical metric. To my surprise, such a solution gives the radius size to be 2.60 times the Schwarzschild radius. ($3\frac{\sqrt{3}}{2} = 2.60$) This agrees with the observed sizes of black holes and neutron stars. The physical metric provides the exact solution for gravity.

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Biography

Dr. Tomozawa has been a faculty member of the University of Michigan, Physics Department since 1966 and became a Professor Emeritus in 2003. Dr. Tomozawa has focused on theoretical high energy physics research his whole career and he currently continues to publish research annually in the area of general relativity, cosmic rays and astrophysics.

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Photonic and excitonic coupling in nanocrystal superstructures

Assembled colloidal quantum dots (QDs) hold great promise as optically active films in novel optoelectronic devices. The wide tunability, low-temperature processability, and high efficiency of QDs make them very beneficial for a wide range of device applications – from LEDs to lasers to photodetectors and photovoltaic devices. The working principles of these devices rely on efficient charge carrier transport and, in the case of photovoltaic devices, on light absorption. Both however are limited for quantum dots and their aggregates.

A recently developed emulsion-templated assembly technique yields QD supercrystals of extraordinary structural quality, expected to feature `artificial solids', with properties such as band-like transport, beneficial for devices. Here, we show that supercrystals of CdSe QDs simultaneously enhance the absorption efficiency and inter-dot coupling of QDs. By comparing optical measurements with Mie theory, we demonstrate that supercrystals can exhibit resonant optical properties resulting in absorption efficiencies greater than 1 in the visible range. By performing ligand exchange, we increase the excitonic coupling, and show via ultrafast transient absorption (TA) spectroscopy that biexcitons transits from a bound to a free state as a consequence of the increased interdot coupling. These results reveal a new state of matter with properties architecturally designed to feature simultaneously photonically and electronically coupled QDs for future optoelectronic devices.

Biography

Peter Schall is full professor in Soft Matter Physics and Nanomaterials at the University of Amsterdam. He received his PhD in physics from RWTH Aachen (Germany) and joined the University of Amsterdam after a postdoc at Harvard University (U.S.A). His current research spans fundamental and applied aspects of Condensed Matter and Nanometerials, including the assembly of nanocrystals such as perovskites, and their resulting opto-electronic properties. The focus is on phase formation principles governed by equilibrium and nonequilibrium statistical physics, as well as properties of the resulting micro- and nano-structured materials such as mechanical and optical response (Research webpage: www.peterschall.de).

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The study of multiwavelength laser array based on REC technique

Multi-wavelength laser arrays (MLAs) have wide applications in photon integration circuits (PICs) for wavelength division multiplexing (WDM) networks. We demonstrate MLA with fine wavelength tuning. We combine the REC technology with the method of introducing phase-shift into the middle region. The phase-shift can be easily controlled by adjusting the injection current ratio. Accordingly, by changing the ratio of the injected current between the three electrodes, the wavelength of the MLA can be fine tuned. This fine-tuning can be used to adjust the wavelengths to fall on the ITU-T grid wavelengths. The balanced output powers of MLA are obtained simultaneously. It has been shown that the proposed laser array had good single longitude mode performance with properly phase-shift, and high SMSR can be ensured, which even up to 62.1 dB. The SMSRs are all above 50 dB, the yield for the array is high. The wavelength range of the proposed laser array can be tuned 25.003 nm with 63 channels of 50 GHz spacing with almost constant output power of standard deviation 0.63 dBm. All lasers are within a wavelength deviation of ± 0.02 nm. These results show that the proposed method is very useful for designing the MLA to meet the ITU-T standard. This provides a compact and cost-efficient light source for large-scale PIC devices.

Biography

Renjia Guo received the B.S. degree in optical information science and technology from Jiangnan University, Wuxi, China, in 2009, the M.S. degree in optical engineering from Nanjing University of Science and Technology, Nanjing, China, in 2012, and the Ph.D. degree in optical engineering from Nanjing University, Nanjing, China, in 2017. He is currently a lecturer in School of Physics and Electronic Engineering, Yancheng Teachers University, Yancheng, China. His research interests include fabrication of the advance photonic device and photonic integrated circuits.

