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July 31- August 02, 2017 Milan, Italy

Keynote Forum
Day 1

Dan Botez, J Laser Opt Photonics 2017, 4:2(Suppl)
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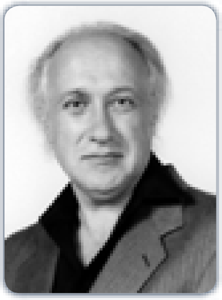
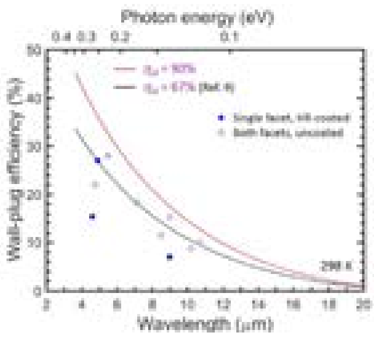


Dan Botez

University of Wisconsin-Madison, USA

High-internal-efficiency quantum cascade lasers: the road to mid-infrared lasers of 40% CW wall-plug efficiency

The internal efficiency η_i of quantum cascade lasers (QCLs) is the factor in the expression for the external differential efficiency that encompasses all differential carrier-usage (i.e., the injection efficiency) and lasing-photon-transition efficiencies. For conventional QCLs the η_i values have been found to be rather low: 50-60% in the 4.5-6.0 µm wavelength range and 57-67% in the 7-11 µm wavelength range; with, until recently, no clear explanation why that was the case. With the advent of combining carrier-leakage suppression with fast, efficient carrier extraction out of the active regions of QCLs, the η_i values have steadily increased and are approaching their fundamental upper limit of ~ 90% for mid-infrared (IR)-emitting devices. We will review the developments that led to high η_i values throughout the mid-IR wavelength range. Conduction-band engineering has led to the so-called step-taper active-region (STA) QCLs which have provided η_i values 30-50% higher than in conventional QCLs over both the 4.5-6.0 µm and 7-11 µm wavelength ranges. A record-high, single-facet, continuous-wave (CW) power, for 8.0 µm-emitting QCLs, of 1.0 Watt has been achieved from STA-type QCLs. Furthermore, the recognition that the fundamental limit for η_i (i.e., 90%) is 34% higher than the η_i value employed a decade ago when determining the fundamental limit for the wall-plug efficiency of mid-IR QCLs, has led to the realization that wall-plug efficiencies ≥ 40% can be achieved for 4.5-5.0 µm-emitting QCLs. The practical benefits of achieving such high performance from mid-IR emitting semiconductor lasers will be discussed as well.



Wall-plug-efficiency fundamental limits for mid-infrared-emitting QCLs

Biography

Dan Botez is Philip Dunham Reed Professor in the Department of Electrical and Computer Engineering at University of Wisconsin (UW) - Madison. In 1976, he obtained a PhD degree in Electrical Engineering from University of California, Berkeley. He has carried out and led research in semiconductor lasers at RCA Labs, Princeton, NJ and TRW Research Center, Redondo Beach, CA before joining, in 1993, the faculty at UW-Madison. His research interests lie in three areas of semiconductor-laser physics: high-power, coherent edge-emitting lasers; high-power, coherent grating-coupled surface-emitting lasers; and quantum cascade lasers. The first two are based on one- and two-dimensional, high-index-contrast, photonic-crystal structures, respectively, for insuring both long-range spatial coherence and stable operation under continuous-wave (CW) driving conditions. The third involves electron transitions between the sub-bands of multi-quantum-well structures and is focused on achieving high-efficiency CW operation in the mid-infrared wavelength range: 3-10 microns, via multi-dimensional conduction-band engineering.

