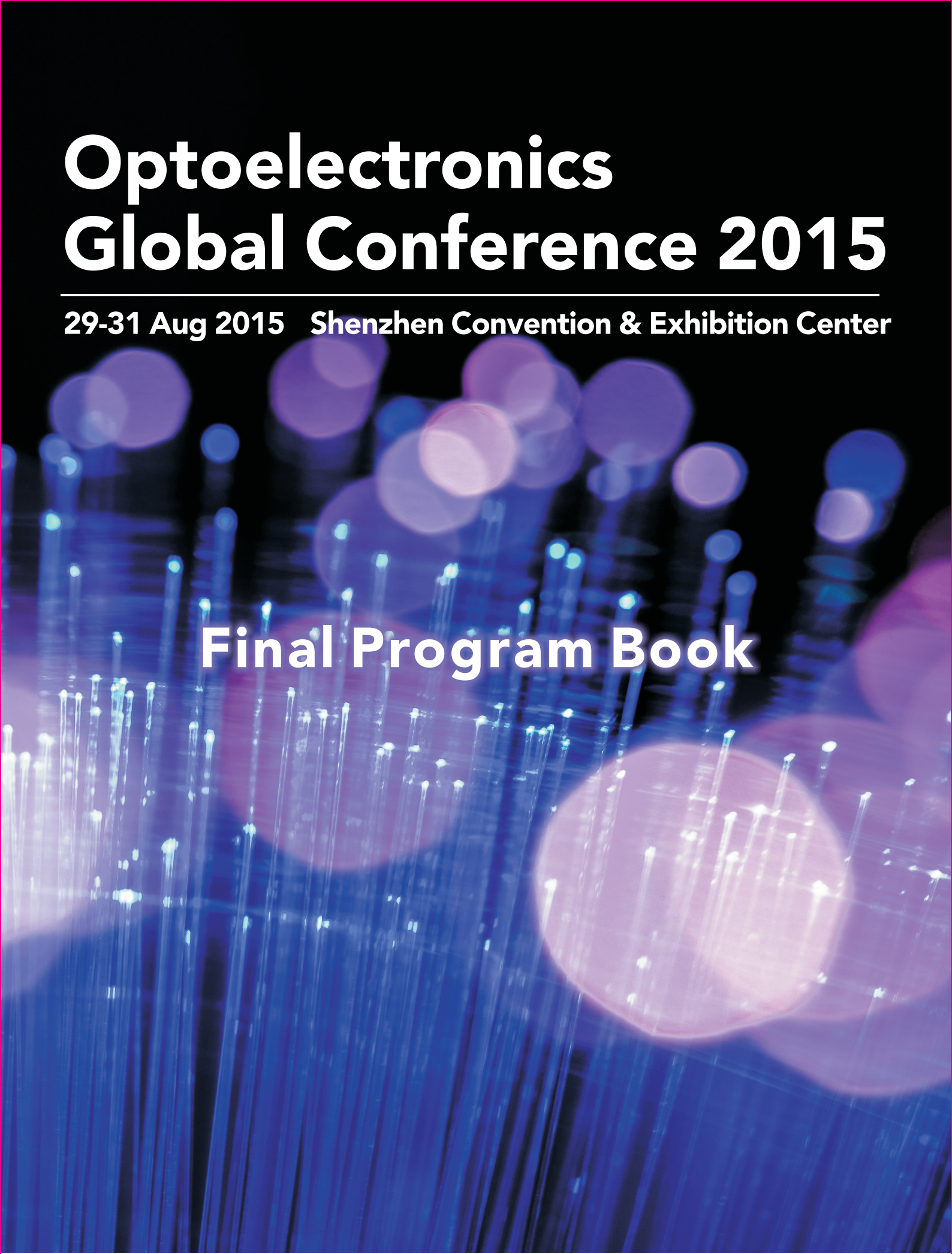
Optoelectronics Global Conference 2015

29-31 Aug 2015 Shenzhen Convention & Exhibition Center



Final Program Book

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CONFERENCE HIGHLIGHT

Conference Opening

09:15 - 10:00, 29 August 2015, Saturday
At Osmanthus Hall

Plenary Talk I **Optical fibres: The next Generation – Prof. Sir David Payne, University of Southampton, UK**