Denis Tihon[1]

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Full-wave modeling of thermal and luminescent sources: a modal approach

For years, electromagnetic modeling tools have been developed to predict the behaviour of spatially coherent or incoherent fields. Such tools are routinely used to design sources and optical systems with controled properties. Nowadays, the partially coherent fields emitted by thermal or luminescent sources are generally approximated as being fully coherent or incoherent in order to enable the use of these tools. However, using such approximation, it is not possible to accurately model emitters structured on a length scale of the order of the wavelength. For such sources, new modeling tools are required.

This talk will focus on the modeling of such partially coherent sources. It will be shown that these sources emit power through a discrete number of modes. Each mode is fully coherent and different modes add up in an incoherent way. Thus, any optical system that is fed by such a source can be modeled using traditional modeling tools.

The determination of the emissive modes requires the evaluation of integrals that are not implemented in traditional electromagnetic software, requiring the use of in-house code. This difficulty can be circumvented by using an extended version of the Kirchhoff's law. It will be shown that, just as thermal and luminescent emitters emit fields through a discrete number of modes, they can absorb incident fields through a similar set of modes. A one-to-one relationship between the absorption and emission modes exists. Thus, emissive modes can be determined from power absorption calculations, which most commercial software can do.

Biography

Denis Tihon received the M.Eng. and Ph.D. degrees in physical engineering from the Université catholique de Louvain (UCLouvain), Louvain-la-Neuve, Belgium, in 2013 and 2018. During his Ph.D. he worked on the numerical modeling of periodic absorbers and partially coherent fields, in collaboration with the University of Cambridge, Cambridge, U.K. Between 2017 and 2019, he also worked on the simulation of magnetic resonance imaging (MRI) antennas in the context of M-Cube FET-OPEN European Project. Since 2019, he is holding a post-doctoral position, under the M. Sklodowska-Curie Fellowship, at the Cavendish Laboratory, Cambridge, where he is studying thermal and luminescent emitters.

Yang Yue and Yiwen Zhang

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Machine Learning Based Detection Technique of Object Open Angle and Direction

Nowadays, object detection techniques have been investigating rapidly for different applications, ranging from remote sensing to autonomous vehicles. When an object with opening is interrogated by a light b-eam, its characteristics can be identified by the intensity or phase information of the deviation from the original incidental beam. Recently, researchers started to apply orbital-angular-momentum phase spectrum analysis techniques into object identification, while the intensity information itself is not enough to identify the rotation characteristics due to its circular symmetry. In the meanwhile, machine learning technique, which has the ability to automatically extract features of data at multiple levels of abstraction, has already been impacting a wide range of sensing and detection work by creating nonlinear detection boundaries. We demonstrate identification of object open angle and direction using machine learning algorithms based on received light beam's intensity profiles. Compared with previous optical spectrum system and other related works, this proposed technique only uses a single-shot image, and can efficiently reduce the complexity of hardware implementation. Our demonstrated technique has the potential to extend its applications, ranging from monitoring fan blade, propeller, to tire pressure. Furthermore, using external interrogated source could help detect cloaking objects.

Biography

Yang Yue received the B.S. and M.S. degrees in electrical engineering and optics from Nankai University, China, in 2004 and 2007, respectively. He received the Ph.D. degree in electrical engineering from the University of Southern California, USA, in 2012. He is a Professor with the Institute of Modern Optics, Nankai University, Tianjin, China. Dr. Yue's current research interests include intelligent photonics, optical communications and networking, optical interconnect, detection, imaging and display technology, integrated photonics, free-space and fiber Optics. He has published over 200 peer-reviewed journal papers and conference proceedings, three edited books, >50 issued or pending patents, >90 invited presentations.

Anna Chiara De Luca

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Raman microscopy-based investigations: from proteins to cells identification and imaging

Raman spectroscopy is a promising analytical tool for non-invasive and label-free biochemical analysis of molecules, proteins and cells. This spectroscopic technique is based on the inelastic scattering of laser photons upon interaction with the sample molecules and allows the characterization of the properties and structure of the molecules.

Here, it is presented the development of an advanced Raman-based device and its integration/correlation with other optical methods (surface-enhanced Raman microscopy-SERS, confocal microscopy and Fiber optics) for the identification, classification and sensing of cancer cells and proteins.

Raman microscopy, in combination with confocal microscopy, allowed the label-free identification of leukocytes as well as the detection and classification of leukemia cells from peripheral blood samples. Raman data reflected the relative changes in the potential biological markers from cell surface antigens, cytoplasmic proteins, and DNA content and correlated with the lymphoblastic B-cell maturation/differentiation stages. Furthermore, the effects of the chemotherapy treatment were evaluated.

