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Part I SOPO 2019 Conference Schedule

Time: August 17-August 19, 2019
Location: Xi'an Grand Dynasty Culture Hotel (西安古都文化大酒店), China

Date	Time	Lobby, Xi'an Grand Dynasty Culture Hotel	
August 17	**14:00-17:00**	**Registration**	
Date	Time	**Hanwu Meeting Room (汉武厅)**	
August 18	**08:30-08:40**	**Opening Ceremony** **Chair: Prof. Zhiping Zhou**	
	08:40-12:00	**Plenary Session 1** Prof. Akiyoshi Mikami, Prof. Dae Wook Kim, Prof. Zenghu Chang, Prof. Jovana Petrovic, Prof. Jietai Jing, Prof. Harith Ahmad, Prof. Yang Yue, Prof. Bayram GÜNDÜZ **Chair: Prof. Zenghu Chang & Prof. Jovana Petrovic** **Group Photo & Coffee Break** **10:25-10:40**	
	12:00-13:30	**Lunch [Chinese Restaurant 中餐厅, 2nd Floor]**	
	14:00-18:00	**Plenary Session 2** Dr. Matthias Koitzsch, Prof. Dr. Hairun Guo, Dr. Shubo Wang, Prof. Jianxin Chen, Prof. Anhui Liang, Prof. Yufei Ma, Prof. Shengjun Zhou, Prof. Hongjun Zheng **Chair: Dr. Shubo Wang** **Coffee Break:15:40-15:50**	
	18:00-19:30	**Dinner [Chinese Restaurant 中餐厅, 2nd Floor]**	
Date	Time	**Hua Shan Hall (华山厅)**	**Tai Bai Shan Hall (太白山厅)**
August 19	**08:30-12:00**	**Plenary & Technical Session 1** Prof. Jingsong Li, Prof. Xinlu Zhang, Prof. Qingzhong Huang **Chair: Prof. Xinlu Zhang** **Coffee Break:10:00-10:15**	**Plenary & Technical Session 2:** Prof. Xiaowei Guo, Dr. Jiangming XU, Prof. Ziji Liu **Chair**: **Prof. Xiaowei Guo** **Coffee Break:10:00-10:15**
	12:00-13:30	**Lunch [Chinese Restaurant 中餐厅, 2nd Floor]**	
August 20	**7:30 - 16:00**	**One Day Tour**	

Part II Plenary Speeches

Plenary Speech 1: Highly Efficient and Wide-Color-Gamut Organic Light-Emitting Devices based on the Multi-Scale Optical Design

Speaker: Prof. Akiyoshi Mikami, Kanazawa Institute of Technology, Japan
Time: 08:40-09:10, Sunday Morning, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
Organic light-emitting devices (OLEDs) are expected as a high performance flat panel display, including the capability of flexible and transparent panels. Luminescent properties such as power efficiency and color purity have been improved by introducing vearious optical design technologies for the enhancement of light-extraction process. It will be shown that the external micro-cavity effect coupled with surface plasmon resonance is useful for the improvement of the color purity of the emission and out-coupling efficiency. In results, color coordinates of three primary color emission approaches to BT.2020 national standard and an external quantum efficiency becomes higher by a factor of about 1.5. The effect and behavior of optical intractionin waveguide and surface plasmonmodesin an OLED will be discussed from a viewpoint of multi-scale optical design analysis.

Plenary Speech 2: Electrically-modulated optoelectronics-based infrared sourceenabling ground surface precision deflectometry

Speaker: Dr. Dae Wook Kim, University of Arizona, USA
Time: 09:10-09:40, Sunday Morning, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
We introduce the design of a scalable, modulated long-wave infrared source. The design makes use of a pseudo-blackbody heating element array, which radiates into a custom aluminum integrating cavity. The elements possess low thermal capacitance, enabling temporal modulation for improved signal isolation and dynamic background removal. To characterize performance, deflectometry measurements were made using both the new source design and a traditional tungsten ribbon source, which possess similar source irradiance and identical emission profile dimensions. Measurements from a ground glass flat and an aluminum blank

demonstrated the new source produces a signal-to-noise ratio four times greater than that of the ribbon. Thermal imaging demonstrated improved source geometry and signal stability over time, and further, the new design measured a previously untestable hot aluminum flat (150 °C). The new design enables high-contrast thermal measurement of surfaces typically challenging to infrared deflectometry due to high surface roughnessor intrinsic thermal noise generation.

Plenary Speech 3: Quantum Metrology with SU(1,1) interferometer

Speaker: Prof. Jietai Jing, East China Normal University, China
Time: 09:40-10:10, Sunday Morning, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract

An SU(1,1) interferometer can be realized by replacing the beam splitters in the Mach-Zehnder interferometer (MZI) with parametric amplifiers. This novel interferometer scheme was proposed more than 30 years ago and its signal- to-noise ratio enhancement has also been experimentally demonstrated based on the four-wave mixing in our recent work. As is well known, the sensitivity of any interferometer increases with the increasing of the internal photon numbers. Therefore, bright-seeded SU(1,1) interferometer has an advantage of boosted sensitivity. However, the phase sensitivity used to characterize the bright-seeded SU(1,1) interferometer has not been shown yet. In this talk, I will present our recent experimental results about the phase sensitivity enhancement of such a bright-seeded SU(1,1) interferometer compared with the the shot noise limit (SNL). It is the direct intensity detection that brings us the major advances of quantum enhancement for the bright-seeded SU(1,1) interferometer in real time. Our results may find potential applications in quantum metrology.

Plenary Speech 4: Ultrafast optical control and investigation of molecules and complexes

Speaker: Prof. Jovana Petrovic, Deutsches Elektronen-Synchrotron DESY, Germany
Time: 10:10-10:40, Sunday Morning, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract

The development of ultrashort-pulse lasers has played a pivotal role in studies of ultrafast chemical reactions and molecular structure by enabling their triggering, observation, and control in real time. I will give an overview of the investigations of the ultrafast dynamics of steric and electronic effects in chemical reactions performed in the Controlled Molecule Imaging (CMI) group. I will give a detailed account of our recent studies of the dynamics of photo-excited indole molecules and indole-(water)1 clusters, with the aim to unravel the mechanisms of formation and breaking of hydrogen bonds, which play an important role in protein inactivation in aqueous environments. Special emphasis will be put on the optical techniques used in alignment and orientation, ultrafast excitation and strong-field probing of molecules, and to an emerging high spatio-temporal resolution imaging technique — laserinduced electron diffraction.

Plenary Speech 5: Novel high power infrared lasers for attosecond science

Speaker: Prof. Zenghu Chang, University of Central Florida, USA
Time: 10:50-11:20, Sunday Morning, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
The advent of Ti:Sapphire lasers in the 1990s leads to the first demonstration for attosecond XUV pulses in 2001. In recent years, carrier-envelope phase stabilized lasers at 1.6 to 2.1 micron based on Optical Parametric Chirped Pulse Amplification pushed attosecond light sources to the "water window" X-rays, which enabled real-time observation of electron and nuclear motion in molecules containing carbon, nitrogen and oxygen. A more efficient way of producing long-wavelength, high energy, femtosecond pulses is through Chirped Pulse Amplification. Very recently, we have demonstrated the generation of 2.3 mJ, 88 fs, 2.5 μm laser pulses from a Chirped Pulse Amplifier employing Cr2+:ZnSe crystals as the active gain media. Our results show the highest peak power at 2.5 μm with a 1 kHz repetition rate. Such lasers will be powerful sources for studying strong field physics and extending high harmonic generation towards the keV X-ray region.

Plenary Speech 6: Usage of Transition Metal Dichalcogenides in Generating Q-Switched and Mode-Locked Pulses in the Wavelength Region of 1.0 micron, 1.3 micron, S-band, C-band, L-band and 2.0 micron.

Speaker: Prof. Harith Ahmad, Photonics Research Centre, University of Malaya, Malaysia

Time: 11:20-11:50, Sunday Morning, August 18, 2019
Location: Hua Shan Hall (华山厅), the 1st Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
Advances in photonics over the past decade has seen a marked interest in the development of various 2-dimensional (2D) and 3-dimensional (3D) materials to serve as saturable absorbers (SAs) in fiber laser systems. These SAs are capable of passively inducing Q-switching and mode-locking in laser systems, allowing a new generation of efficient yet compact and cost-effective optical devices to be realized. While many 2D and 3D materials have been explored for their possible application as SAs, transition metal dichalcogenides (TMDs) in particular have shown significant potential. TMDs have unique opto-electronic characteristics that can be configured for various applications through the many possible combinations of one transition metal with two chalcogen atoms. This presentation will examine the key aspects of TMDs and their main opto-electronic charactersitics, as well as the fabrication methods and techniques used to fabricate SAs based on these materials. Subsequently, the application and performance of Q-switched and mode-locked lasers using TMD based SAs operating at the key wavelength regions of 1.0 μm, 1.3 μm, the S-, C- and L-bands as well as the 2.0 μm are examined. Finally, the feasibility of laser systems built around these SAs are discussed, touching on potential aspects of communications and sensing.

Plenary Speech 7: Eye-diagram-based Joint Monitoring of Coherent Channel Using Deep Learning

Speaker: Prof. Yang Yue, Nankai University, China
Time: 11:50-12:20, Sunday Morning, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
With the continuous advancement of the artificial intelligence technology, machine learning is widely used in various fields. We review the application of optical performance monitoring (OPM) in optical communications system, and its latest evolution with machine learning techniques.

Nowadays, coherent-based wavelength-division multiplexing (WDM) technology is the de-facto standard for Tb/s and beyond optical transport networks. With increased system complexity, it can significantly improve the data-carrying capacity. In such a system, there are more performance parameters that need to be monitored in real-time.

In this talk, we review our recent demonstration on eye-diagram-based joint monitoring of coherent channel using deep learning. Unlike many other technologies, low-speed eye diagram measurement can significantly reduce the hardware implementation cost and complexity. Besides modulation

format identification (MFI), experiments also show that the proposed technique can simultaneously determine the optical signal to noise ratio (OSNR), roll-off factor (ROF), and timing skew of a quadrature amplitude modulation (QAM) transmitter with high accuracy.

Plenary Speech 8: Comparisons of Theoretical and Experimental Optoelectronic Properties of the Organic Semiconductor

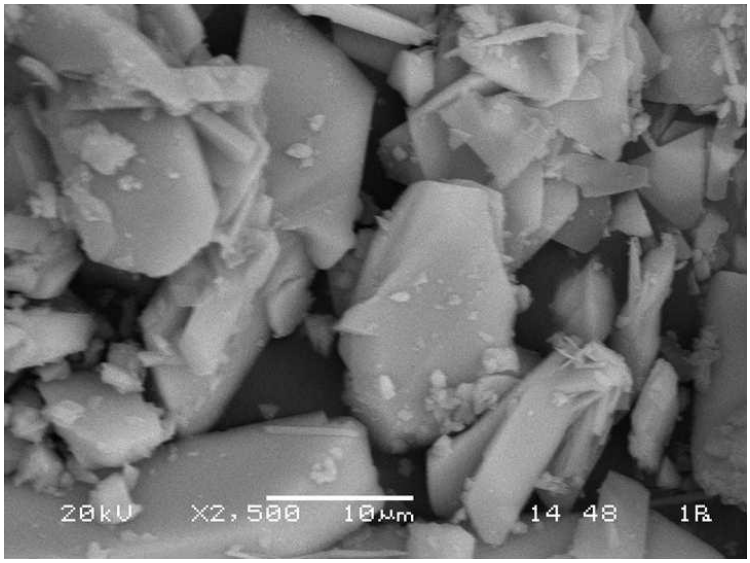
Speaker: Prof. Bayram GÜNDÜZ, Muş Alparslan University, Turkey
Time: 12:20-12:50, Sunday Morning, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract

Organic semiconductors (OSCs) have widely investigated due to excellent electronic, photovoltaic, optical, photonic, luminescence, optoelectronic and applied science properties. In this talk, we will talk on comparisons of theoretical and experimental optoelectronic properties of the organic semiconductor. For this, experimental and advanced computational technique was performed to investigate various properties of the organic semiconductor.

UV and FTIR spectra, photonic and fluorescence properties were analyzed by using experimental and advanced computational technique. SEM images of the organic semiconductor were obtained and investigated in detail.