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Manyalibo J Matthews, J Laser Opt Photonics 2017, 4:2(Suppl)
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Manyalibo J Matthews

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Understanding laser materials processing: the dichotomy between laser damage and laser machining

In the decades since the invention of the laser, new applications and discoveries in materials science have continued year after year as laser sources evolve and more areas of research exploit them. The transformation of materials using focused, high irradiance laser beams fundamentally involves multiple physical phenomena such as optical absorption, heat transport, structural mechanics and material phase transitions. For example, nonlinear absorption of nanosecond pulsed laser light can lead to a nano-scale thermal runaway effects and subsequent damage, which can be detrimental in the operation of high power laser systems. On the other hand, laser processing of materials often involves ablative removal of material or transformations which rely on efficient coupling of laser energy into a work piece. In both cases, understanding laser-material interactions is essential for the optimization of the high power optical system design. In this talk, we will present a few examples of high photon flux laser material processing, using both experiment and finite element modeling to understand energy deposition, heat transport and material transformation. Specifically, we will explore the conditions which bring about optical damage in ultraviolet Q-switched laser optics and compare these conditions to those used in typical microscale laser materials processing technologies. Among the laser processing techniques discussed, we will focus on microsecond-pulsed, resonant IR laser heating for laser micro-machining and metal powder bed additive manufacturing (3D printing). We will discuss how our results can be used to elucidate material behavior, optimize processing and develop new technologies based on laser modified materials.

Figure 1: Examples of laser damage (left), laser micro-machining (center) and laser-based 3D printing.

Biography

Manyalibo J Matthews currently serves as Deputy Group Leader in the Optical Materials and Target Science group in MSD. He holds a PhD in Physics from MIT and a BS in Applied Physics from UC Davis. His research interests at LLNL include novel applications in laser-assisted material processing (e.g. metal additive manufacturing, laser-based CVD, nano-coarsening of metal films, non-contact laser polishing of glass), optical damage science, vibrational spectroscopy and in-situ optical characterization of transient processes. Prior to LLNL, he was a Member of Technical Staff at Bell Labs and worked on materials characterization of optical devices using novel spectroscopic techniques, stress-induced birefringence management in planar optical devices and research in advanced broadband access networks. He is a Fellow of the Optical Society of America.

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Shien-Kuei Liaw, J Laser Opt Photonics 2017, 4:2(Suppl)
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Shien-Kuei Liaw

National Taiwan University of Science and Technology, Taiwan

WDM bidirectional optical wireless communications

In this talk, high-speed free space optics communication (FSO) technologies will be reviewed and introduced. Then we will design and demonstrate two proposed FSO schemes. The first scheme is bi-directional short-range free-space optical (FSO) communication with 2x4x10 Gb/s capacity in wavelength division multiplexing (WDM) channels short transmission distance. The single-mode-fiber components are used in the optical terminals for both optical transmitting and receiving functions. The measured power penalties for bi-directional, four-channel WDM FSO communication are less than 0.8 dB and 0.2 dB, compared with the back-to-back link and uni-directional transmission system, respectively. The second scheme is hybrid optical fiber and FSO link in outdoor environments such as cross bridge or inter-building system. A sensor head is used for monitoring the condition of bridge, and in the case of the bridge being damaged the transmission path could be changed from fiber link to FSO link to ensure data link connectivity. In both cases, the single-mode-fiber (SMF) components are used in the optical terminals for both optical transmitting and receiving functions. The influences of environmental factor including window glasses, air turbulence and rainfall will also be addressed. The colorless and colored window glasses introduce losses under various incident angles, but did not induce substantial power penalties. The air turbulence induces extra transmission loss and instability in the received power. Raindrops are the most influential environmental factor. The bit error rate (BER) test shows that raindrops result in a seriously impaired BER to interrupt the transmission instantaneously. After appropriate performance improvement, these proposed transmission structures show potential applications for outdoor transmission under various natural weather conditions.

Biography

Shien-Kuei Liaw received Double Doctorate from National Chiao-Tung University in Photonics Engineering and from National Taiwan University in Mechanical Engineering, respectively. He joined the Chunghua Telecommunication, Taiwan, in 1993. Since then, he has been working on Optical Communication and Fiber Based Technologies. He joined the Department of Electronic Engineering, National Taiwan University of Science and Technology (NTUST) in 2000. He has ever been Director of the Optoelectronics Research Center and the Technology Transfer Center, NTUST. He was a Visiting Researcher at Bellcore (now Telcordia), USA for six months in 1996 and a visiting Professor at University of Oxford, UK for three months in 2011. He owned six US patents, and authored or coauthored for 250 journal articles and international conference presentations. He earned many domestic honors and international honors. He has been actively contributing for numerous conferences as a conference chair, technical program chair, organizing committee chair, steering committee and/or keynote speaker. He serves as an Associate Editor for Fiber and Integrated Optics. Currently, he is a Distinguished Professor of National Taiwan University of Science and Technology (NTUST), Vice President of the Optical Society (OSA) Taiwan Chapter and Secretary-General of Taiwan Photonic Society. His research interests are in Optical Sensing, Optical Communication and Reliability Testing.