10:00 - 10:45, 29 August 2015, Saturday
At Osmanthus Hall

Plenary Talk II **Using Metamaterials to Manipulate Light – Prof. Che-Ting Chan, HKUST, HK**

11:15 - 12:00, 29 August 2015, Saturday
At Osmanthus Hall

Best Paper Award Session

11:15 - 12:00, 29 August 2015, Saturday
At Lotus 4, Lotus 5 & Lotus 6

Workshop 1. **Fiber-Based Technologies**

09:30 - 12:20, 30 August 2015, Sunday
At Rose 3

Workshop 2. **Optoelectronics Technopreneurship**

09:30 - 12:20, 30 August 2015, Sunday
At Rose 2

Workshop 3. **Metro Optical Transmission (Huawei)**

13:30 - 17:00, 29 August 2015, Saturday
At Rose 3

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WELCOME MESSAGE

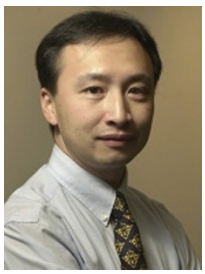
A very warm welcome to the inaugural Optoelectronics Global Conference (OGC) from the Program Chairs and the Technical Program Committee. We are confident that you will find the technical presentations and technical interactions over the next three days to be interesting and inspiring.

The Optoelectronics Global Conference (OGC) is an annual event co-located with China International Optoelectronic Exposition (CIOE) in Shenzhen China. The aim of this conference is to foster interactions among broad disciplines in the optoelectronics family. This year we expect more than 3,000 exhibitors and 85,000 delegates attending CIOE. OGC will be a perfect platform for international academics, researchers, practitioners and students working in the optoelectronics areas to discuss new developments, concepts and practices, and to identify synergies in research directions that will lead to broader and deeper applications of optoelectronics.

We are pleased to host the OGC in Shenzhen Convention & Exhibition Center (SZCEC) from 29 to 31 August 2015. At the forefront of technical program are two eminent plenary speakers Professor Sir David Payne and Prof. C T Chan. All major areas in photonics technologies will be covered in talks, along with invited/special sessions. This is an opportunity for researchers around the world to exchange ideas and latest research results in areas such as Laser Technologies, Optical Communications and Networks, Infrared Technologies and Applications, Precision Optics, Lightings and Displays, Fiber-Based Technologies and Applications , Optoelectronic Devices and Applications, Biophotonics and related fields. We look forward to your participation so as to make this conference an exciting and fruitful event.

A vast and diverse technical program such as this would not have been possible without the help of several people, whom we take this opportunity to thank: The members of the Technical Program Committee, for their guidance and their role as track chair or reviewer; The track chairs, for arranging the reviews; The reviewers, for their time and their crucial inputs; The session chairs, for smooth running of the technical sessions; The invited speakers and delegates, for making this conference a success; The workshop chairs for organizing exciting special workshops; The PCO for handling the publication of the conference proceedings; The publicity committee for reaching out to so many researchers; and the management, technical staff and volunteers, for getting the work done on time.

We hope you have a great time at the conference and also enjoy the stay in Shenzhen.



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Nanyang Technological University

John Dudley
Université de Franche-Comté

Junle Qu
Shenzhen University

Mang I Vai
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TECHNICAL COMMITTEE

S1 Laser Technologies

Han Zhang	Shenzhen University
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Penn Cheng	Shenzhen JPT Electronics Co., Ltd.