Fig. 1. SEM image of the organic semiconductor.



Acknowledgments: This study was supported by "The Management Unit of Scientific Research Projects of Muş Alparslan University (MUSBAP) under Project BAP-17-EMF-4901-09.

Plenary Speech 9: “Smart Production – On The Way To Autonomous Laser Processes”

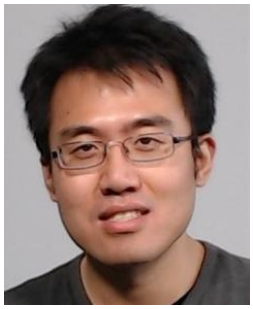
Speaker: Dr. Matthias Koitzsch, TRUMPF（China）Co., Ltd, China
Time: 14:00-14:30, Sunday Afternoon, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi’an Grand Dynasty Culture Hotel

Abstract
Modern laser processes have to become more and more efficient. The new era of digitization enables better quality, higher production speeds and reduced downtimes. Overall this delivers a high potential for reducing the production cost and – time.

There are four main building blocks to achieve the full advantages of more efficient processes in terms of Industry 4.0:

- Intelligent Equipment
- Intelligent Processes
- Networks
- Artificial intelligence

Plenary Speech 10: Nanophotonic Optical Frequency Combs: From Microresonator Combs to Supercontinuum-based Spectroscopy



Speaker: Dr. Hairun Guo, Shanghai University, China
Time: 14:30-15:00, Sunday Afternoon, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi’an Grand Dynasty Culture Hotel

Abstract
Optical frequency combs provide equidistant laser frequencies, and have become a pivotal tool for time measurement and frequency metrology, including optical clocks, spectroscopy and low-noise microwave generation [1,2]. In 2007, a new method to generate optical frequency combs was discovered based on high-Qand nonlinear optical microresonators [3–6]. Microresonator frequency combs have since then been widely investigated.They enable combs with large bandwidth, high repetition rate, and high compactness, and have found advanced applications such as coherent communication [7], ultrafast ranging [8], fully integrated optical synthesizer [9], astro-comb, etc. In particular, they can be implemented on nanophotonic integrated platforms, e.g. the silicon nitride photonics that is CMOS compatible [10],

and combines both high material nonlinearity with unprecedented ways that dispersion is lithographically controlled in integrated photonics. Remarkably, this has led to combs with octave-spanning bandwidth [11,12] and enables the self-referencing without external broadening regime [13]. On another direction of the development, the loss rate of the photonic integrated waveguides has been largely reduced, leading to record-high quality (Q) factor in silicon nitride microresonators, and combs that can be generated at diode's power level [14]. Fundamentally, microresonator frequency combs correspond to temporal soliton pulses that are spontaneously formed in the resonator [5], and allow for rich soliton dynamics including the Raman effects [15], soliton induced Cherenkov radiation, soliton switching [16], breather solitons [17–19], and soliton spatial multiplexing [20]. In this presentation, the developments at EPFL will be reviewed, with respect to both fundamental physics and applications of microresonator frequency combs. In addition, we will review nanophotonic supercontinuum generation in silicon nitride waveguides, which benefits from the high-flexible nanophotonic dispersion engineering, and is alternative to mid-infrared frequency comb generation [21]. A supercontinuum-based mid-infrared spectroscopy will also be presented.

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Plenary Speech 11: Photon Momentum Effects in Artificial Microstructures

Speaker: Dr. Shubo Wang, City University of Hong Kong, Hong Kong (China)
Time: 15:00-15:30, Sunday Afternoon, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract

Light carries both linear momentum and angular momentum. The interactions between light and matter lead to momentum transfer/conversion that not only change the propagation of light but also induce forces on matter. These photon momentum effects can give rise to counterintuitive phenomena in artificial microstructures (i.e. man-made structures with desired properties). In this talk, I will discuss several phenomena that deepen our understanding of the fundamental properties of photon momentum. I will report that the light-induced force on a metamaterial boundary can be either pushing or pulling depending on the symmetry of microstructures [1,2]. I will also report that photonic spin-orbit interactions enabled by artificial microstructures can induce chirality-dependent lateral optical forces [3] and arbitrary-order non-Hermitian exceptional points [4]. Interpretations of these phenomena could help to resolve a century-old debate about photon momentum in media and generate novel applications such as ultra-sensitive optical sensors and sorting chiral molecules using light-induced forces.

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Plenary Speech 12: New Equations More Precise Than Uncertainty Principle, Biological Optical Fiber Couplers, Bio-transistors and Modulation Format on Human Retina

Speaker: Prof. Anhui Liang, Guangdong University of Technologies, China
Time: 15:30-16:00, Sunday Afternoon, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi’an Grand Dynasty Culture Hotel

Abstract

Anhui Liang[1] and Zhimin Liang[2]
[1]Guangdong University of Technology, China
[2]University of California, San Diego, USA

We discovered a pair of equations which are more precise than Heisenberg’s Uncertainty Principle. We first derive one new equation:

$\Delta E_{rms}^2 \Delta t_{rms}^2 = \frac{4}{16 \Delta E_l^2 \Delta t_l^2} + \frac{^2 G_{rms}^2}{4 \Delta t_l^2} + \frac{^2 Chirp_{E,rms}^2}{4 \Delta E_l^2} + Chirp_{E,rms}^2 G_{rms}^2$, Our equations may help to resolve the important question: there are may be deeper relationship between quantum indeterminacy and non-localization.

We first discovered there are biological transistors on human retina. We first proposed the modulation formats on human retina. We first find the trend of the hue resolution curve of human eyes is correlated to S+0.5M-0.25L. We first found there are optical couplers consisted of cones and rods on human retina.

We first find there are optical couplers consisted of Chinese Meridians. We first found several types optical couplers in human bodies, one type consisted of nerve cell, glia cell and blood capillary, another type consisted of nerve cell, glia cell and collagenous fiber.

We first proposed live chromosomes are optical fibers and a pair of natural sister chromatids form an optical fiber coupler, We first propose the live chromosomes in a human body can form many optical fiber components including fiber lasers, optical fiber amplifiers, optical modulators and saturable absorbers etc.

Plenary Speech 13: Multiphoton diagnostic information and its application in clinical medicine

Speaker: Prof. Jianxin Chen, Fujian Normal University, China
Time: 16:10-16:40, Sunday Afternoon, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract

Multiphoton microscopy uses ultrafast, near-infrared laser as excitation sources and bases on nonlinear optical signals of intrinsic fluorophores in tissues such as two or three photon-excited fluorescence (2PEF or 3PEF) and second or third harmonic generation (SHG or THG), providing enhanced imaging penetration depths in scattering samples, reduced overall specimen photodamage, photobleaching and phototoxicity. The first issue we need to answer is to establish the correlation between the tumor progression and optical diagnostic information when we want to translate it into routine clinical use of cancer diagnosis and therapy. In our research, we used ex vivo specimen of human oesophageal cancer, gastric cancer, colorectal cancer, cervical cancer, breast cancer, and brain tumor as the object of study to establish the correlation between the tumor progression and optical diagnostic information based on SHG and 2PEF. We demonstrated that MPM has the potential to differentiate between normal and dysplastic tissues, to differentiate between normal and cancerous tissues, to monitor cancer progression, to identify intramural metastasis, to detect morphological alterations in rectal cancer following preoperative radiochemotherapy to assess treatment efficacy in relation to dose or strategy and so on.

Plenary Speech 14: Recent advances in nitride-based blue/green/ultraviolet light-emitting diodes

Speaker: Prof. Shengjun Zhou, Wuhan University, China
Time: 16:40-17:10, Sunday Afternoon, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
Nitride-based light-emitting diodes (LEDs) have attracted considerable interest for their applications in solid state lighting, automotive front lighting, and full-colour displays because of their high luminous efficiency, low energy consumption, long operation lifetime, and broad spectral range spanning from ultraviolet to red wavelengths. However, the poor internal quantum efficiency and low light extraction efficiency constitute the bottlenecks in realizing high performance devices. This talk will outline the emerging challenges in the design and fabrication of micro/nano-structures for improving light extraction efficiency of GaN-based blue/green/ultraviolet LEDs. Recent advances from our group in developing light-out coupling micro/nano-structures, such as nanometer-scale V-pits, 3D patterned dual-layer ITO, nanoscale patterned sapphire substrate, wavy sidewall, sidewall nano-prisms, embedded air voids, microstructured SiO2array, and metal wire gird transparent conductive electrode will be discussed. Moreover, the recent development in fabricating flip-chip LED, vertical LEDs, and Mini-LEDs will also be introduced.

Plenary Speech 15: Quartz tuning fork based trace gas detection

Speaker: Prof. Yufei Ma, Harbin Institute of Technology, China
Time: 17:10-17:40, Sunday Afternoon, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
Photoacoustic spectroscopy (PAS) is an effective trace gas sensor technology which employs a broadband microphone for acoustic wave detection. When the output of a near-infrared semiconductor laser is absorbed by a gas sample, the absorbed energy is transformed to heat energy by non-radiative processes, and will subsequently result in an increase of the local temperature and pressure in the sample. Therefore the absorption of a modulated near-infrared laser beam in a gas sample leads to the generation of an acoustic wave. The intensity of the acoustic wave is related to the sample concentration which can be detected by a sensitive microphone. However, most microphone-based PAS cells have a low resonance frequency, which makes such cells more sensitive to environmental and sample gas flow noise. A recent modification

of the conventional PAS is the quartz-enhanced photoacoustic spectroscopy (QEPAS) technique which was first reported in 2002. This technique uses a commercially available millimeter sized piezoelectric quartz tuning fork (QTF) as an acoustic wave transducer. The high Q-factor and narrow resonance frequency band of QTF improve the QEPAS selectivity and immunity to environmental acoustic noise. In this paper, high sensitive trace gas detection based on QEPAS method will be introduced and discussed.

Plenary Speech 16: Recent progresses in few mode (de)multiplexer for mode-division multiplexing

Speaker: Prof. Hongjun Zheng, School of Physics Science and Information Technology, Liaocheng University, China
Time: 17:40-18:10, Sunday Afternoon, August 18, 2019
Location: Hanwu Meeting Room (汉武厅), the 2nd Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
In recent years, mode-division multiplexing (MDM) using few-mode fibers (FMF) have been intensively investigated as the method to increase transmission capacity beyond the nonlinearity Shannon limit of single-mode fibers (SMF). FMF and it's (de)multiplexers have drawn much attention in optical communications. In this invited presentation, recent progress in (de)multiplexers will be reviewed, including (de)multiplexers design and characteristics, as well as the wide applications. We firstly review some types of (de)multiplexers such as a spatial (de) multiplexers with glass phase plane, spatial (de)multiplexers with liquid crystal on silicon (LCOS) phase modulator, fiber (de)multiplexers with photonic lantern and fiber (de)multiplexers with directional coupler. Then, we propose a novel graded index fiber (de)multiplexers with directional coupler. Finally, we demonstrate some optical transmission systems based on FMF and (de)multiplexers for the front-haul transmission.

Plenary Speech 17: Quartz crystal tuning fork (QCTF) based detector and its application

Speaker: Prof. Jingsong Li, Anhui University, China
Time: 08:30-09:00 Monday Morning, August 19, 2019
Location: Hua Shan Hall (华山厅), the 1st Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
Laser spectroscopy sensing techniques show significant superiority in terms of sensitivity, selectivity and time resolution, and being universal in gaseous, solid, and liquid phases. Recent advances in new laser sources and detectors have triggered an increasing application in atmospheric monitoring, industrial process control, medical and combustion diagnostics, etc.
In this paper, we report on the development of quartz crystal tuning fork (QCTF) based detector and its comparison with commercially mature detectors. Similar to the photoelectric effect of traditional semiconductor detectors, we utilize the piezoelectric effect of the QCTF to gauge the light intensity, and its resonant effect for signal enhancement. Details of integrating the QCTF detector with a broadband tunable external cavity quantum cascade laser (ECQCL) for sensitive detection of volatile organic compounds (VOCs) and atmospheric trace gases will be presented. The novel QCTF detector technology may pave a way towards developing a new type of photodetector suitable for the whole electromagnetic radiation.