Raman imaging rather than single-point spectral analysis could benefit surgeons allowing more complete visualization of the tumor cells. The proposed label-free imaging approach was particularly useful to localize and follow the internalization kinetics and transport of nanovectors in living cancer cells, without chemical/charge alteration of the nanovectors surface itself, and to study the drug release in real-time. Cell membrane components were analysed by SERS imaging with several exciting prospects including sub-diffraction resolution and single molecule sensitivity which would aid studies of trans-membrane transport dynamics.

Finally, the integration of SERS substrate directly on the optical fiber tip for biosensing application is presented.

Biography

Anna Chiara De Luca has completed her PhD from Department of Physics, University of Naples Federico II, Italy in 2008 and postdoctoral studies from School of Physics and Astronomy, University of St Andrews, UK in 2012. She is researcher at IBBC-CNR, Italy and head of the Biophotonics and Advanced Microscopy Lab since 2012. Her research interests mainly focus on She has published more than 50 papers in reputed journals and 50 refereed conference communications related to Raman/SERS Spectroscopy and imaging, correlative imaging, biophotonics and optical sensors for application in biomedicine. She has been serving as an editorial board member for Sensors (MDPI).

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DAY 2

Laser, Optics & Photonics Virtual

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V-Laser2021

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High-power lasers and their use for preventing enamel and dentin demineralization

High-power lasers can be used to prevent incipient caries and dental erosion lesions, and the parameters must be adjusted depending on the tissue to be irradiated (enamel or dentin), as well as the wavelength and pulse duration of the laser to be used. Still, the association of preventive strategies, such as with the topical application of fluoride or other biomaterials, can prolong the action of the treatments. The temperature rises promoted during irradiation can exert morphological, compositional, and crystallographic effects on the irradiated tissues, and alter the response of irradiated tissues to the presence of acids, decreasing their solubility. In this work, the changes promoted by the Er,Cr:YSGG and Nd:YAG lasers on enamel and dentin will be reported, in healthy and after the simulation of the beginning and the progression of dental caries and erosion lesions. In addition, the effects of different durations of laser pulses will be described on these conditions, as well as the association with topical application of fluoride or glass-ceramic biomaterials. Analytical techniques such as Fourier transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy and optical coherence tomography are used to evaluate the short and long-term effects of treatments. The results suggest that lasers increase the resistance of tissues to both caries and erosion, and that the effects are more lasting than those promoted by agents traditionally used in clinical practice. However, the association of laser and fluoride still seems to be the best strategy, even when different wavelengths or temporal pulse widths are employed.

Biography

Patricia Aparecida Ana has completed his PhD from IPEN/ University of Sao Paulo, Brazil and postdoctoral studies from the same institution. She is associated professor at Federal University of ABC (UFABC) and coordinator of the Biomedical Engineering post-graduation program at UFABC. Also, she is associated editor of Brazilian Society of Photonics (SBFOTON) and member of the Executive Board of the South American Division of the World Federation for Lasers in Dentistry (WFLD). She has published more than 50 papers in reputed journals and has been serving as a reviewer member of repute

Junqing Zhao

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Pulse dynamics in fiber lasers encountering strong nonlinearity

Many nonlinearities have always been considered as deleterious effects in various systems, especially in the long-haul fiber communications. However, it has been found that they can also be utilized to investigate some particular pulse dynamics in fiber lasers, if proper manipulations are performed. Interestingly, benefiting from these, much greater pulse energy can be achieved prior to pulse breaking. This occurs especially when a type of closely related peak power clamping effect dominates the operating regime. In this talk, I will present some of our recent works relating to such kind of highly nonlinear fiber systems. The details are included below as seven sections,

1. Nonlinearity matters: How and how much?
2. DSR: still the most ever typical scenario
3. h-shaped pulse: not necessarily a curious mixture?
4. From PPC to pulse energy transferring
5. Peak-power-clamped passive Q-switching
6. NAbLM: an alternative scheme for nonlinear loop

Biography

Junqing Zhao received the Doctor of Engineering degree in Optical Engineering from Shenzhen University, Shenzhen, China, in 2014, for research on fiber lasers. Since then, his research has covered device, system, and application aspects of fiber lasers and amplifiers, first with the Shenzhen Key Laboratory of Laser Engineering, Shenzhen University, China, and later with the Optoelectronics Research Centre (ORC), University of Southampton, U.K. He is currently with the Jiangsu Key Laboratory of Advanced Laser Materials and Devices, Jiangsu Normal University, Xuzhou, China. He has published over 60 scientific articles. He is a Life Member of the Optical Society of America.