S2 Optical Communications and Networks

Bin Chen	Shenzhen University
Gangxiang Shen	Soochow University
Sanjay Kumar Bose	IIT Guwahati, India
Jie Zhang	Beijing University of Posts and Telecommunications

S3 Infrared Technologies and Applications

Xiaoke Yi	University of Sydney
Chunmei Ouyang	Tianjin University, China
Jianqiang Li	Beijing University of Posts and Telecommunications
Liwei Li	University of Sydney

S4 Precision Optics

Aaron Ho	The Chinese University of Hong Kong
Guanghui Wang	Nanjing University
Xiaosheng Xiao	Tsinghua University
Xinyong Dong	China Jiliang University

S5 Lightings and Displays

Xiaowei Sun	Nanyang Technological University, Singapore
Xinhai Zhang	South University of Science and Technology of China
Kai Wang	South University of Science and Technology of China

S6 Fiber-Based Technologies and Applications

Yiping Wang	Shenzhen University
Qizhen Sun	Huazhong Universiy of Science and Technology
Dora Juan Juan HU	Institute for Infocomm Research, A*STAR, Singapore

S7 Optoelectronic Devices and Applications

Jinyu Mo	Shenzhen JPT Electronics Co., Ltd.
Jianguo Liu	Institute of Semiconductors, Chinese Academy of Sciences
Xiangfei Chen	Nanjing University

Ying Huang	institute of microelectronics, A*STAR, Singapore

S8 Biophotonics

Junle Qu	Shenzhen University
Tong Ye	Clemson University
Xunbin Wei	Shanghai Jiaotong University, China
Pengcheng Li	Huazhong University of Science and Technology, China

W1 Fiber-Based Technologies

Ming Tang	Huazhong University of Science and Technology, China
Weijun Tong	YOFC
Guobin Ren	Beijing Jiaotong University

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Junhao Hu	Darma Inc.
Na Ni	GE
Gordon Ning Liu	Huawei Technologies Co., Ltd.
Songyang Li	Venture
Jing Zhang	NMC

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Gordon Ning Liu	Huawei Technologies Co., Ltd.

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PROGRAM AT A GLANCE

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Time	**Rose 3(玫三)**	**Rose 2(玫二)**	**Rose 1(玫一)**	**Lotus 6(荷六)**	**Lotus 5(荷五)**	**Lotus 4(荷四)**	**Lotus 3(荷三)**
08:00 - 17:00	On-Site Registration						
09:15 - 10:00	Opening Ceremony (At Osmanthus Hall)						
10:00 - 10:45	**Plenary Talk I --- Prof. Sir David Payne, University of Southampton, UK** **Topic:** Optical fibres: The next Generation At Osmanthus Hall (桂花厅)						
10:45 - 11:15	Coffee Break at Orchid Hall						
11:15 - 12:00	**Plenary Talk II --- Prof. Che-Ting Chan, HKUST, HK** **Topic:** Using Metamaterials to Manipulate Light At Osmanthus Hall (桂花厅)						
12:00 - 13:30	Lunch at Orchid Hall (兰花厅)						
13:30 - 15:00	**W3-a**			**Best Paper Award Session**			
15:00 - 15:30	Coffee Break at Orchid Hall (兰花厅)						
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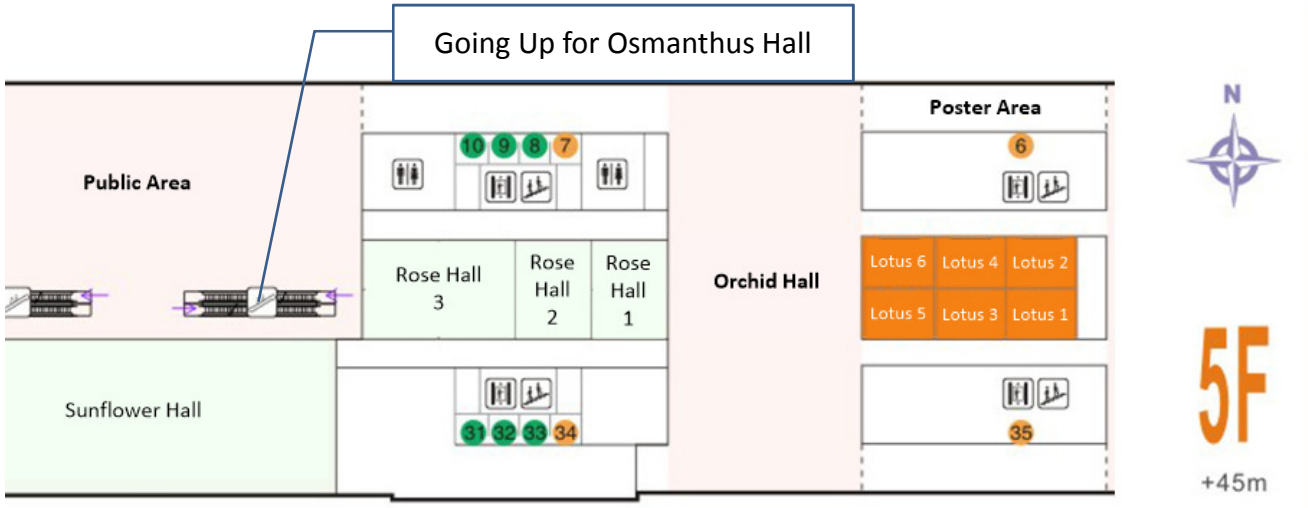
18:00 - 20:00	**Welcome Reception** at Orchid Hall (兰花厅)						
30 August 2015, Sunday							
08:00 - 17:00	On-Site Registration						
09:30 - 10:15	**W1-a**	**W2-a**	**S8-b**	**S1-a**	**S7-b**		
10:15 - 10:45	Coffee Break & PS-1 at Orchid Hall (兰花厅)						
10:45 - 12:20	**W1-b**	**W2-b**	**S8-c**	**S1-b**	**S5-a**		
12:20 - 13:30	Lunch at Orchid Hall (兰花厅)						
13:30 - 15:00			**S8-d**	**S7-c**	**S6-a**	**S4-a**	**S3-a**
15:00 - 15:30	Coffee Break & PS-2 at Orchid Hall (兰花厅)						
15:30 - 17:00			**S8-x**	**S7-d**	**S6-b**	**S2-b**	**S1-c**
18:00 - 20:00	**Banquet** at Golden Palace Restaurant (金皇廷酒家)						
31 August 2015, Monday							
08:00 - 09:00	On-Site Registration						
09:00 - 10:30			**S8-e**	**S6-c**	**S3-b**	**S2-c**	
10:30 - 10:50	Coffee Break at Orchid Hall (兰花厅)						
10:50 - 12:20				**S8-f**	**S4-b**	**S2-d**	
12:20 - 13:30	Lunch at Orchid Hall (兰花厅)						