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Carl C Jung

CCJ Software, Germany

Twisted and turned layers – no problem for ITE (Immersion Transmission Ellipsometry)

If looking at optically thin layers or thin films with an anisotropic structure, the main applications of such films are in display technology. There are different ways, such layers can be used: as polarisers, if absorbing, as retarders, if transparent, as photo-alignment films, if very thin and with a specific surface, that can be used to align other attaching films during an annealing step in fabrication. Of course, the optical properties of the resulting display depend on the quality of the layers used to produce it. Therefore, we developed a new method, which can very accurately determine the three-dimensional refractive index and its orientation in a thin layer. Even films, whose properties vary in the direction perpendicular to the film plane, can be studied with success. We employed a combination of transmission in two different media - immersion transmission ellipsometry and reflection ellipsometry at one single wavelength. Ellipsometry is the measurement of the alteration of the polarization state of light transmitted or reflected by the layer or film studied. The accuracy of the method was very high compared to conventional reflection ellipsometry in only one medium. If compared to combined transmission and reflection measurements in air, we also reached a drastic improvement. The method of immersion transmission ellipsometry is a significant step forward in the development of non-destructive optical characterization methods for thin films with complex anisotropic structure.

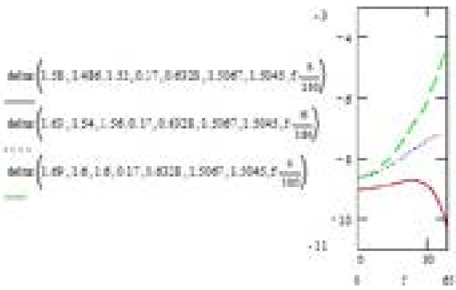

Figure1: Three normally indistinguishable sets of data can be expanded by immersion transmission ellipsometry. Depicted is the ellipsometric parameter Δ measured in transmission under immersion. The first 3 figures are the refractive indices of the film. Then wavelength in μm, and immersion and substrate index follow.

Biography

Carl C Jung has his expertise in finding mathematical models for engineering, physical and physical chemistry questions and implementing them in evaluation and simulation software. His way led from amperometric biosensors (Cambridge University, UK), via biophysics employing florescence (Max Planck Institute, Frankfurt a M) to display technology and ellipsometry (IDM, Berlin and Potsdam). Here the presented topic was generated. Thereafter he returned to biophysics and fluorescence (Bayreuth University), and after one year in research management (Fraunhofer, Munich) he finally performed theoretical and experimental studies on the heating of bond wires used in integrated circuits by electronic engineers (Robert Bosch Center for Power Electronics, Reutlingen).

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Fabienne Michelini, J Laser Opt Photonics 2017, 4:2(Suppl)
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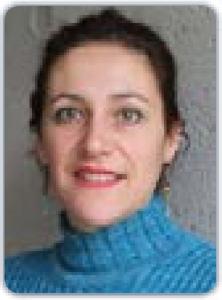

Fabienne Michelini

Aix Marseille University, France

Energy transfer dynamics in molecular junctions under ultra-short excitation pulses from non-equilibrium Green's function formalism

The problem of energy transfer is emerging as one of the most crucial issues of our occidental societies. At a fundamental level, how energy flows at the nanometre scale is gaining specific interests due to its implications in both alternative energy production and basics of quantum thermodynamics. The nature of our work is hence two-fold. In the first part, we provide a definition of energy current operator in the Heisenberg representation, while discussing certain conditions which an operator shall fulfill. The obtained expression is applicable to non-stationary as steady-state situations. We implement this definition to derive time-dependent energy current using non-equilibrium Green's function formalism, which represents a suitable approach for calculating measurable quantities in opened nanosystems. The second part applies these developments to molecular junctions sandwiched in between two thermal reservoirs. Molecular electronic devices are indeed a promising alternative to standard electronic switches due to their fast response on the picosecond time scale. Here, the approach is used for the study of molecular junctions subjected to ultra-short excitation pulses. We thus analyze the electronic energy fluxes across the molecular junction engendered by femtosecond laser pulses. Our numerical implementation enables us to correlate the time-dependent energy current to the underlying intra-molecular dynamics, with special attention paid to the impacts of intra-molecular coupling and incoherence on the energy transfer time-resolved measurables.