Keywords: QCTF; Piezoelectric detector; ECQCL; Gas sensing; Spectroscopic applications

Plenary Speech 18: Mid-infrared Ho:YAG/BaWO4 and YVO4 intracavity Raman lasers resonantly pumped by a Tm:YLF laser at 1908 nm

Speaker: Prof. Xinlu Zhang, Tianjin Polytechnic University, China
Time: 09:00-09:30, Monday Morning, August 19, 2019
Location: Hua Shan Hall (华山厅), the 1st Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
Stimulated Raman scattering (SRS) in crystalline materials has been a very important nonlinear frequency conversion method. Solid state Raman lasers based on the SBS effect can generate a new wavelength of Raman laser, which is difficult to access with direct laser oscillation. The output wavelength of a Raman laser depends on the wavelength of fundamental laser and the Raman frequency shift of Raman crystal. With the development of high quality Raman crystals, solid state Raman lasers have attracted more and more attentions. Among these known Raman crystals, the BaWO4 and YVO4 are two kinds of excellent Raman crystals which are widely investigated, due to high thermal conductivity and high optical damage threshold.
In this paper, we report the mid-infrared intracavity Raman lasers based on BaWO4 and YVO4 Raman conversion in a resonantly pump actively Q-switched Ho:YAG laser for the first time, to the best of our knowledge. The output performances of the BaWO4 and YVO4 Raman lasers are investigated in detail. For the 2640 nm BaWO4 Raman laser, at a pulse repetition frequency of 5 kHz, the maximum average output power of 473 mW is obtained with a 9.8 W incident pump power at 1.91 μm. At a repetition frequency of 1 kHz, the threshold pump power is as low as 2.1 W. At the pump power of 3.3 W, the maximum pulse energy, the shortest pulse width, and the highest peak power are 93 μJ, 7.3 ns, and 12.7 kW, respectively. Compared with the BaWO4 Raman laser, the

2518 nm YVO4 Raman laser has a higher threshold pump power of 5.1 W at the repetition frequency of 1 kHz. The maximum pulse energy, the shortest pulse width, and the highest peak power are 265 μJ, 10 ns, and 26.2 kW, respectively.

Plenary Speech 19: Integrated optical microresonators for filtering, buffering, and switching applications

Speaker: Prof. Qingzhong Huang, Huazhong University of Science and Technology
Time: 09:30-10:00, Monday Morning, August 19, 2019
Location: Hua Shan Hall (华山厅), the 1st Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
Owning to the compact size, wavelength selectivity and flexibility, optical microresonators (e.g. microring resonator, microdisk resonator, Fabry-Perot resonator) have become the key building blocks for various integrated photonic devices, which are widely applicable for optical filtering, buffering, and switching. Using a single microdisk resonator (MDR) in silicon, we experimentally demonstrated a dual-band optical filter with low insertion loss and high optical isolation (>20dB). We also show that the waveguide-coupled multimode resonator (i.e. MDR, microdonut) can exhibit either a flat-top response for filtering or all-passtransmission for buffering, by engineering the dual resonances in the resonators. Electromagnetically induced transparency (EIT) has attracted considerable attentions recently due to its wide applications in slowing or stopping light. We observed EIT-like resonance in an ultra-compact two-bus waveguides coupled MDR of 3 μm in radius with a quality factor of 4200. Then, we have obtained EIT and electromagnetically induced absorption phenomena in a compact silicon ring-bus-ring-bus system (~22 μm × 11 μm). Furthermore, we investigated the plasmon-induced transparency and slow-light properties in a plasmonic single-mode and two-mode resonators coupled system. A delay-bandwidth product larger than 1 and ultralow dispersion are obtained, and a delay of 1 bit with negligible pulse distortion is achieved. To construct optical switches, we have proposed and realized a novel channel add-drop filter based on a single Fabry–Perot resonator, behaving like a traveling-wave resonator where fields are coupled to the buses in one direction. Silicon thermo-optic switch based on such a resonator is realized with an insertion loss of 0.8dB, crosstalk of -8dB, and switching time of < 8μs.

Plenary Speech 20: Light Management on Monolithic Perovskite/c-Si Tandem Device

Speaker: Prof. Xiaowei Guo, University of Electronic Science and Technology of China (UESTC), China
Time: 08:30-09:00, Monday Morning, August 19, 2019
Location: Tai Bai Shan Hall (太白山厅), the 1st Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
The rapid improvement of perovskite solar cells in terms of power conversion efficiency (PCE) makes them a promising material for further efficiency enhancement for silicon photovoltaic technology by using a tandem approach. In a traditional monolithic perovskite/c-Si tandem device, the perovskite top cell has to be deposited onto a flat c-Si bottom cell to avoid bad electrical contact, which, however, greatly limits the photocurrent due to bad optical matching.

In this study, we present a perovskite/silicon tandem solar cell with electrically flat and optically rough interlayer. It is realized by introducing front pyramid texture on c-Si bottom cell but with a thick NiOhole transfer layer, which keeps the perovskite layer electrically flat. In addition, a textured polydimethylsiloxane (PDMS) anti-reflection foil covers the tandem solar cell. Our results show that Device B can reach a matched photocurrent density as high as 19.63 mA/cm2, as shown in Fig.2. Our results also show that Device A suffers from large reflection losses and consequently has a relatively low matched device current density of 17.24mA/cm2. As compared to the traditional device, the matched current density in our proposed tandem solar cell is increased by over 13.5%, which can be attributed to the proper light management techniques.

Plenary Speech 21: High power random fiber laser with flexible spectral manipulation property

Speaker: Dr. Jiangming Xu, National University of Defense Technology, China
Time: 09:00-09:30, Monday Morning, August 19, 2019
Location: Tai Bai Shan Hall (太白山厅), the 1st Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
High power random fiber laser, whose operation is based on unique random distributed feedback (RDFB), has many remarkable features, such as cavity-free, mode-free, and structural simplicity, and has attracted a great deal of attention in recent years for the potential

application in frequency doubling, mid-infrared laser pumping, and supercontinuum generation. Furthermore, thanks to the special power distribution, the output spectral properties of high power random fiber laser can be manipulated via a device with relatively low operation power. In this talk, we will review the progresses in the field of high power random fiber laser. The recent achievements concerning random fiber laser in our group, including performance exploration with the aid of new pump source, power scaling by utilizing power amplifier, and multiple spectral manipulation, will also be introduced.

Plenary Speech 22: Real-time Multi-mode Contrast Imaging Based on LED Array for Vivo Cell Monitoring fluid in Micro-channel

Speaker: Prof. Ziji Liu, University of Electronic Science and Technology of China, China
Time: 09:30-09:50, Monday Morning, August 19, 2019
Location: Tai Bai Shan Hall (太白山厅), the 1st Floor, Xi'an Grand Dynasty Culture Hotel

Abstract
An real-time multi-mode contrast imaging method is developed based on LED arrey with programmable LEDs array. The fast response speed of programmable LEDs array accommodates high-speed imaging setup, which consists of a Nikon microscope and a CMOS camera. Furthermore, the quality of phase contrast image is further improved by motion deblur and registration algorithm. In experiment, a video of cell flow in microfluidic chip with the speed of 0.1329mm/s is obtained using the real-time multi-mode contrast imaging method, which shows promising applications in high-quality and fast-speed phase contrast imaging devices.

Part IV Technical Sessions

Plenary & Technical Session 1:

Session Chair: Prof. Xinlu Zhang, Tianjin Polytechnic University
Hua Shan Hall (华山厅), the 1st Floor 08:30-12:00, Monday Morning, August 19, 2019

No.	Paper Title	Author	Affiliation
Plenary Speech	Quartz crystal tuning fork (QCTF) based detector and its application	Prof. Jingsong Li	Anhui University, China
Plenary Speech	Mid-infrared Ho:YAG/BaWO4 and YVO4 intracavity Raman lasers resonantly pumped by a	Prof. Xinlu Zhang	Tianjin Polytechnic University

Tm:YLF laser at 1908 nm

Plenary Speech	Integrated optical microresonators for filtering, buffering, and switching applications	Prof. Qingzhong Huang	Huazhong University of Science and Technology
20054	Propagation characteristics of super gaussian pulse in dispersion decreasing fiber	Shi Shengda	Guangdong University of Technology
20034	A 2×2 Optical Switches Based on Semiconductor Optical Amplifier Cross Gain Modulation Technology	Shao hua Zhou	School of Information and Communication, National University of Defense Technology, China
10:00-10:15	**Coffee Break**		
20071	SNR uniformity optimization for LEDs ring alignment in visible light communications	Fang Li	Shanghai Technical Institute of Electronics & Information
20046	A phase shift keying quantum-noise randomized cipher simulation system model based on the standard commercial devices	Chen Yukai	Army Engineering University of PLA
20023	Comparative studies of TV-regularized sparse reconstruction algorithms in projection tomography	Huiyuan Wang	Xidian University
20031	Adaptive learning rate and target re-detection for object tracking based on correlation filter	Pengyu Shen	Collage of Information and Communication Engineering of Harbin Engineering University
02012	Long working distance common-path optical coherence tomography	Yimin Wang	Huaiyin Institute of Technology
20044	Research on Gesture Recognition Method in Video Based on the Sparse Representation Theory	Yang Lei	Shanghai University, Shanghai 200444
20080	An Improved Algorithm for 3D Reconstruction In-tegration Based on Stripe Reflection Method	Gao Xu	Soochow University
20036	Synchronous photoelectric scanning imaging in underwater scattering environments	Xiyu Song	GuiLin University of Electronic Technology

20010	54 ps Q-switched microchip laser with a high modulation depth SESAM	Lei Gong	Huazhong University of Science and Technology (HUST)
20047	Tunable Soliton Mode-locked Laser using Single-Walled Carbon Nanotube as Saturable Absorber	Leonard Bayang	Photonics Research Centre, University of Malaya, 50603 Kuala Lumpur
20048	Tunable Pulse Modulation in Thulium-doped fiber using Graphene Saturable Absorber	Muhamad Zharif Samion	Photonics Research Centre, University of Malaya, 50603 Kuala Lumpur
02019	All-Optical Modulation System Using 2D Materials as Modulator	Z. C. TIU	Photonics Research Center, University of Malaya, Malaysia
02018	New IR Tunable Filter for Fire Detection System	Meir Danino	Faculty of Engineering, Bar-Ilan University, Ramat-Gan, 52900, Israel
20032	Micro-structured fiber hydrogen sensing based on optimized Pd-Ag film	Xian Zhou	Hubei University of Arts and Science
20064	Time-synchronization Measurement Technology based on conjugate reflection for High-Power laser Facility	Zhang Bo	Research Center of Laser Fusion，CAEP
20006	Field-free orientation dynamics of CO molecule by utilizing two dual-color shaped laser pulses and lower intensity of THz laser pulse	Wei-Shen Zhan	Dalian University of Technology
20068	Effects of pressure on the femtosecond filamentation with HOKE in air	Xiexing Qi	College of Physical & Electronic Information, Luoyang Normal University
20062	Research on Zoom Prism-Coupled OI-RD System	Bilin Ge	Fudan University
20075 Poster	Study on Synthesis and Pharmacological Activity of Novel 8-azapurines as P2Y12 Inhibitors	Zhichang Zhao	Beijing University of Technology

20076 Poster	Role of Chiral Auxiliaries in Synthesis of 2,3-dihydropyrroles by Photochemical Ring Contraction of 1,4-dihydropyridine	Shijie Wang	Beijing University of Technology
20077 Poster	Study on Synthesis of 1,4- and 1,2-Dihydropyridine Derivatives: A combined experimental and DFT study	Peng Li	Beijing University of Technology
20078 Poster	Study on photochemical reactions of the 1,4-dihydropyridine	Runzhi Sun	Beijing University of Technology
20026 Poster	Laser echo from star-mounted reflector-array in atmospheric turbulence	Ya-qing Li	Xi'an Technological University
20061 Poster	Time-Delay Measurement of Optical Fiber Link Based on Time-Frequency Simultaneous transmission Method	JUN CHENG GUO	Institute of Communication Engineering, Army Engineering University of PLA
20059 Poster	Mode Competition and Cavity Tuning Characteristics of a New Integrated Orthogonal Polarized He-Ne Laser with Y-Shaped Cavity	Jiabin Chen	National University of Defense Technology
20041 Poster	Influence analysis of mixing efficiency of partial coherent optical heterodyne detection	Jianying Ren	PLA Strategic Support Force, Beijing, China
20042 Poster	Calculation Method of Infrared Temperature on the Natural Ground Surface	CHEN Shan	Xi'an Research Institute of High Technology