Room Assignment

Osmanthus Hall (桂花厅)	Opening Ceremony, Plenary Talk I, Plenary Talk II
Rose 1 (玫瑰厅一)	S8-a, S8-b, S8-c, S8-d & S8-e
Rose 2 (玫瑰厅二	W2 & S2-a
Rose 3 (玫瑰厅三)	W1 & W3
Lotus 3 (荷花厅三)	S1-c & S3-a
Lotus 4 (荷花厅四)	Best Paper Award Session, S2-b, S2-c, S2-d & S4-a
Lotus 5 (荷花厅五)	Best Paper Award Session, S3-b, S4-b, S5-a, S6-a, S6-b & S7-b
Lotus 6 (荷花厅六)	Best Paper Award Session, S1-a, S1-b, S6-c, S7-a, S7-c, S7-d & S8-f
Orchid Hall (兰花厅)	Coffee Break, Lunch & Welcome Reception



SYMPOSIA

S1. Laser Technology

S2. Optical Communications and Networks

S3. Infrared Technologies and Applications

S4. Precision Optics

S5. Lightings and Displays

S6. Fiber-Based Technologies and Applications

S7. Optoelectronic Devices and Applications

S8. Biophotonics

WORKSHOPS

W1. Fiber-Based Technologies

W2. Optoelectronics Technopreneurship

W3. Metro Optical Transmission (Huawei)

PLENARY SPEAKERS

Plenary Talk I Optical fibres: The next Generation

10:00 - 10:45, 29 August 2015, Saturday At Osmanthus Hall

Sir David Payne, Optoelectronics Research Centre Director, University of Southampton, UK

Professor David Neil Payne CBE FRS FREng is a leading Professor at the University of Southampton and Director of the Optoelectronics Research Centre. A world class pioneer of technology, his work has had a great impact on telecommunications and laser technology over the last forty years. The vast transmission capacity of today's internet results directly from the erbium-doped fibre amplifier (EDFA) invented by David and his team in the 1980s.His pioneering work in fibre fabrication in the 70s resulted in almost all of the special fibres in use today including fibre lasers which are currently undergoing rapid growth for application in manufacturing and defence. David has made numerous leading contributions to many diverse fields of photonics and is widely acknowledged as an inventor of key components.