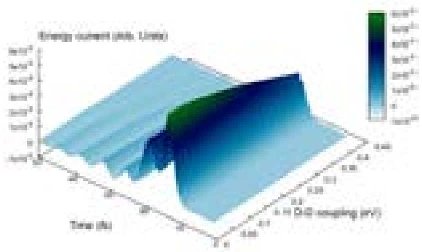

Figure1: We consider a junction made of two donors (D) that interact with light and an acceptor (A), the whole is in contact with tow thermal reservoirs. Effects of the intra-molecular D-D coupling on the time-resolved energy current flowing from D to A during a 30 fs laser pulse

Biography

Fabienne Michelini has worked on the theoretical/numerical building of empirical models within the k•p method to understand the electronic properties of realistic condensed-matter systems. In parallel, she has gained a great expertise in high performance computing for large-scale numerical problems. For the last years, she has investigated the transport properties of opened quantum structures for novel nanodevices using effective methods within the Green function formalism. She is now focusing on time-dependent and non-linear regimes of nanosystems interacting with light for optoelectronic and thermoelectric applications at the nanoscale.

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Shao-Wei Wang

Shanghai Institute of Technical Physics - CAS, China

Integrated narrow bandpass filters array for miniature spectrometer

Compact, lightweight, and rigid miniature spectrometers without moving parts are needed for a wide variety of applications, including space applications, where every inch of payload counts. Miniaturization increases the portability and paves the way for making *in situ* spectral measurements for daily life of food-safety and health, etc. It also eases the integration of microspectrometers and miniature spectrometers into other technologies, such as microelectronics, and helps to realize lab-on-a-chip devices. It attracts many research interests in recent years. Many novel wavelength division approaches have been proposed for miniature spectrometers, such as colloidal quantum dot spectrometer and disordered photonic chip. The optical filter array is one of the most important components in wavelength-division multiplexing, multispectral devices, and parallel array optics, which are widely used in communication and electrooptical systems. We proposed and realized the concept of integrated narrow bandpass filter array from 2004, which can totally match with detectors array with very high spectral resolution and high structure & spectrum flexibility, and resulting in simple structure and small volume with high reliability. We developed the combinatorial etching technique and combinatorial deposition technique for fabrication of such devices. We also demonstrated a concept of a high-resolution miniature spectrometer using an integrated filter array. Such a device has already been successfully used in a multi-spectral luminescence imaging for plant growth research setup of Shijian ten satellites launched in 2016.

Figure1: The photos of plant growth setup in space (left), integrated narrow bandpass filters array (INBPFA) used (middle) and spectra of each channels (right)

Biography

Shao-Wei Wang received his PhD (2003) degree in Microelectronics and Solid State Electronics from Shanghai Institute of Technical Physics, Chinese Academy of Sciences, China. He is a Professor of the institute and works at National Laboratory for Infrared Physics from 2010. His research interests include artificial photonic structure and devices, such as interaction between high-Q optical cavity and low-dimensional materials, integrated-cavities for miniature spectrometers, solar selective absorbers, metamaterial polarizers, and optical thin films. He has published more than 50 research papers and authorized one US patent. He has received several which includes: Lu Jiaxi Young Talent Award (2009), Rao Yutai Basic Optical Award (2007), National Natural Science Award (2014, 4th principal achiever), National Technological Invention Award (2011, 5th principal achiever), Shanghai Technological Invention Award (2010, 7th principal achiever), Shanghai Natural Science Award (2007, 5th principal achiever), etc.