Plenary & Technical Session 2:

Session Chair: Prof. Xiaowei Guo, University of Electronic Science and Technology of China (UESTC), China

Tai Bai Shan Hall (太白山厅), the 1st Floor 08:30-12:00, Monday Morning, August 19, 2019

No.	Paper Title	Author	Affiliation
Plenary Speech	Light Management on Monolithic Perovskite/c-Si Tandem Device	Prof. Xiaowei Guo	University of Electronic Science and Technology of China (UESTC), China
Plenary Speech	High power random fiber laser with flexible spectral manipulation property	Dr. Jiangming Xu	National University of Defense Technology,

			China
Plenary Speech	Real-time Multi-mode Contrast Imaging Based on LED Array for Vivo Cell Monitoring fluid in Micro-channel	Prof. Ziji Liu	University of Electronic Science and Technology of China, China
10:00-10:15	**Coffee Break**		
10100	Cladding Height Inspection Based Upon Vision-Based System in Direct Energy Deposition Additive Manufacturing Process	Yu-Lung Lo	National Cheng Kung University, Taiwan
20001	Ultrafast quantum random number generation based on quantum phase fluctuation unlimited by coherence time	Wei Liu	Huazhong University of Science and Technology
20007	2D light confinement in MOSFET structure based on near-zero epsilon	Shiyu Sun	Huazhong University of Science and Technology
20073	Design of a planar super-oscillatory lens	Tao Liu	Xi'an Jiaotong University
20021	A square metal-insulator-metal nanodisks sensor with simultaneous enhanced refractive index sensitivity and narrowed resonance linewidth	Xianchao Liu	School of Optoelctronic Science and Engineering, University of Electronic Science and Technology of China
20056	Design and nanofabrication of subwavelength grating based polarizer at visible wavelength	Zongyao Yang	Fudan University
20003	The development of high performance streak cameras and their applications	Xing Wang	Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences
20008	Mechanistic Investigations on the Dramatic Thermally-Induced Luminescence Enhancement in Upconversion Nanocrystals and Anticounterfeiting Applications	Yanqing Hu	Southeast University
20009	Semiconductor-Superconductor Quantum	Alex Hayat	Department of

	Optoelectronics		Electrical Engineering, Technion, Haifa 32000, Israel
20011	Plastic optical fiber chemosensor for mercury detection in aqueous solution	Jaehee Park	Keimyung University
20013	Research of distributed weak fiber Bragg grating sensing system under the action of temperature and strain	Peng Ding	Naval University of Engineering, PLA
20014	DEMODULATION METHOD FOR DYNAMIC AND STATIC PARAMETERS OF PHASE-MODULATED FIBER OPTICAL SENSORS	Shuai Wang	Hubei Key Laboratory of Optical Information and Pattern Recognition, Wuhan Institute of Technology
20016	An improved circulating interferometric integrated optical gyro design method by using graphene-based optical switch	Zhaoyuan Chen	Department of Basic Courses, Rocket Force University of Engineering, No.2 Tongxin Road, Xi'an 710025, China
20018	Optical fiber sensor based on hybrid structure of Hollow Core Fiber and Up-tapers for dual-parameter measurement	Haihao Cheng	Wuhan Institute of Technology
20037	Strained SiGe layer grown on microring-patterned substrate for silicon-based light-emitting devices	Yi Li	Huazhong University of Science and Technology
20040	Viscoelastic tuning of regenerated fiber grating under strain	Tao Wang	China University of Petroleum (East China)
20070	A low-cost and compact fiber-optic sensor based on modal interference for humidity sensing	Yun Liu	Dalian University of Technology
02025	Optical zooming scheme based on focusing grating in direct drive ICF	Xiaoxia Huang	Laser Fusion Research Center, China Academy of Engineering Physics
21000	The effect of silver-plating time on silicon nano-wires arraysfabricated by wet chemical	Shanshan Wang	Xi'an Technological University

	etching method		
20141	How to control the interfacial debonding between surface-attached optical fiber sensors and the monitored structures	Huaping Wang	School of Civil Engineering and Mechanics, Lanzhou University, Lanzhou, China
20066 Poster	Ultra-compact, high-sensitivity refractive index sensor based on an in-fiber Mach-Zehnder interferometer with a droplet-shape air-cavity	Tingting Wang	Nanjing University of Information Science & Technology
20033 Poster	A simple frequency-tunable integrated microwave photonic filter based on sideband selective amplification effect	Xin Zhang	College of Communications Engineering, Army Engineering University of PLA, China
20024 Poster	Photon storage in a dynamic two-ring-two-bus system	Guo Zhifang	Huazhong University of Science and Technology
20074 Poster	Optical System Design of Inter-spacecraft Laser Interferometry Telescope	Chen Shengnan	Department of Optical Engineering, Changchun University of Science and Technology
20081 Poster	WGM microcavity lasers for carbon dots	Yiqun Ni	Shenzhen University
20082 Poster	NaYF4：Yb3+/Tm3+ NCs for ultraviolet random laser and 3D printing application	Di Xiao	Shenzhen University

Part V Abstracts

ID: SOPO2019_20054

Title: Propagation characteristics of super gaussian pulse in dispersion decreasing fiber

Name: Shi Shengda

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Abstract:

Based on the nonlinear Schrödinger equation (NLSE) and split-step Fourier method, the evolution equations of super Gaussian pulses in Gaussian tapered dispersion-decreasing fiber (DDF) with anomalous group-velocity dispersion (GVD) are derived. The propagation characteristics of the super Gaussian pulse and the influence of the initial chirp on the pulse propagation are both analyzed. In this paper, we discuss the transmission characteristics of super Gaussian pulses with different initial chirp parameter C, that is C= 0, C = 2, and C = -2. The result shows that

the initial chirp affects the transmission characteristics of pulse in time domain and frequency domain. When C= 0, the super Gaussian pulse has the best transmission waveform, spectral characteristics and chirp evolution characteristics.

ID: SOPO2019_20034

Title: A 2×2 Optical Switches Based on Semiconductor Optical Amplifier Cross Gain Modulation Technology

Name: Shao Hua Zhou

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Abstract:

A 2×2 optical switch structure was designed and investigated based on semiconductor optical amplifier cross gain modulation technology. The 2×2 optical switch structure, not only can realize optical-controlled switch function, but also can amplifier the exchanged optical signal, the correctness of the 2×2 optical switch was verified by simulation of OptiSystem simulation platform, simulation shows that the signal to be connected was amplified from -10dBm to 16dBm, and the other one signal to be suppressed, and the extinction ratio was up to 26dB, in an optimization system by the control of 15dBm control optical pulse, the switch speed exceeds 20Gbit/s.

ID: SOPO2019_20071

Title: SNR uniformity optimization for LEDs ring alignment in visible light communications

Name: Fang Li

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Abstract:

In this paper, we proposed an optimization for LED ring alignment, to obtain optimal SNR uniformity. Compared with the non-optimized situation, results show that the variance of SNR can be reduced from 8.4 dB to 2.1 dB. Moreover, we also investigated the optimiza-tion for LED ring-corner alignment, it demonstrated superior overall performance of SNR and illuminance, since the performance for corners and edges promote.

ID: SOPO2019_20046

Title: A phase shift keying quantum-noise randomized cipher simulation system model based on the standard commercial devices

Name: Chen Yukai

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Abstract:

On the basis of the industry-standard devices, phase shift keying(PSK) quantum noise randomized cipher(QNRC)anti-interception transmission simulation system model with 10Gb/s single-channel transmission over 198km is simulated in this paper. The effect of the core parameters on the system transmission capability are estimated in consideration of bit error rate(BER). The results show that, the greater the transmission distance or rate, or the fewer the average photon number, the transmission performance becomes worse. However, the level number of M-ary signal(M) takes little effect on the transmission performance. Moreover, the impact of M on system security are analyzed. The eye diagram of the eavesdropper(Eve) becomes worse with the rise of M. Therefore, legitimate users(Bob) can achieve an excellent security performance by advancing M without affecting transmission performance too much.

ID: SOPO2019_20023

Title: Comparative studies of TV-regularized sparse reconstruction algorithms in projection tomography

Name: Huiyuan Wang

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Abstract:

Projection tomography techniques, such as optical projection tomography and stimulated Raman projection tomography, can provide the quantitative

distributions of compositions in a three-dimensional volume that are isotropic, in addition to high spatial resolution and computational efficiency. A projection model and a reconstruction algorithm are two important parts of such techniques. Here, two projection models are used: the pixel vertex driven projection model and the distance driven projection model (DDM). These models are integrated with three TV-regularized iterative reconstruction algorithms: the algebraic reconstruction technique, the simultaneous algebra reconstruction technique (SART), and the two-step iterative shrinkage/thresholding algorithm. The performance of the combinations of these projection models and reconstruction algorithms are evaluated with a sparsely sampled data set in simulation experiments. The experiments consider both the reconstruction image quality and the time complexity. The comparative results show that the combination of SART and DDM provide a good balance between the quality and efficiency of reconstructed images. The exploratory results of this study are expected to provide some useful guidance on algorithmic development and applications in the projection tomography field.

ID: SOPO2019_20031

Title: Adaptive learning rate and target re-detection for object tracking based on correlation filter

Name: Pengyu Shen

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Abstract:

In this paper, two problems about the update rate and long-term tracking in target tracking model are discussed. Traditional correlation filter tracker only uses a fixed rate mecha-nism, so the target update rate is fixed. In this paper, we improved it so that it can adjust the update rate adaptively according to the similarity between different image sequences and first frame. Besides, in order to deal with more challenging scenarios and long-term tracking targets, we add a re-detection mechanism to the tracker. This method overcomes the limitation of the traditional correlation filter tracker using fixed update rate by studying the similarity between the frames of the image, and can adaptively change the update rate of the model. A large number of experimental results show the superiority of our improved tracker in accuracy and success rate.

ID: SOPO2019_02012

Title: Long working distance common-path optical coherence tomography

Name: Yimin Wang

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Abstract:

In a fiber based optical coherence tomography（OCT）system，light from a low coherence source is launched into the source arm of a Michelson interferometer, and split between reference and sample arm arms of the interferometer. To optimize the interference signal, polarization state of the reference light should be matched with that of the sample light through using a polarization controller. However, in endoscopic or handheld OCT probe study, fiber perturbations in the sample arm may lead to the polarization state mismatching between sample and reference light in the OCT interferometer, and degrade performances of the imaging system. In a common-path OCT system, sample and reference light travel through the same optical fiber. So the system is polarization insensitive with the reduced dispersion mismatch between its reference and sample light. However, the working distance of a spectral domain (SD) common-path OCT system is usually limited to several millimeters. This restrains its application in large volumetric tissue imaging. To overcome this problem, we propose a method to extend the working distance of a common-path SD-OCT system. Common-path OCT light, which consisting of sample and reference light signal, is directed into a free space optical interferometer. The OCT light is split spatially into two beam segments by a wavefront splitting mirror, and the two parallel beams interfere non-collinearly in the interferometer. Distance between the end of the

probing fiber, which serves as the reference plane of our OCT system, and the OCT sample is about 140 mm. The measured system sensitivity is 89.1dB, and the OCT performance is demonstrated by imaging biological tissues. Future work will be carried out to improve the system performance through optimizing reference reflection power level and developing polarization insensitive handheld OCT probe.

Key words : Optical coherence tomography, common-path interferometer

ID: SOPO2019_20044

Title: Research on Gesture Recognition Method in Video Based on the Sparse Representation Theory

Name: Yang Lei

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Abstract:

Gesture recognition is an important research topic in computer vision. Existing gesture recognition methods are generally based on single image and lack spatiotemporal continuity in the analysis of image content. In order to deal with this problem, a new gesture recognition method in video based on sparse representation theory is proposed in this paper. Firstly, the foreground image of the hand region is obtained by using the skin color segmentation of the YCbCr color space for a continuous video. Secondly, the center of gravity of the foreground image for the hand region is extracted as feature vector for recognition. Gesture dictionary is further constructed, and a sparse representation model of certain kind of gesture is established. Then, gestures in video are classified by determining the sparse representation error for a new sample to be identified. Finally, experiments on the collected video sequences are performed. Experimental results show that the proposed method can recognize four kinds of gestures such as moving up, down, left and right in video. The proposed method would be used to recognizing more complex gestures in future work.