Plenary Talk II Using Metamaterials to Manipulate Light

11:15 - 12:00, 29 August 2015, Saturday At Osmanthus Hall

Che-Ting Chan, Chair Professor, Hong Kong University of Science and Technology

Professor Che Ting Chan received his BSc degree from the University of Hong Kong in 1980. He completed his PhD degree at the University of California at Berkeley in 1985. He joined the Physics Department of HKUST in 1995. Before coming to HKUST, Professor Chan worked at Ames Laboratory in the United States.

Professor Chan was a co-winner of an Outstanding Scientific Accomplishment Award (Solid State Physics) in the U.S. Department of Energy Materials Science Research Competition. He has been a Fellow of the American Physical Society since 1996. In 1999, he was awarded the Michael Gale Medal for Distinguished Teaching, HKUST. In 2000, he was awarded the Achievement in Asia Award by the Overseas Chinese Physics Association.

Professor Chan's main research interests include application of first principles and related methods to study the electronic, structural and other physical properties of matter; surface physics; photonic band gaps; and material physics.

WORKSHOP

Workshop 1 – Fiber-Based Technologies

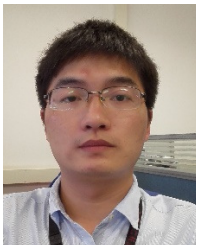
The special optical fiber plays a key role in modern information system carrying optical signal as for communication, transmission and sensing applications. The design, manufacturing, processing, measurement, and exploitation of special optical fibers are vital for fundamental research as well as for commercialization and market expansion of lightwave technology. This workshop will emerge activities from academic and industry, provide a unique platform for discussion and collaboration, and foster future R&D directions in this area.

Session chair:

Ming Tang, Huazhong University of Science and Technology, China

Weijun Tong, Yangzte Optical Fiber and Cable Joint Stock Limited Company (YOFC)

Invited talks:



Yucheng, Yang, Yangzte Optical Fiber and Cable Joint Stock Limited Company (YOFC)

He received doctor's degree of condensed matter physics from Wuhan University in 2014. He joined Yangzte Optical Fiber and Cable Joint Stock Limited Company (YOFC) as a R&D engineer in 2014. His research now is fiber laser, rare earth doping fiber and corresponding passive matched fiber.

ACTIVE AND PASSIVE OPTICAL FIBERS ASSEMBLING SOLUTION FOR FIBER LASERS

Abstract: Fiber lasers are widely used in many fields, including optical communication、industry processing、biotechnology、military、medicine、scientific research etc, due to its intrinsic advantages of outstanding optical - optical conversion efficiency, excellent thermal dissipation performance, close to the limit of the beam quality, more compact structure. This presentation introduces the integrated solutions for 1um fiber laser with series of Yb doped double clad fibers and matched passive fibers made by YOFC. The combination of the glass composition optimized active fiber with lower photo-darkening, higher clad absorption coefficient, the optimal matched passive fiber resulting to lower splicing loss and higher pump efficiency, and the excellent high-temperature coating material assembly, guarantees the durability of fiber lasers for long-term storage and operation under extreme conditions.

Xiaolong Tian, Fiberguide Industries, a Halma Company.

Dr. Xiaolong Tian is the general manager of Fiberguide Inc., China, being responsible for the marketing, R&D and production in China. Before that he was a R&D manager in Oclaro, Shenzhen, took the technical leadership in laser diodes projects such as 980nm pumps, high power industry lasers and tunable narrow-linewidth lasers. He got his Ph.D in Nanyang Technological University. His research interests are fiber lasers, fiber sensors, semiconductor lasers and Terahertz.