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Keynote Forum

Day 2

Bernd Witzigmann, J Laser Opt Photonics 2017, 4:2(Suppl)
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Bernd Witzigmann

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III-V nanowire arrays as a platform for photovoltaics, solid state lighting and electronics

In this presentation, the physical principles of semiconductor nanowire arrays are discussed, with a focus on applications for photovoltaics and solid state lighting. Both of these fields are pivotal for green photonics technologies. As analysis tools, specific physics-based numerical models for nanophotonics and nanoelectronics have been developed, which will be discussed. In particular, the three-dimensional nature of a wire array, including the substrate and the free space on top is included in the study. For the optical extraction efficiency of an LED, absorption of electromagnetic energy in the contacts and the active layers themselves, as well as re-emission (photon-recycling) are investigated. The latter is an effect that couples the electronic and the optical system. In addition, the optical density of states is analyzed and its impact on the extraction efficiency is shown. Finally, the total electro-optical efficiency of a nanowire array LED emitting at 400nm is presented and compared to conventional efficient thin-film LEDs. It is shown that the efficiency droop commonly observed in III-nitride based LEDs can be shifted to high operating currents. For the nanowire array solar cell, a detailed electromagnetic and electronic analysis is presented, from which fundamental rules in terms of materials choice and wire geometry will be derived. It shows that low density regular III-V nanowire arrays can reach absorptivities identical to bulk cells, with the advantage of substrate flexibility, low material consumption, and improved strain engineering for multi-junction cells. As outlook, the integration of III-V nanowire arrays for electronic and optical functional devices will be discussed and some applications are shown.

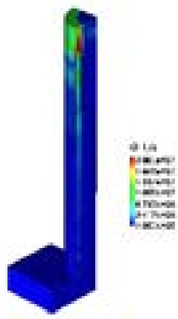

Figure1: Optical generation rate in an InGaN/GaN core-shell nanowire solar cell

Biography

Bernd Witzigmann received his PhD degree (with honors) in Technical Sciences from the ETH Zürich, Switzerland, in 2000. He then joined Bell Laboratories, Murray Hill, NJ, as a Member of Technical Staff. In 2004, he was appointed as Assistant Professor at ETH Zurich in Switzerland. Since 2008, he was Professor at University of Kassel, Germany, and Co-Director of the Centre of Interdisciplinary Nanoscience and Technology. He is author/co-author of more than 180 journal and conference publications, Chairman of a SPIE Photonics West conference, and has been Editor of several journals. He is a Senior Member of the IEEE and SPIE and Co-Director of the Nanocenter CINSaT at Kassel University.

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Jun Hee Choi, J Laser Opt Photonics 2017, 4:2(Suppl)
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Jun Hee Choi

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Nanostructured GaN light-emitting diodes on unusual substrates and blue light enhancement by surface plasmon resonance

There have been significant recent developments in the growth of single crystal gallium nitride (GaN) on unconventional templates for large-area blue or green light-emitting diodes (LEDs) which, together with layer transfer onto foreign substrates, can enable flexible and stretchable lighting applications. Here, the heteroepitaxial growth of GaN on amorphous and single-crystal substrates employing various interlayers and nucleation layers is discussed, as well as the use of weak interfaces for layer-transfer onto foreign substrates. Layer-transfer techniques with various interlayers are also discussed. These heteroepitaxial GaN growth and layer-transfer technologies are expected to lead to new lighting and display devices with high efficiency and full-color tunability, which are suitable for large-area, stretchable display and lighting applications. We shall also discuss blue light enhancement in CdS/ZnS quantum dots using surface plasmon resonance to achieve near-unity quantum yield. Finally, nanostructured GaN-based LEDs for white light generation will be reviewed.

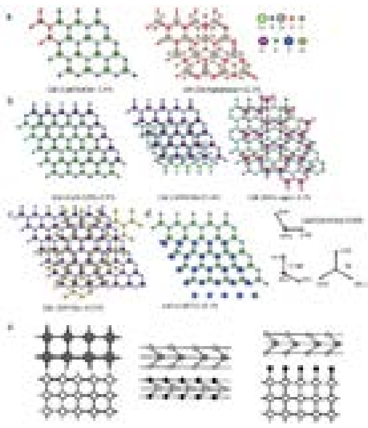

Figure1: Atomic arrangement of various hetero-epitaxial interfaces for different multilayer structures: a) GaN/ZnO (NL)/graphite (IL/SB): (left) GaN/ZnO and (right) ZnO/graphene. b) GaN/AlN (NL)/BN (IL)/sapphire (SB): (left) GaN/AlN, (center) AlN/BN, and (right) BN/sapphire. c) GaN/Ti (IL)/glass (SB): GaN/Ti. d) GaN/AlN (IL)/Si (SB): AlN/Si. e) Interfaces connected by (left) dangling bonds (3D on 3D), (center) van der Waals gap (2D on 2D), and (right) quasi van der Waals gap (2D on dangling-bond passivated 3D).