ID: SOPO2019_20080

Title: An Improved Algorithm for 3D Reconstruction In-tegration Based on Stripe Reflection Method

Name: Gao Xu

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Abstract:

This paper introduces the basic principle of stripe reflection method and proposes an improved algorithm on the traditional Southwell gradient iterative integration algorithm. The algorithm adds a coefficient value with an attenuation factor to the compensation height value and the value of the attenuation factor is changed by the determination of the compensation height threshold. Through computer simulation, the fitting error of the reconstructed surface show that the RMS of the new method is one order of magnitude better than the traditional algorithm and the PV value of the high frequency part is about 1/15 of the traditional algorithm. It is proved that the improved algorithm can effectively improve the convergence and noise resistance of the iterative algorithm.

ID: SOPO2019_20036

Title: Synchronous photoelectric scanning imaging in underwater scattering environments

Name: Xiyu Song

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Abstract:

Optical imaging is an intuitive method to detect and observe the underwater targets in marine exploration. However, due to the severe effects of light scattering and absorption, especially effected by the backscatterred light, the image quality is dramatically degraded. Based on the transmission behavior of the scattered light, this paper developed a synchronous photoelectric scanning imaging technique. By replacing the mechanical control method with photoelectric scanning, we overcome the implementation problems of mechanical scanning and light source image acquisition devices, finally,

alleviate low image quality phenomenon caused by scattering effects. Furthermore, we designed a suitable imaging system and demonstrate it through water tank testing. The experimental results show that the designed scanned based imaging system has higher imaging quality than the non-scanned imaging system.

ID: SOPO2019_20010

Title: 54 ps Q-switched microchip laser with a high modulation depth SESAM

Name: Lei Gong

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Abstract:

We present a passively Q-switched diode-pumped Nd:YVO4 microchip laser based on a SESAM with high modulation depth of 40%. We obtained 54 ps pulses with 2.9 mW aver-age power at repetition rate of 550 kHz.

ID: SOPO2019_20047

Title: Tunable Soliton Mode-locked Laser using Single-Walled Carbon Nanotube as Saturable Absorber

Name: Leonard Bayang

Affiliation: Photonics Research Centre, University of Malaya, 50603 Kuala Lumpur

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Abstract:

A soliton fiber laser with a tunable mode-locked output is proposed and demonstrated. Mode-
locking begins at a pump power of 6.0 mW and able to generate pulsed outputs from 1550 nm to
1566 nm. The 3 dB bandwidth and pulsewidth of the output pulse is seen to vary slightly from
6.34 nm to 6.90 nm and from 0.51 ps to 0.56 ps respectively, which results in the corresponding
time-bandwidth product varying from 0.40 to 0.46. The results suggest that proposed laser would
have significance advantages in photonics applications.

ID: SOPO2019_20048

Title: Tunable Pulse Modulation in Thulium-doped fiber using Graphene Saturable Absorber

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Abstract:

Graphene, a 2D material, has been used for generation of pulse lasers due to the presence of its various fascinating optical properties compared to other materials. Hence in this paper, we report the first demonstration of a thulium doped fiber laser with a wavelength-tunable, passive Q-switched output using a graphene-polyvinyl-alcohol composite film for operation in the 2.0 μm region. The proposed laser has a wavelength-tunable output spanning from 1932.0 nm to 1946.0 nm, giving a total tuning range of 14.0 nm. The generated pulse has a maximum repetition rate and average output power of 36.29 kHz and 0.394 mW at the maximum pump power of 130.87 mW, as well as a pulse width of 6.8 μs at this pump power. The generated pulses have a stable output, having a signal-to-noise ratio of 31.75 dB, and the laser output is stable when tested over a period of 60 min. The proposed laser would have multiple applications for operation near the 2.0micron region, especially for bio-medical applications and range-finding.

ID: SOPO2019_02019

Title: All-Optical Modulation System Using 2D Materials as Modulator

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Abstract:

In-line with the grow of all-optical based systems, optical signal processing technologies is one of the most important part, particularly in the control of light interaction. The basic concept of optical signal processing is to modify the optical properties of propagating light. In general, light modulations are including amplitude modulation, phase modulation, polarization modulation, time and wavelength domain

modulation. On the other hand, two-dimensional (2D) materials exhibited extraordinary optical properties, which are favorable to induce various of nonlinear effects. These properties are highly potential in the application of all-optical modulation system. Therefore, all-optical modulations using 2D materials attracted a great attention in photonics field. Moreover, 2D materials able to induce thermo-optic effect. The variation of refractive index caused by thermo-optic effect able to modify the incident light intensity, polarization and phase that propagate through the 2D materials. As a result, thermo-optic effect is another potential phenomenon that able to contribute to optical modulations using 2D materials. In this work, we demonstrated the photon-to-photon amplitude modulation, polarization modulation and temporal modulation using 2D materials in all-fiber system.

ID: SOPO2019_02018

Title: New IR Tunable Filter for Fire Detection System

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Abstract:

IR plume detectionIs employed in Fire Fetection systems (FDS). Multinational cooperation with significant capital is invested in the development of two major Infra-Red (IR) based plume detection alternatives, single-color IR (SCIR) and dual-color IR (DCIR). IR natural clutter especially solar reflections cause significant false alarm rate. SCIR uses state-of-the-art technology and sophisticated algorithms to filter out threats from clutter. On the other hand, DCIR are aiming at using additional spectral band measurements, to allow the implementation of a robust approach for performing efficiently the plume detection.

We present the results of a thorough study that we conducted for exploiting the added value of the additional data available from the second spectral band. Here we consider the CO2emission bands as well as off peak band that is used as a guard. The innovative filter that we propose is based on the properties of the Surface Plasmon Resonance (SPR) of nanorods. Using visible photons to change the sample resonance condition we affect the IR transmission parameters within microseconds. The findings of this study refer also to missile warning systems efficacy, in terms of operational added value.

Keywords:Nano-rod filters, Fire plume detection, IR detection, Remote sensing, Dual color sensing.

ID: SOPO2019_20032

Title: Micro-structured fiber hydrogen sensing based on optimized Pd-Ag film

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Abstract:

A novel microstructured fiber Bragg grating (FBG) hydrogen sensor was developed by magnetron sputtering method to prepare alloy films with optimized palladium and silver atom ratios, femtosecond laser was employed to fabricate spiral microstructure on fiber cladding to improve the flexible of fiber. The effects of different palladium and silver at-om contents on the performance of microstructured FBG hydrogen sensors were investi-gated. Finally, the microstructured fiber sensor with the atoms ratio of Pd:Ag=4:1 has the best hydrogen sensing performance and has the prospect of monitoring hydrogen leakage.

ID: SOPO2019_20064

Title: Time-synchronization Measurement Technology based on conjugate reflection for High-Power laser Facility

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Abstract:

A method for high power facility timing synchronization measurement based on conjugate reflection is proposed. Firstly, two reflectors parallel each other were placed beside the target and two high

speed photodiode were placed on the conjugate photo point of target point; Secondly, two laser beam from up halfsphere and down halfsphere point to target would be reelected to the two photodiode placed on the conjugate photo point of target, the time D-value between two pulses output by two photodiodes can be measured and the synchronization D-value is gotten. The measurement technology has less prepare time and simple operate skill, also it can be more safety and efficient with a precision better than 18.86ps. The technical scheme provides a basis for the rapid and precise time synchronization diagnose of high power laser facility.

ID: SOPO2019_20006

Title: Field-free orientation dynamics of CO molecule by utilizing two dual-color shaped laser pulses and lower intensity of THz laser pulse

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Abstract:

Field-free orientation of CO molecule is studied theoretically by combining two dual-color shaped laser pulses with low intensity of THz laser pulse. It is indicated that the molecular orientation can be greatly improved by applying two dual-color shaped laser pulse and lower intensity of THz laser pulse compared with single THz laser pulse. The influence of the electric field amplitude of the two dual-color shaped laser pulses on molecular orienta-tion is discussed. Furthermore, by varying the delay time td1 between the two dual-color shaped laser pulses as well as the delay time td between the second dual-color shaped laser pulse and THz laser pulse, the molecular orientation can be changed to some extent. Addi-tionally, it's also shown that the enhancement or suppression of the molecular orientation can be coherently manipulated by changing the center frequency and the carrier envelope phase of the THz laser pulse.

ID: SOPO2019_20068

Title: Effects of pressure on the femtosecond filamentation with HOKE in air

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Abstract:

We investigate the pressure effects on the propagation of the intense femtosecond laser pulse with wavelength of 800 nm by numerical simulations. We adopt the higher-order Kerr model and consider the effects on the on-axis intensity, the beam radius and the energy of the filament, as well as the on-axis electron density. Numerical results show that when the pressures increase, the filament appears later and ends earlier resulting in the shorter filament length. The cross-sectional radius of the filament becomes narrower with the increase of pressure. We also obtain the conclusion that the energy in the filament background energy pool increases when the pressure increases.

ID: SOPO2019_20062

Title: Research on Zoom Prism-Coupled OI-RD System

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Abstract:

The oblique incident reflectance difference (OI-RD) biosensing system can simultaneously study the interactions between tens of thousands of biomolecules, it has the advantages of label-free, high throughput and so on. However, the current OI-RD system is unable to measure small molecules with molecular weights below 1000 Da directly. To improve the sensitivity of the OI-RD system, the prism-coupled surface plasmon resonance (SPR) technology can be adopted to enhance the OI-RD signal. Nevertheless, the prism changed the focus position of the incident light during the movement, which caused the image quality to deteriorate. In order to make the OI-RD system have both high throughput and high sensitivity, we use a zoom lens for automatic zooming, so that the incident beam is always focused on the surface of the chip in

the scanning area. We established a high-throughput OI-RD biosensing system based on the focus tunable lens, determined the correspondence between the focal length and scanning position of the system that can be clearly imaged, established a software-controlled automatic zoom prism-coupled OI-RD system and verified that the system has good reproducibility and stability. This study laid the foundation for constructing a surface plasmon resonance enhanced prism-coupled OI-RD system.

ID: SOPO2019_20075

Title: Study on Synthesis and Pharmacological Activity of Novel 8-azapurines as P2Y12 Inhibitors

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Abstract:

Abstract: P2Y12 receptor is an important target of anti-platelet aggregation drugs for the treatment of thrombotic diseases. In this study, a series of novel 8-azoppurine carbocyclic nucleoside hydrazones compounds were designed and synthesized by taking Ticagrelor as the lead compound. All the products were characterized by 1H NMR, 13C NMR, HRMS spectral analysis. Moreover, the anti-platelet aggregation activity of the synthesized 8-azapurines were evaluated by LTA (light transmittance aggregometry) and the inhibition ratio of compounds 1a-e was 69.05-100% at 10 μM concentration. Where, the IC50 value of 1e was 0.58μM, which was better than 0.74μM of the reference substance Ticagrelor.

ID: SOPO2019_20076

Title: Role of Chiral Auxiliaries in Synthesis of 2,3-dihydropyrroles by Photochemical Ring Contraction of 1,4-dihydropyridine

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Abstract:

In order to research the role of chiral auxiliaries in synthesis of 2,3-dihydropyrroles by photochemical ring contraction of 1,4-dihydropyridine, a series of chiral 1,4-dihydropyridine derivatives were synthesized. The 1,4-dihydropyridines with chiral auxiliary were photo rearrangement with air under irradiation of LED light (410 nm). The light-shrinkable ring of chiral 1,4-dihydropyridine was researched, the orientation of 1, 4-dihydropyridine in ring contraction was found to be the one without chiral promoter. And finally, given the possible mechanism. The structure of the compounds synthesized in the paper all determined by 1H NMR, 13C NMR, HRMS, and single crystal X-ray diffraction analysis.