APPLICATIONS OF OPTIC FIBER & FIBER ASSEMBLIES: A SEGMENT MARKET

Jiajing Tu, University of Science and Technology Beijing (USTB), China

Jiajing Tu received her PhD degree at Hokkaido University, Japan in 2014. From November 2014 until now, she is working as a postdoctoral research fellow at Institute of Advanced Network Technologies and New Services at University of Science and Technology Beijing (USTB), China. Dr. Tu's main research interests include multi-core fiber, few-mode fiber and mode multiplexer/demultiplexer, etc.

Dr. Tu was awarded the Best Student Presentation Award form OSA in 2012 and won Dean's Award for the PhD thesis in 2014. She also obtained the China Postdoctoral Science Foundation in 2015.

DESIGN AND ANALYSIS OF TWO-MODE SUPPORTING FEW-MODE MULTI-CORE FIBER

Abstract: We proposed a two-mode supporting few-mode multi-core fiber (FM-MCF), analyzed two types of core arrangements which are one-ring structure (ORS) and square-lattice structure (SLS) and presented the optimization scheme for each structure. For ORS, it is hard to find appropriate core deployment to meet both requirements of inter-core crosstalk between LP_{11} modes ($XT_{11\text{-}11}$) and cable cutoff wavelength (λ_{cc}) at wavelength (λ) of 1625 nm. For SLS, $XT_{11\text{-}11} < -30$ dB/100km, $\lambda_{cc} \leq 1530$ nm and relative core multiplicity factor (RCMF) can reach ~15 at λ of 1625 nm, which indicates that SLS can be treated as a suitable core arrangement.

Ming Tang, Huazhong University of Science and Technology, China

He obtained the degree of Bachelor of Engineering in Huazhong University of Science and Technology (HUST), Wuhan, China, 2001, and Doctor of Philosophy in Nanyang Technological University (NTU), Singapore, 2005, respectively. From Feb 2009, he was with Tera-photonics group led by Professor Hiromasa Ito in RIKEN, Japan, as a research scientist. Since Mar 2011, Dr. Tang joined school of Optoelectronics Science and Engineering, Wuhan National Lab for Optoelectronics (WNLO), Huazhong University of Science and Technology (HUST) as a professor. He has been the member of IEEE and member of LEOS (now IEEE Photonics Society) since 2001. He became the senior member of IEEE since 2011, and he is also a member of OSA. He has published more than 100 technical papers in the international recognized journals and conferences, and he serves as the regular reviewer for the journals such as IEEE JQE, JLT, PTL and OSA publications.

After joining HUST, China since 2011, he has been awarded several key National R&D Projects of China as principle investigator, such as National High Technology Plan (863) of China, grant No. 2013AA013402, Funding 9.17 million RMB, and National Natural Science Foundation of China, grant No, 61331010, 2.85 million RMB, devoting on the R&D on high speed optical fiber communication and sensing system, both in fundamental theory and key technologies. He has been awarded the new century talent program of MOE of China.

MULTI-CORE FIBER AND FEW MODE FIBER: VERSATILE PLATFORM FOR COMMUNICATION AND SENSING APPLICATIONS

Abstract: It is well recognized that the technologies incorporating optical fibers and smart optical fiber based devices are essential for future flexible all-optical network to enhance the transmission capacity and processing efficiency. We will demonstrate our works about space-wavelength division flexible optical transmission and all-optical fiber based signal processing in spectral or temporal domains. The multicore fiber and few mode fiber based technologies recently developed in our group will be addressed and its perspectives in multi-dimensional communication and sensing applications will be given.

Zhenggang Lian, Chief Technology Officer, Yangtze Optical Electronics Co.

Zhenggang Lian received B.Eng. degree (with first class honour) and Ph.D. degree in Electronic and Electrical Engineering from the University of Nottingham, U.K., in 2006 and 2010, respectively. He then joined the Optoelectronics Research Centre, University of Southampton, as a research fellow. His research interests include fabrication and characterisation of micro-structured optical fibres, based on variety of compound glasses. In 2014, he joins the Yangtze Optical Electronics Co. as Chief technology officer; and holds part-time professorship at the Huazhong University of Science and Technology.