Biography

Jun Hee Choi received his PhD in Materials Science and Engineering from Seoul National University in 2012. He is currently a Research Master and Research Staff Member of the Device and System Research Center at Samsung Advanced Institute of Technology, Samsung Electronics. He has published more than 45 papers in SCI journals, more than 20 conference papers, and more than 50 US patents. His research includes GaN-based optoelectronics on unconventional substrates, and low dimensional electronics based on quantum dots, ZnO nanorods, and graphene.

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Shien-Kuei Liaw, J Laser Opt Photonics 2017, 4:2(Suppl)
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Shien-Kuei Liaw

National Taiwan University of Science and Technology, Taiwan

Design and implementation of Er/Yb co-doped fiber lasers

In this talk, several types of single-longitudinal mode (SLM) linear cavity tunable fiber lasers will be reviewed and discussed. Integrating a partial reflectance fiber Bragg grating (FBG) as the front cavity end, the rear cavity end elements may be a loopback optical circulator (OC), a broadband fiber mirror, a Faraday rotator mirror or a 2x2 fiber coupler. For SLM selection, using multiple subring cavities based on the Vernier effect, a piece of gain fiber saturable absorber as modes filter or their hybrid type. For wide-tuning range fiber laser, the wavelength tuning mechanism may be tunable FBGs, a 3-point bending device or a four-lamina composite device to facilitate wavelength tuning of FBGs, a large tuning range cover C+L band with good resolution of 0.1 nm was achieved. Laser characteristics such as output power, optical signal-to-noise ratio, laser linewidth, threshold pump power and pumping slope efficiency are measured. An example characteristic of 1 MHz, 59 dB, 13% and 0.1 dB for linewidth, side-mode suppression ratio, quantum efficiency and power variation of whole tuning range, respectively, are obtained. The pumping power efficiency may be 10% improved by recycling the residual pump power to the gain medium and has the advantages of simple structure, large pump slope efficiency and short cavity. The proposed fiber lasers may find various potential applications.

Biography

Shien-Kuei Liaw received Double Doctorate from National Chiao-Tung University in Photonics Engineering and from National Taiwan University in Mechanical Engineering, respectively. He joined the Chunghua Telecommunication, Taiwan, in 1993. Since then, he has been working on Optical Communication and Fiber Based Technologies. He joined the Department of Electronic Engineering, National Taiwan University of Science and Technology (NTUST) in 2000. He has ever been Director of the Optoelectronics Research Center and the Technology Transfer Center, NTUST. He was a Visiting Researcher at Bellcore (now Telcordia), USA for six months in 1996 and a Visiting Professor at University of Oxford, UK for three months in 2011. He owned six US patents, and authored or coauthored for 250 journal articles and international conference presentations. He earned many domestic honors and international honors. He has been actively contributing for numerous conferences as a conference chair, technical program chair, organizing committee chair, steering committee and/or keynote speaker. He serves as an Associate Editor for *Fiber and Integrated Optics*. Currently, he is a Distinguished Professor of National Taiwan University of Science and Technology (NTUST), Vice President of the Optical Society (OSA) Taiwan Chapter and Secretary-General of Taiwan Photonic Society. His research interests are in Optical Sensing, Optical Communication and Reliability Testing.

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Emily Wilson

NASA Goddard Space Flight Center, USA

A portable laser heterodyne radiometer for measurements of CO_2 and CH_4 in the atmospheric column

Laser heterodyne radiometry is a technique based on radio receiver technology that has been in use since the 1970s for measuring trace gases in the atmosphere such as ozone, water vapor, methane, ammonia, and chlorine monoxide. Earlier iterations of this technique featured large, high-powered lasers that limited widespread use and the potential for commericalization. With the relatively recent availability of distributive feedback (DFB) lasers, it has become possible to make this technique low-cost, low-power, and portable. The miniaturized laser heterodyne radiometer (mini-LHR) is a passive variation of this technology developed at NASA Goddard Space Flight Center that measures methane (CH_4) and carbon dioxide (CO_2) in the atmospheric column by mixing sunlight and DFB laser light in the infrared. The entire instrument fits on a backpack and operates on a fold-out 35 watt solar panel. Over the course of its development, the mini-LHR has been field tested in a range of locations and conditions including urban locations in Washington, DC and Los Angeles, a high-altitude site at Mauna Loa observatory in Hawaii, a rural location in upper Wisconsin, and a dairy farm in California. Recently, the mini-LHR was used to monitor CH_4 and CO_2 over varying thawing permafrost terrains. In the image, the mini-LHR (right) is shown in a collapse scar bog next to an eddy flux tower (left) at a field site near Fairbanks, Alaska. The mini-LHR operates in tandem with AERONET - a global network of more than 500 sensors that measure aerosol optical depth. The benefit of this partnership is that the mini-LHR could be readily deployed into this global network and provide validation for satellite missions as well as a long-term stand alone data product.