ID: SOPO2019_20077

Title: Study on Synthesis of 1,4- and 1,2-Dihydropyridine Derivatives: A combined experimental and DFT study

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Abstract:

Dihydropyridines is an important class of nitrogen-containing heterocyclic compounds. Among them, 1,4-dihydropyridines and 1,2-dihydropyridines are the two most common isomers, and the position of the double bond in the molecules has an important influence on its pharmacological activitys and applications. 1,4-Dihydropyridines are often used as calcium channel inhibitors in the treatment of cardiovascular and cerebrovascular diseases, and 1,2-dihydropyridines are important raw materials for the synthesis of active backbones of many natural alkaloids. Therefore, the systematically studies on the influence of the double bond position of dihydropyridine on its synthesis has important theoretical and practical significance. In this content, the synthesis reaction of 1,4-dihydropyridine and 1,2-dihydropyridine derivatives was studied by quantum chemical density functional theory (DFT) calculation associating with experimental studies. This study results will provide experimental and theoretical foundations for the following study of chemical synthesis and drug development basing on this two types of dihydropyridine skeletons.

ID: SOPO2019_20078

Title: Study on photochemical reactions of the 1,4-dihydropyridine

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Abstract:

The chirality of the 1,4-dihydropyridine derivative have the effect on the products of the photoaddition. The chirality can promote the reaction to giving a single chiral product. Racemic and R-configured 1,4-phenyl-1,4-dihydropyridine-3-formamide was used as the substrate to investigate the photocyclization. The effects of the wavelength of the light and the substrate structure (chiral effect and steric effect) on the photocyclization were studied. Controlling the chiral configuration could simplify the photochemical reaction system and reduce the photochemical reaction between the different chiral compounds. The steric hindrance effect of the substituent has an effect on the photochemical reaction,and under some certain circumstances, hinders the formation of photochemical reaction products.

ID: SOPO2019_20026

Title: Laser echo from star-mounted reflector-array in atmospheric turbulence

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Abstract:

The Rytov method is used to derive the distribution of the scintillation index on the receiving aperture plane of a laser beam from a retro-reflector in the ground-air-ground double-path propagation. According to the mutual independence of the turbulence effect and the speckle effect caused by the random vibration of the retro-reflector array, the intensity covariance function and the scintillation index on the aperture plane are calculated. The variations of the aperture smoothing effect and scintillation index of the beam on the finite aperture receiving plane with the aperture size are revealed. The study results could also provide theoretical and technical guidance for the application of laser target detection and recognition.

ID: SOPO2019_20061

Title: Time-Delay Measurement of Optical Fiber Link Based on Time-Frequency Simultaneous transmission Method

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Abstract:

In order to meet the requirements of time delay measurement in optic-fiber links. We propose a scheme of joint transfer of frequency and pulse-per-second time signals on same wavelength. The scheme combines the coarse results of pulse-per-second time counting method and fine results of frequency signal to achieve high-precision and large range measurement of the true delay of the fiber link. We build up an experimental system to measure the absolute delay of the signal during the 25km optic fibers under temperature variation. The experimental results show that the method can effectively combine the large-range advantage of the one pulse-per-second counting method with the high-resolution advantage of the phase measurement method.

ID: SOPO2019_20041

Title: Influence analysis of mixing efficiency of partial coherent optical heterodyne detection

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Abstract:

Mixing efficiency is an important indicator of the laser heterodyne detection system, which directly reflects the sensitivity of the system. Based on the mixing efficiency theory combined with the partially coherent Gaussian-Schell field model, the expression of the mixing efficiency of partially coherent light is derived, and the relationship between spatial mismatch angle, spatial coherence length, receiving radius and mixing efficiency is obtained. The numerical analysis results

show that increasing the spatial coherence length and the receiving aperture can improve the mixing efficiency, but it will lead to the reduction of the receiving field of view. In a heterodyne system, when , the laser heterodyne detection system can obtain ideal mixing efficiency and field of view.

ID: SOPO2019_20059

Title: Mode Competition and Cavity Tuning Characteristics of a New Integrated Orthogonal Polarized He-Ne Laser with Y-Shaped Cavity

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Abstract:

ABSTRACT: Aiming at the new integrated orthogonal polarized He-Ne laser with Y-Shaped Cavity, an experimental system for testing cavity tuning characteristic (including the light intensity tuning and frequency difference tuning curve) is built. By tuning the voltage of the piezoelectric ceramics on the two sub-cavities of S and P, the cavity length of the two sub-cavities is changed to obtain different split frequency differences. In the case of different split frequency differences, the voltage of the piezoelectric ceramic PZT1 on the public cavity mirror is tuned to obtain the light intensity tuning curve of the laser and the corresponding beat frequency variation curve. By tuning the public cavity or S sub-cavity, the double S longitudinal modes are stabilized at both edges of the gain curve, and then the P sub-cavity is continuously tuned to obtain a frequency difference tuning curve. The mechanism of mode competition in the laser is analyzed by using the Lamb semi-classical gas laser theory of the third-order perturbation approximation. The analysis shows that the split frequency difference is the main factor affecting the mode competition. The split frequency difference affects the linear gain and self-saturation effect, mutual saturation effect and the loss of each longitudinal mode. These three factors ,which obey the self-consistent equation of light intensity, combine to influence the intensity and competition result of mode competition , thus affecting the change of light intensity. On the basis of the analysis, the longitudinal mode distribution and competition process of each working stage of the laser are theoretically analyzed. The theoretical analysis and interpretation of the intensity tuning curve, the corresponding beat frequency variation and the frequency difference tuning curve obtained by the experiment are carried out.The influencing factors and tuning laws of the light intensity tuning curve are summarized. In the end, the experiment verifies that when the split frequency difference is in the range of 129—1302MHz, the laser is basically in the working state which the single longitudinal mode pair (including a S longitudinal mode and the neighboring P longitudinal mode) is oscillating.

ID: SOPO2019_20042

Title: Calculation Method of Infrared Temperature on the Natural Ground Surface

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Abstract:

Infrared detection is one of the most important means of modern reconnaissance. The recognition method based on infrared image is widely used in infrared detection. In the process of infrared scene generation, infrared image generation of the natural ground surface is the key link. Starting with various factors affecting the boundary conditions of surface temperature, this paper firstly calculates the change of surface temperature by establishing the transient heat balance equation of the ground surface; secondly, combining with the principle of infrared imaging detection, the method of simulating and generating surface infrared image is given. By comparing the calculated value with the actual measured value, it is shown that the surface temperature curve calculated by the method proposed in this paper is quite accurate, and the infrared image generation method given is more reasonable.

ID: SOPO2019_10100

Title: Cladding Height Inspection Based Upon Vision-Based System in Direct Energy Deposition Additive Manufacturing Process

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Abstract:

A vision-based inspection system based on digital camera is proposed in order to measure the cladding height in Direct Energy Deposition (DED) additive manufacturing process. For improving the accuracy in cladding height measurements, an image processing technique is applied to get rid of the undesirable zone from the binary image. Also, the camera locations must be carefully chosen for preventing possible collisions. In the proposed approach, a calibration bar method is applied for compensating for the Field-of-View (FOV) and perspective effects in the trinocular system. The results confirm that the proposed vision-based system provides a rapid, convenient and accurate means in determining the cladding height in DED additive manufacturing process.It is found that the maximum estimation error is found just 4.2%.

ID: SOPO2019_20001

Title: Ultrafast quantum random number generation based on quantum phase fluctuation unlimited by coherence time

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Abstract:

We propose a scheme for quantum random numbers generator (QRNG) based on measuring phase noise, which can get rid of the limitation of coherence time and extract quantum information threefold than the Mach-Zehnder interferometer (MZI) scheme. By the optical switches, it makes the interference between the beams fill each other's coherence time window, which provides a basis for breaking the theoretical maximum sampling rate. Theoretically, the scheme can even achieve greater sampling speed through increasing branches.

ID: SOPO2019_20007

Title: 2D light confinement in MOSFET structure based on near-zero epsilon

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Abstract:

Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) in the inversion mode is investigated as both an electronic device and a photonic device. The permittivity distribution in the semiconductor region is calculated from the electron density distribution for different gate and source-drain voltages. It is found that an inversion layer of electrons formed under the gate electrode can be a permittivity near zero (ENZ) region due to the graded distribution of permittivity. By conducting mode analysis, it is further found that 2D confinement of electromagnetic field can be realized due to graded distribution of permittivity in both x and y directions in the transverse plane. The advantage of this structure is that the ENZ performance can be tuned over a wide frequency and the field distribution in the transverse plane can be tailored at a specific frequency by changing gate and source-drain voltages.

ID: SOPO2019_20073

Title: Design of a planar super-oscillatory lens

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Abstract:

Since 2012, optical superoscillation and metasurface have attracted wide attentions from the scientific community and become one state-of-the-art research topic. Superoscillatory lens (SOL) is one novel two-dimensional ultra-thin planar nanophotonic microstructure. The super-focusing capability is due to the delicated interference of a large number of diffracted light beams. This talk discusses the theory

and method to manipulate the vector light field passing through a SOL, and introduces the way to construct a miniature super-resolution planar optical system based on SOL and Fresnel zone plate. The research applies vectorial angular spectrum theory and vectorial Rayleigh-Sommerfeld diffraction integral. Three-dimensional finite-difference time-domain (FDTD) method is used to validate the electric field and intensity distribution. New dielectric SOLs with high light efficiency is to be optimized compared with the metallic SOL. Optimization is done based on the configured genetic algorithm. The spectral dispersion focusing characteristics, the diffraction focusing property and aberrations are analyzed. The micromaching process of SOL will be introduced. Large-scale SOL is tested in experiment. The study of this project has important scientific value and wide application prospects in far-field optical nanoscopy, planar micro-optics system integration, nanolithography, particle manipulation, nearfield optics, etc.

ID: SOPO2019_20021

Title: A square metal-insulator-metal nanodisks sensor with simultaneous enhanced refractive index sensitivity and narrowed resonance linewidth

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Abstract:

High-performance plasmonic sensors are widely needed in testing refractive index of surrounding environment, identification of gas/solution types and content. Here, a simple square metal-insulator-metal (MIM) nanodisks structure is studied by numerical calculation, in which the metal is Au or Ag. Tunable Fabry-Perot (FP) like cavity absorption are obtained near the near infrared for nanodisks composed of Au-insulator-Au or Ag-insulator-Ag, respectively. High-absorption remains for a wide range of disks side length. The rough sensitivities are high and close to that of the round MIM nanodisks at the same light wavelength[1]. Unexpectedly, the resonances linewidths of the square MIM nanodisks structures are pronounced narrower than that of round MIM nanodisk structure, especially for Ag-insulator-Ag nanodisks structure. Furthermore, when the side length of the insulator disks is scaled down, the refractive index sensitivity (RIS) reaches ~1000nm/RIU (refractive index unit). The proposed square MIM nanodisks structure is promising to find application in high-performance sensing.

ID: SOPO2019_20056

Title: Design and nanofabrication of subwavelength grating based polarizer at visible wavelength

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Abstract:

Light transmittance and extension ratio are two most important properties to characterize the performance of grating based polarizers. Basic research was conducted to study the structural effect of grating line cross-section on the polarization characeteristics. To max-imize both the transmittance and the extension ratio, the grating materials, the geometry dimensions and the grating line structure are systematically studied. Then, a shape as a rec-tangle stacked by a parabolic shape on the top, was proposed for achieving both high transmittance and extension ratio. Nanofabrication for subwavelength gratings in Al was carried out. High transmittance over 70% was achieved, but the extension ratio was still not satisfactory, which was ascribed as the thickness in the fabricated grating was not high enough. However, the measured ratio fits to the simulation result well, indicating that the designed grating parameters can be a good guide for high quality polarizer based on sub-wavelength grating in aluminium.

ID: SOPO2019_20003

Title: The development of high performance streak cameras and their applications

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Abstract:
We will present our recent development of two type streak cameras in detail. A design of traveling wave deflector before a magnetic lens is used to avoid the velocity between the electrons and sweeping signals, in which way a time resolution of 450fs is achieved. This kind of femtosecond streak camera has been used for the synchronization of multi-laser beams in the inertial confined fusion experiment. In order to capture ultrafast signal with both high and low radiation intensity, a high dynamic range streak camera is designed and produced. By combing the novel anisotropic focusing electro-optical design for reducing the space-charge effect and a transfer technique for low noise photocathode deposition, the value of dynamic range we obtained is more than 1000:1 at 2ps time resolution. The applications of these streak cameras for fluorescence lifetime imaging of complex flows, measuring the pulse width of singe mode perovskite nanocuboid laser and for capturing the dynamic scene of laser spot by compress ultrafast photography will also be present.