Honglin Liu

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Optical Memory Effect: Its essence and range

Optical memory effect is an interesting phenomenon and also the theoretical foundation of many promising techniques. Here, we present a new physical picture of the optical memory effect, in which the memory effect and the conventional spatial shift invariance are united. Based on this picture we depict the role of thickness, scattering times and anisotropy factor and derive equations to calculate the ranges of the angular memory effect (AME) of different scattering components (ballistic light, singly scattered, doubly scattered, etc.), hence a more accurate equation for the real AME ranges of volumetric turbid media. A conventional random phase mask model is modified according to the new picture. With the aid of the modified model we studied the AME range versus thickness and anisotropic factor systematically.

Biography

Dr. Honglin Liu completed her PhD from Shanghai Institute of Optics and Fine Mechanics (SIOM), CAS. She was a postdoctoral research fellow in Washington University in St. Louis from 2009 to 2011. Currently she is an associate professor in SIOM. She has published 30 papers in reputed journals and has been serving as an editorial board member of Journal of Optics. Her research interests include light propagation in scattering media, imaging and light manipulation in/through scattering media, and super resolution imaging into biological tissue.

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Quantum cascade laser spectroscopy for gas sensing application

Tunable diode laser absorption spectroscopy (TDLAS) is an excellent method for trace gas detection, since it presents advantages of high sensitivity, good selectivity, fast response and high temporal resolution. With the rapid development of laser fabrication technology, quantum cascade lasers (QCLs) have emerged as attractive laser sources for mid-infrared (MIR) spectroscopic applications. In this paper, state-of-the-art quantum cascade laser based TDLAS gas sensor is demonstrated as a promising new tool for high resolution molecular spectra and for noninvasive, real-time identification and quantification of trace gases in environmental atmosphere monitoring and isotope analysis, human breath gases diagnosis, gas exchange process between soil and atmosphere, and Volatile Organic Compounds (VOCs) analysis and remote sensing, etc.

Biography

Dr. Jingsong LI has completed his PhD Hefei Institute of Physical Science (HIPS), Chinese Academy of Sciences (CAS), China and postdoctoral studies from Reims University (France), Max Planck Institute for Chemistry (Germany), and visiting scholar from Swiss Federal Laboratories for Materials Science and Technology (Switzerland). He is the director of Laser Spectroscopy and Sensing Lab, Anhui University. He has published more than 60 papers in reputed journals and has been serving as an invited reviewer of more than ten international SCI journals. His research interests focusing on development and implementation of mid-infrared quantum cascade lasers and sensitive spectroscopy techniques for atmospheric chemistry, soil ecosystems and environmental applications, and advanced digital signal processing algorithms.

Nilesh Kumar Pathak
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Plasmonics fundamentals & Applications

Plasmonic is the interaction of electromagnetic waves to the conduction electron of metal nanoparticle. Metallic nanoparticles supports surface plasmon resonances that can be tuned in desired range of electromagnetic spectrum. The tunability in plasmonic resonances highly depends on the morphology of chosen metallic particles. The motive of this most emerging branch of nanophotonics is to study and tune the surface plasmon resonances in different regime of electromagnetic spectrum to cover broader range of application. The various possibilities related to size and shape of metal nanoparticles are analysed to understand the physics of scattering, absorption, extinction and surface plasmon resonances under the influence of organic and inorganic surrounding environment that finds variety of applications.

Biography

Dr. Nilesh Kumar Pathak has completed his PhD from Indian Institute of Technology Delhi, India and postdoctoral studies from Science & Engineering Research Board (SERB)/University of Delhi, India. He was exchange fellow at EPFL Switzerland. He was Visiting Research Fellow in National Taiwan University (NTU) Taiwan. He is Assistant Professor in Department of Physics, Maharaja Agrasen College, University of Delhi since 2018. He is working in Computational plasmonics field to explain the electromagnetics of metallic nanogeometries. He has published more than 30 Research papers, 5 Book chapters 7 conference proceeding in reputed journals and has been serving as an editorial board member and reviewers of reputed journals like ACS Photonics, Scientific Report, Plasmonics, Nanoscale etc.