Biography

Emily Wilson specializes in Instrument Development for measurement of atmospheric trace gases. She joined NASA in 2005 after working there as an NRC Postdoc. She leads two instrument developments: a laser heterodyne radiometer for column measurements of CO2, CH4, and H2O, and a miniaturized gas correlation radiometer for measurements of CH4, CH2O, H2O, and CO2 in the Martian atmosphere.

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Dror Malka

Holon Institute of Technology, Israel

Design of 1xN MMI power and wavelength splitters/couplers based on slot silicon waveguide structures

A slot-waveguide is a unique structure that enables light to be strongly confined and guided inside a narrow nanometer-scale region of low index material that is surrounded by two layers with high index material. Using this unique structure leads to a variety of advantages such as small beat length of the guided light and strong confinement in the slot region that results in extremely low losses. Choosing a slot material with lower-index value leads to a stronger confinement inside the slot region. However, a multimode interference (MMI) demultiplexer component with closer spacing between ports is very sensitive to the variation of the optical signals in the C-band (1530-1565 nm), which can influence the MMI coupler size and the performance. To overcome this problem, we choose Gallium nitride (GaN) as the slot material. GaN has a low-index value compared to Si material and is also high-index value compared to alumina or silica. Thus, the MMI demultiplexer component based silicon (Si)-GaN slot waveguide is not very sensitive to the variation of the effective refractive index that lead, the ability to separate closer wavelengths in the C-band inside the MMI coupler with good performances. We propose a novel 8-channel wavelength MMI demultiplexer in slot waveguide structures that operate at 1530 nm, 1535 nm, 1540 nm, 1545 nm, 1550 nm, 1555 nm, 1560 nm and 1565 nm. Gallium nitride (GaN) surrounded by silicon (Si) was found to be a suitable material for the slot-waveguide structures. The proposed device was designed by seven 1x2 MMI couplers, fourteen S-band and one input taper. Simulation results show that the proposed device can transmit 8-channel that works in the whole C-band (1530-1565 nm) with low crosstalk ((-19.97)-(-13.77) dB) and bandwidth (1.8-3.6 nm). Thus, the device can be very useful in optical networking systems that work on dense wavelength division multiplexing technology.

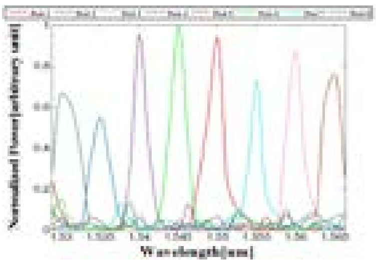

Figure1: Normalized power as function of the operated wavelengths.

Biography

Dror Malka received his BSc and MSc degrees in Electrical Engineering from Holon Institute of Technology (HIT), Israel in 2008 and 2010, respectively. He has also completed a BSc degree in Applied Mathematics at HIT in 2008 and received his PhD degree in Electrical Engineering from Bar-Ilan University (BIU) in 2015, Israel. Currently, he is a Lecturer in the Faculty of Engineering at HIT. His major fields of research are Nanophotonics, Super-resolution, Silicon Photonics and Fiber Optics. He has published around 21 refereed journal papers, 20 conference proceeding papers, and 2 book chapters.