ID: SOPO2019_20008
Title: Mechanistic Investigations on the Dramatic Thermally-Induced Luminescence Enhancement in Upconversion Nanocrystals and Anticounterfeiting Applications
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Abstract:
Luminescent bulk materials generally suffer from the thermal quenching, while upconversion nanocrystals (UCNCs) have recently been found to show the dramatic emission increase at elevated temperatures. A deep understanding on this quite different light-heat interaction at the nanoscale is important both scientifically and technologically. Herein, temperature-dependent upconversion luminescence (UCL) is investigated for UCNCs with various sizes, activators (Ho3+, Tm3+, Er3+) and core/shell structures. An anomalous UCL enhancement with increasing temperature is found for UCNCs with larger surface/volume ratios (SVRs). Moreover, this UCL increase shows a pronounced dependence on the SVRs, activators, emitting levels and measuring environments. Substantial evidence confirms that the thermally-induced UCL increase is primarily due to the temperature-dependent quenching effect of surface-adsorbed H2O molecules, instead of the previously proposed surface phonon-assisted mechanism. Temperature-dependent spectral investigations also show that the energy-loss process of Yb3+-sensitized UCNCs is largely due to the deactivation of Yb3+ ions caused by surface quenchers, rather than the direct quenching to activators.1 UCNCs with an active-shell (doped with Yb3+) exhibit the similar thermally-induced UCL increase, due to energy migration to the surface over the Yb-Yb internet. Utilizing opposite luminescent temperature-dependences between active-core@inert-shell (thermal quenching) and active-core@active-shell (thermally-induced enhancement) UCNCs, the hybrids of them are obtained by a simple mixing method and show obvious color changes under 975 nm excitation with increasing temperature. Various color-shifting pathways (from white to green, blue to green, etc.) are achieved by adjusting the core/shell NC combinations in the hybrids. Moreover, color changes of the printed patterns using the hybrid NC inks can be realized simply by the hairdryer heating, increasing the laser power or prolonging the irradiation time. The results indicate the great potential of these core/shell NC hybrids for anticounterfeiting applications with multilevel security and convenient authentication methods.2

Keywords: upconversion, luminescence, anticounterfeiting, temperature-dependent, hybrid

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Thermally Induced Luminescence Enhancement in Upconversion Nanocrystals. J. Phys. Chem. C 2018, 122, 26142−26152.

(2) Hu, Y.; Shao, Q.; Deng, X.; Han, S.; Song, D.; Jiang, J. Core/Shell Upconversion Nanocrystal Hybrids with Temperature-Dependent Emission Color Changes for Multilevel Anticounterfeiting Applications. Adv. Mater. Technol. 2018, 1800498.

ID: SOPO2019_20009

Title: Semiconductor-Superconductor Quantum Optoelectronics

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Abstract:

We demonstrated experimentally Cooper-pair injection and enhanced light emission in super-semiconductor structures, proposed by us for enhanced two-photon gain, electrically-driven entangled-photon generation and Bell state analyzers. We also demonstrated high-Tc superconductor-semiconductor devices

ID: SOPO2019_20011

Title: Plastic optical fiber chemosensor for mercury detection in aqueous solution

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Abstract:

This paper presents the plastic optical fiber(POF) chemosensor based on an in-line fiber hole and rhodamine derivative for mercury detection in aqueous environments. This sen-sor is a POF having a rectangular in-fiber hole partially filled with the synthesized rho-damine derivative. The absorbance spectrum of the synthesized rhodamine derivative was changed according to mercury concentration increased. The maximum variations of the absorbance occurred at about 530nm. Experiments were performed using the POF chemosensor having a 3 mm x 0.65 mm rectangular hole filled with 0.5 mm thickness rhodamine derivative. The transmittance decreased as the mercury concentration in-creased. The experimental results show that the POF chemosensor can be used for detec-tion of mercury ion in aqueous solution.

ID: SOPO2019_20013

Title: Research of distributed weak fiber Bragg grating sensing system under the action of temperature and strain

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Abstract:

Effect of temperature on strain measurement in weak reflective fiber Bragg gratings(FBGs) using time division multiplexing(TDM) is analyzed firstly. Sensing mechanism of FBGs TDM is discussed, and strain measurements affected by different kinds of temperature are simulated. Using vibrating liquid column, periodic strain signals are detected in the experiment. The simulated and experimental results show that temperature can distort the strain signal, and the strain signal can be recovered when the temperature influence is reduced. So people should pay more attention to the effect of temperature on strain measurement and try to reduce it.

ID: SOPO2019_20014

Title: DEMODULATION METHOD FOR DYNAMIC AND STATIC PARAMETERS OF PHASE-MODULATED FIBER OPTICAL SENSORS

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Abstract:

This paper proposes a method for demodulating dynamic parameters of fiber-optic sensors, and verifies the feasibility for dynamic parameters of the fiber-optic sensor as well as the demodulation method for static parameters. For the static parameters such as strain or temperature, the optical vernier structure

based sensors are formed by cascading two single interferometers, and the static parameters can be demodulated by observing the drift of the envelope. For dynamic parameters such as acoustic signal or vibration, by modified spectral scanning method, the spectrum can be processed to obtain not only the frequency but also the amplitude of the dynamic signal.

ID: SOPO2019_20016

Title: An improved circulating interferometric integrated optical gyro design method by using graphene-based optical switch

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Abstract:

The integrated optical gyroscopes have exerted a tremendous fascination on many re-searchers for their high sensitivity and miniature and light weight. In this paper, an im-proved design method based on graphene electro-optic switch has been presented to re-duce the extra loss of the coupler. Simulation results indicate that the presented modula-tion method can effectively increase the input power and eliminate extra loss.

ID: SOPO2019_20018

Title: Optical fiber sensor based on hybrid structure of Hollow Core Fiber and Up-tapers for dual-parameter measurement

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Abstract:

We proposed and demonstrated a compact inline optical fiber sensor for curvature and temperature measurement with low cross sensitivity. The device consists of a 5 mm long hollow-core fiber (HCF) spliced between two single-mode fibers. Two up-tapers were fabricated at each splicing joint forming a Mach-Zehnder Interferometer(MZI). The HCF acted as the anti-resonant reflecting waveguide (ARROW), giving periodic dips at resonant wavelengths in the optical transmission spectrum. The cross sensitivity of curvature and temperature problem is solved by demodulating the wavelength shift of MZI for temperature change and intensity variation of ARROW dips for curvature change. Our experimental curvature and temperature sensitivity are measured to be -2.9 dB/m-1 and 25.76 pm/°C, respectively. The structure of the sensor is simple and compact, which can be used for structural health monitoring in a complex environment.

ID: SOPO2019_20037

Title: Strained SiGe layer grown on microring-patterned substrate for silicon-based light-emitting devices

Name: Yi Li

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Abstract:

A silicon light emitter operating in 1–1.6 μm wavelength range are realized by growth of strained SiGe layer on microring-patterned silicon-on-insulator substrates by molecular beam epitaxy. Strong resonant peaks are observed in the microphotoluminescence spec-trum at 5 K and 295 K. The quality factor is on the order of 103. The mode indexes and profiles of these whispering-gallery modes are computed through numerical simulation. Significant enhancement of photoluminescence from SiGe layer by microring resonators is attributed to Purcell effect. Our process provides an enlightening way to fabricate defect-free silicon-based light emitters, and will be further improved in the future.

ID: SOPO2019_20040

Title: Viscoelastic tuning of regenerated fiber grating under strain

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Abstract:

Significant tunability of the Bragg wavelength is

observed during postannealing at or above the strain temperature of the glass. The main reason for the grating wavelength shift during annealing with load is the elongation of the fiber. The viscosity of an optical fibre over 1000–1150 °C is studied by inscribing an optical fibre Bragg grating that can withstand temperatures up to 1200 °C and monitoring fibre elongation under load through the Bragg wavelength shift. Viscoelastic tuning of regenerated fiber grating can be controlled by changing the tem-perature and strain. High temperature resistant grating with complex structure can be fabricat-ed through this operation.

ID: SOPO2019_20070

Title: A low-cost and compact fiber-optic sensor based on modal interference for humidity sensing

Name: Yun Liu

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Abstract:

In this work, we proposed a low-cost and simple fiber-optic humidity sensor with a graphene oxide coating. Our sensor was fabricated by splicing single-mode fibers with a short piece of capillary. The sensing region of the sensor was coated by graphene oxide sheets which can ab-sorb water molecule in air and enhance the strength of evanescent fields of the sensor. The humidity sensor was verified by placing it in a humidity chamber at room temperature. With the relative humidity increase, the interference fringe of the sensor shifted to longer wave-length, which indicated the humid environment led to a refractive index change in graphene ox-ide coating and effected the modal interference of the sensor. This fiber optic humidity sensor has potential to be used for environmental and health monitoring.

ID: SOPO2019_02025

Title: Optical zooming scheme based on focusing grating in direct drive ICF

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Abstract:

In direct drive inertial confinement fusion (ICF), optical zooming is an effective way to increase illumination uniformity, avoid energy loss and mitigate the cross-beam energy transfer. By reducing spot size while the target compressing, optical zooming is implemented. In this report, a novel single-beam optical zooming scheme is presented, which employs a focusing grating to focus the broadband laser pulse, changing the spot size on the target within single beamlet. Experimentally, a 40mm×40mm sized focusing grating placed after the collimated light with the wavelength ranging from 1052.43nm to 1053.23nm successfully realized the peak-valley of defocusing wavefront distribution at 0.73μm. As for the normal 360mm×360mm sized focusing grating at the wavelength ranging from 350.81nm to 351.08nm with 300μm shaping continuous phase plate, the focal spot has a reduction of 21.8%.Different from NIF's combining several beams into one by turning on and off each one with its own specific spot size in time dependently, this single-beam optical zooming scheme doesn't need to divide the pulse into different width, which reduces energy extraction, limits the deliverable peak power on target and requires precise control of pulse splicing and synchronization.

Keywords:inertial confinement fusion,direct drive, optical zooming

ID: SOPO2019_21000

Title: The effect of silver-plating time on silicon nano-wires arraysfabricated by wet chemical etching method

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Abstract:

MACE (Metal-Assisted Chemical Etching) approach has drew a lot of attentions due to its ability to create highly light-absorptive silicon surface. This method can generate numerous cylindrical shape microstructure on the surface of silicon like a forest,

which is called “silicon nanowires arrays”. This structure can dramatically suppress both reflection and transmission at the wavelength range from 400nm to near-infrared 1800nm by increasing the propagation path of light.

In this paper, ordered silicon nanowires arrays with a large area are prepared by wet chemical etching. It is demonstrated that the SiNWs (Silicon nanowires) arrays with different morphologies can be fabricated from monocrystalline silicon of a given orientation by changing silver-plating time. Excellent anti-reflection performance in broadband wavelengths and incident angle is obtained. The fabri-cation method and potential application of such SiNWs in the field of photoelectric detection have great value and can provide reference for further research in this field.

ID: SOPO2019_20141

Title: How to control the interfacial debonding between surface-attached optical fiber sensors and the monitored structures

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Abstract:

Optical fiber sensors have been intensively used to measure the strain, temperature, pressure, deflection, displacement, vibration parameters, and so on. For the unique advanteges of high sensitivity, anti-corrosion, immune to electromagnetic interference, absolute measurementsmall size and light weight, sensing fiber (including fiber Bragg grating and Brillouin optical fiber) have been developed to configure industrialized sensors for the long-term and high-precision monitoring of strucutres. The sensors have often installed on the surface of steel structures(i.e., steel beam, steel pipe, steel plate and turbine blade). However, the interfacail debonding often occurs between the surface-attached sensors and the monitored structures during the measurement. It can be attributed to the deformation incompatibility between the silica fiber and steel material. To gaurantee the effective and accurate measurement, control measure should be performed to aviod the interfacial debonding damage. Strain transfer theory is thus adopted to discuss the interfacial interaction between the sensor and the structure. Suggestions are proposed for the design of the optical fiber based sensors. The study can be further adopted to instruct the feasible application of similar sensors in practical engineering.

ID: SOPO2019_20066

Title: Ultra-compact, high-sensitivity refractive index sensor based on an in-fiber Mach-Zehnder interferometer with a droplet-shape air-cavity

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Abstract:

We demonstrate a novel, ultra-compact and high-sensitivity refractometer based on a tapered region with an in-fiber droplet-shape air-cavity (TDA). The TDA is sandwiched between an input photonic crystal fiber (PCF) and an output single mode fiber (SMF) with a very short interference arm of ~330μm and the taper waist diameter of ~40μm. The droplet-shape air-cavity is formed by two steps: ① splicing together a SMF and a PCF to form a spherical air-cavity; ② tapering one side of the spherical air-cavity. Due to the large ERI difference between the air-core mode and the silica-cladding mode, the scale of the ultra-compact Mach-Zehnder interferometers can be reduced to several hundred micrometers, which is the most compact MZI for RI measurement, to the best of our knowledge. Experimental results show that this sensor offers high sensitivity (up to 2803.6nm/RIU at RI~1.42) for RI measurement in the range of 1.3164-1.4270. In addition, this type of UCMZI is highly sensitive to RI but insensitive to temperature. Therefore, such a device operates as a high-sensitivity refractometer with the advantages such as ultra-compact size, easy in fabrication, low cost, easy to package, which make it a competitive fiber RI sensor in the biochemical and physical sensing fields.

ID: SOPO2019_20033

Title: A simple frequency-tunable integrated microwave photonic filter based on sideband selective amplification effect

Name: Xin Zhang

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Abstract:

In this paper, we demonstrate a simple frequency-tunable microwave photonic filter (MPF) and the selective amplification effect of has been researched experimentally. The compact MPF is based on an integrated mutual injection DFB laser which is fabricated by REC technique. The out-of-band rejection is over 30 dB, 3-dB bandwidth is 10 MHz at the frequency of 24.8 GHz. The MPF can be tuned from 16 GHz to 36 GHz by adjusting the bias current of the laser which is easy to realize.

ID: SOPO2019_20024

Title: Photon storage in a dynamic two-ring-two-bus system

Name: Guo Zhifang

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Abstract:

We propose a novel dynamic two-ring-two-bus system to achieve photon storage. We have demonstrated numerically that the photon can be stopped and released by tuning the ring coupled to two buses in a short time. The two-ring-two-bus system is fabricated on the silicon-on-insulator platform, with the Q factor changing significantly when shifting one resonance. Due to the flexibility and simplicity, it is a promising candidate for the future optical storage and buffering device.

ID: SOPO2019_20074

Title: Optical System Design of Inter-spacecraft Laser Interferometry Telescope

Name: Chen Shengnan

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Abstract:

The fundamental measurement of space gravitational wave detection is to monitor the relative motion between pairs of freely falling test masses using heterodyne laser interfer-ometry to a precision of 10 pm. The masses under test are millions of kilometers apart. The inter-spacecraft laser interferometry telescope deliver laser efficiently from one spacecraft to another. It is an important component of the gravitational wave detection observatory. It needs to meet the requirements of large compression ratio, high image quality and extraordinary stray light suppression ability. Based on the primary aberration theory, the method of the large compression ratio off-axis four-mirror optical system design is explored. After optimization, the system has an entrance pupil of 200mm, compression ratio of 40 times, scientific field of view (FOV) of ±8μrad. To facilitate suppressing the stray light and delivering the laser beam to the back-end scientific interferometers, the intermediate images and the real exit pupils are spatially available. Over the full FOV, the maximum root mean square (RMS) wavefront error is less than 0.007λ, PV value is less than 0.03λ (λ=1064 nm).The image quality is approached to the diffraction-limit. The TTL noise caused by the wavefront error of the telescope is analyzed. The TTL noise in the image space of 300μrad range is less than 1×10-10m whose slope is lower than 0.6μm/rad, which is under the noise budget of the laser interferometer space antenna (LISA), satisfying the requirements of space gravitational wave detection.

ID: SOPO2019_20081

Title: WGM microcavity lasers for carbon dots

Name: Yiqun Ni

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Abstract:

Carbon dots (CD) microcavity lasers have attracted

extensive attention in recent years due to numerous superior merits such as high photostability, nontoxicity, low-cost, easy- preparation. Among all the CD lasers, whispering gallery mode (WGM) lasers exhibiting small linewidth, high Q factor, tunable mode spacing at a relatively small volume can meet different applications, such light probe, photo detectors, optical sensor. Here we propose a type of carbon dot emitting orange emission with the highest quantum yield of 82% and an extremely narrow emission bandwidth of 30 nm, then the carbon dots are used as the gain medium of whispering gallery mode microcavity lasers. The lasers can generate stable orange laser emission with a low excitation threshold of 12 kW cm−2 and a high quality factor of ~3600 at the size of 20-30μm and elevated temperature. Reasons for these excellent performances are not only the carbon dots possess high QY and excellent stability, also structure of the lasers can offer strong optical confinement in the resonator and low optical loss. This work can provide an example that carbon dots lasers can achieve stable, low-threshold lasing, and can expand the application of carbon dots lasers in extreme conditions.

ID: SOPO2019_20082

Title: NaYF4 ： Yb3+/Tm3+ NCs for ultraviolet random laser and 3D printing application

Name: Di Xiao
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Abstract:
Up-conversion in rare-earth-doped luminescent materials have attracted extensive attention in recent years due to extraordinarily excellent characteristics such as low-cost, large light penetration depth, almost no damage to biological tissue. Hence, we propose the concept of light activation of NaYF4:20%Yb,1%Tm nanocrystals (NCs). In particular, we show outstanding high-intense ultraviolet characteristics, which can be used in biotherapy and micro stereolithography three-dimensional (3D) printing technology. NaYF4:20%Yb,1%Tm NCs were synthesized by hydrothermal method. The NaYF4:20%Yb,1%Tm NCs are used as a laser gain medium and put quartz plate to form laser microcavities. UV upconverted random lasing is obtained from the laser microcavities. 3D printing is achieved by using continuous wave commercial near-infrared laser diodes. Hence, our work verifies explicitly that the NaYF4:20%Yb,1%Tm NCs support UV up-conversion random lasing via a 980 nm nanosecond laser excitation. And We have successfully performed several experiments to achieve 3D polymer structures, demonstrating a novel cost-effective UCNP-assisted 3D printing technology.

Part VI Instructions for Presentations

Oral Presentation

Devices Provided by the Conference Organizing Committee:

- Laptops (with MS-office & Adobe Reader)
- Projectors & Screen
- Laser Sticks

Materials Provided by the Presenters:

- PowerPoint or PDF files

Duration of each Presentation:

- Regular Oral Session: 15-20 Minutes of Presentation
- Plenary/Invited Speech: 30-40 Minutes of Presentation

Poster Presentation

Materials Provided by the Conference Organizing Committee:

- X Racks & Base Fabric Canvases (60cm×160cm, see the figure below)
- Adhesive Tapes or Clamps

Materials Provided by the Presenters:

- Home-made Posters

Requirement for the Posters:

- Material: not limited, can be posted on the Canvases
- Size: smaller than 60cm×160cm
- Content: for demonstration of the presenter's paper

Part VII Hotel Information

About Hotel

The Grand Dynasty Culture Hotel (西安古都文化大酒店) is ideally located in the city center near several major Xi'an attractions. All 464 guestrooms in this Xi' an hotel feature modern amenities including large screen TV's, mini-bars and 24-hour room service. The hotel's restaurant serves a variety of Asian and Western delicacies, and a bar/lounge caters for after dinner drinks. Conference rooms at the business center are equipped with audiovisual facilities as well as all necessary amenities for an efficient office environment away from home. In terms of recreation, the hotel offers a fully-equipped gymnasium and a tennis court for active guests, along with an indoor swimming pool, steam room and sauna for guests seeking something a little more relaxed.

Address: No.172 Lianhu Road, Lianhu District, Xi'an, China （陕西省西安市莲湖区莲湖路 172 号）

Post code: 710002

Tel: +86-029-87216868

Transportation:

Xi'an Xianyang International Airport: 34.15km

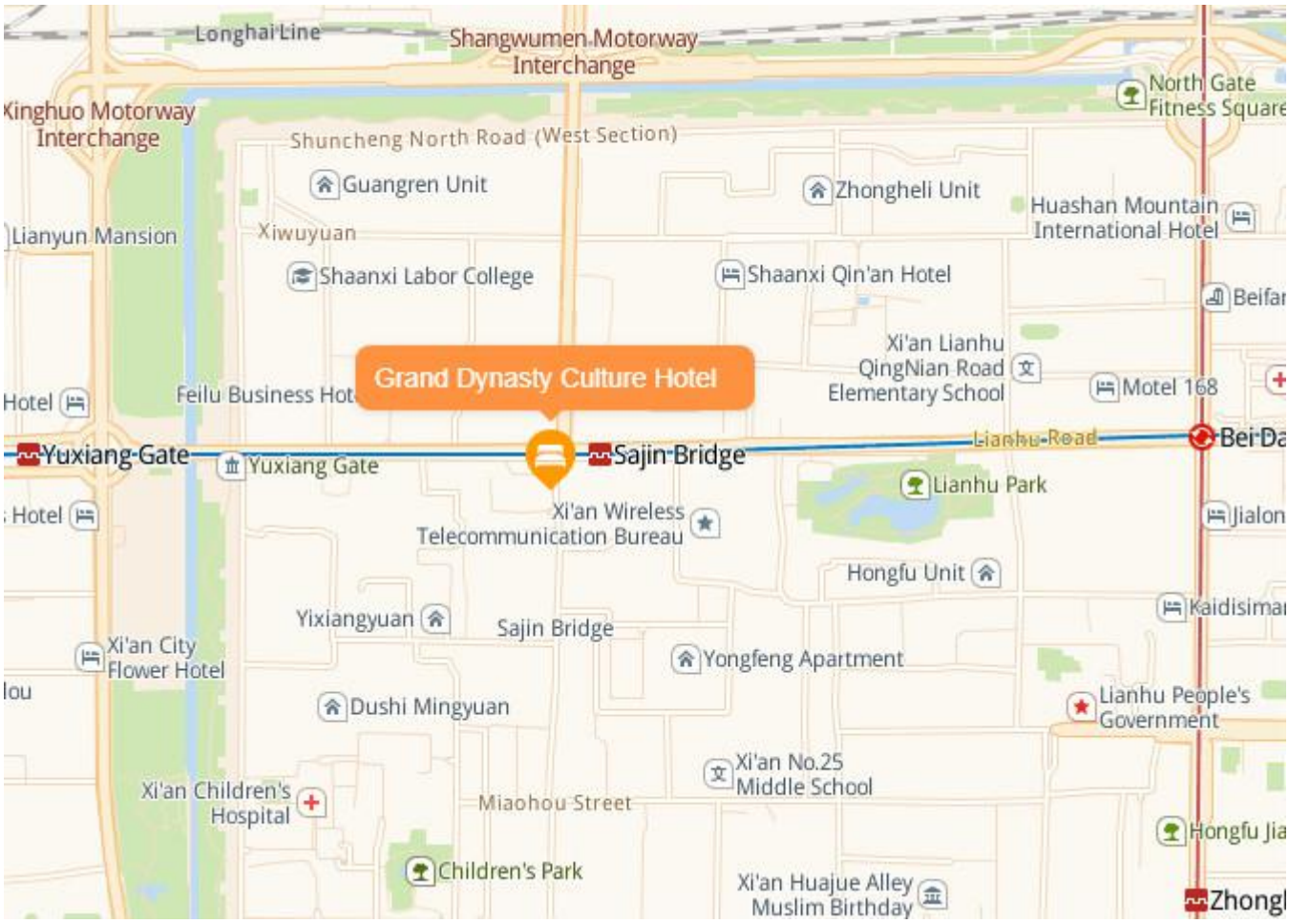
咸阳国际机场：全程约 34.5 公里，打车费约 95 元

Xi'an Railway Station: 3.75km

西安火车站： 全程约 3.7 公里， 打车费约 11 元

Line 1 Metro Station Sajinqiao: 0.24km

For non-Chinese author, please show the following info to the driver if you take a taxi:
请送我到：陕西省西安市莲湖区莲湖路172号 西安古都文化大酒店



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