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Mingshan Zhao

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Progress on microwave photonic signal processing and transmission

Microwave photonics (MWP) provides a unique way to synthesize, deliver and process radio frequency (RF) signal. Thanks to its numerous advantages like low transmission loss, immunity to electromagnetic interference and high bandwidth handling capacity, it is being rapidly applied into radar, satellite communication and metrology. Herein, we would like to introduce some new progresses of our research, which basically includes signal transmission, processing and detection. We proposed some methods to improve the spurious-free dynamic range of microwave photonic link (MPL), such as destructive combination of nonlinear distortions in a balanced photodiode, optical carrier band processing achieved by Stimulated Brillouin Scattering (SBS) processing and Sagnac interferometer-assisted dynamic range improvement strategy. These methods can greatly enhance the fidelity of microwave signal transmitted via an optical link, enabling realization of higher capacity with lower distortion signal transmission. We also developed some photonic techniques to eliminate in-band self-interference exists in Full-Duplex wireless communication system. We have developed a technique of optical RF self-interference cancellation by using the inherent out of phase property between the left and right sidebands of phase-modulated signal, matching their phase and amplitude to achieve self-interference cancellation. Another technique is based on a compact Dual-Parallel Mach-Zehnder Modulator (DPMZM), by detuning the electrical delay line and three bias voltage of DPMZM, the self-interference in received signal can be greatly suppressed. This work offers the possibility to achieve reliable full-duplex communications. Another work we have done is detection of low-power RF signal. It is based on a tunable optoelectronic oscillator (OEO), which can provide gain to the weak RF signals that match the oscillation frequency by tuning the wavelength of the laser. Throughout this work, it is just part of our work on MWP, further research still need to be done in the future.

Biography

Mingshan Zhao received his PhD degree in Electronic Engineering from Ghent University, Belgium, in 2003. He is a Professor in the School of Physics and Optoelectronic Engineering, Dalian University of Technology, Dalian, China. He leads the Photonics Research Center at DUT, which focuses on new concepts for microwave photonic components and systems, polymer-based photonic components, and circuits for optical communication and optical sensing.

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Generation of Mathieu-Gauss beams with an intra-cavity spatial light modulator

Helmholtz–Gauss beams (HGBs), nearly non-diffraction beams that can propagate a long distance without significant divergence, have attracted considerable attention for their potential applications in science and technology. Mathieu-Gauss beams (MGBs) are one kind of Helmholtz–Gauss beams, which are the ideal non-diffraction Mathieu beams apodized by Gaussian transmittance. Unlike the ideal non-diffracting Mathieu beams, MGBs can be realized experimentally for the reason that MGBs carry a reasonable finite power. The nearly non-diffraction properties of MGM show their potential to lots of practical applications, such as: optical interconnections, laser machining, collimation and measurement, optical manipulation, etc. Alvarez-Elizondo et al. first generated MGBs in an axicon-based stable resonator in a real CO2 laser by slightly breaking the symmetry of the cavity in 2008. Later, Tokunaga et al., adopted special micro-grain Nd:YAG laser crystals, they also achieved spontaneous MGMs oscillation in end-pumped solid-state lasers. A general approach for the selectively excitation of any specified MGM in a laser system is necessary for the development of future MGBs' applications. This study investigated in finding a way to selectively excite any specified MGM in an end-pumped solid-state laser system with an intra-cavity spatial light modulator. We drafted codes to simulate the lasing operation of the laser system to explore the selectively exciting a specified MGM in end-pumped solid-state lasers using numerical simulation. This study proposed a systematic approach to the selective excitations of all Mathieu-Gauss modes (MGMs) in end-pumped solid-state lasers with a SLM-based stable laser resonator.

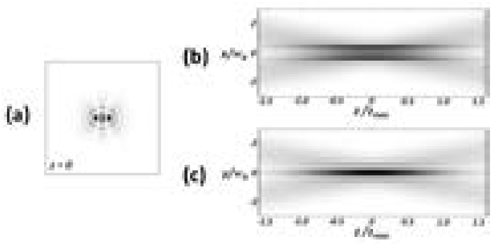

Figure1: It shows propagation of amplitude profile along plane (x, z) or plane (y, z) of an even MGB from the simulated laser resonator with mode order m=2 and ellipticity parameter q=5.

Biography

Shu-Chun Chu received her PhD degree from the Institute of Electro-Optical Engineering, National Chiao Tung Univisity. She currently serves as a Professor in Department of Physics, National Cheng Kung University. She has her expertise in designing laser cavity and finding approaches for generating various structure beams in solid-state lasers. She also has expertise in designing non-imaging optical systems, such as solar concentrators, LED illuminators, backlight modules, etc.

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