FABRICATION AND ACTUATION OF NANOMECHANICAL OPTICAL FIBRES

Abstract: We present micro-structured optical fibres exhibiting microelectromechanical functionality. This novel type of micro-structured optical fibre contains two suspended cores that not only transmit light also continuously tuneable. Optical transmission is controlled by mechanical actuation through gas pressure, temperature, or electrostatically via fibre-embedded electrodes. We demonstrate light switching and sensing etc. Also, a recent fabrication progress on multi-core fibre will be introduced.

Workshop 2 – Optoelectronics Technopreneurship

The scope of the Symposium includes, but not limited to, latest results and research in optoelectronics technopreneurship and related fields.

Session chair:

Junhao Hu, DARMA Inc

Invited talks:

Lin Ma, Shanghai Net Miles Fiber Optics Technology Co., Ltd., China

OPTICAL INTERCONNECT TECHNOLOGY FOR NEXT GENERATION DATA CENTER AND HPC APPLICATIONS

Abstract: We will introduce the latest active optical cables (AOC), optoelectronic boards, backplanes technologies and their scenarios for inter- and intra-cabinet applications. We will demonstrate our 40/56/100 Gbps QSFP+ AOC products and also technologies for speed beyond 100 Gbps. We provides state-of-the-art optical interconnect solutions and products for Data Center, High Performance Computing, and Storage Area Network applications with advantages such as high speed, high density, low latency, and low power consumption.

Hai Ding, InnoLight Technology Corporation, Worldwide

INNOVATION LIGHTS OUR FUTURE

Abstract: Technology innovation drives society improvement. It starts with using stones, bronzes, and up to irons during first industrial revolution. Afterwards, information technology enables data storage, computation, and communication. So that, people live much better lives, and work much more efficiently.

Entrepreneurship plays the key role to bring technology innovation alive. Only with Edison Lighthouse, people can enjoy stable and bright lights. Entrepreneurs are willing to take risk and exercise initiative, taking advantage of market opportunities by innovating new or improving existing products.

In high tech industries, technopreneurship integrates technology innovation and entrepreneurship, to advance society, and at the same time to realize personal achievement. In this workshop, how InnoLight Technology grows from a start-up to being listed in NASDAQ during short seven years will be shared. The optical communication technology trend and business opportunities will be discussed.

Jian CHEN, Nanjing University of Posts and Telecommunications, China

CONCEPTUAL DESIGN OF VISIBLE LIGHT COMMUNICATION SYSTEMS OVER THE EXISTING LIGHTING INFRASTRUCTURE

Abstract: We review on our recent proposed schemes based on multiple input multiple output (MIMO) and orthogonal frequency division multiplexing (OFDM) techniques so as to raise concerns about the practicability and applicability of futuristic indoor visible light communication (VLC) systems. These conceptual designs of VLC systems over indoor lighting infrastructure are feasible in practical VLC applications.

Jesse Zhu, Ocean Optics Asia, China

APPLICATIONS OF MINIATURE SPECTROMETERS IN INDUSTRY FIELD

Abstract: As spectroscopy technology progresses, miniature fiber optics spectrometers have promising prospects for their features such as stability, compact size and rapid measurement in industry production site testing.

Ocean Optics will introduce the development of miniature fiber optic spectrometers and application cases in industrial automation field, including online monitoring solutions in automation detection, LED industry chain, environmental protection, medical diagnosis and intelligent agriculture.

Meantime, Ocean Optics, as inventor and top manufacturer of fiber optics spectrometers, also explains how to deal with various special requirements in industry site and harsh industrial environment.

Workshop 3 – Metro Optical Transmission (Huawei)

Besides the backbone optical networks covering over thousands of kilometers for long-haul transmission, metro optical networks are widely deployed in metro-area for aggregation and accessing. Some research shows that the growing bandwidth demand from metro optical transmission will be much more than that from the long-haul optical transmission in the near future. Besides, there are tremendous amounts of optical equipment in metro optical transmission compared with the long-haul transmission systems and thus will induce large cost and huge energy consumption. Therefore, the power and cost efficiency should be one key consideration for metro optical transmission besides the transmission performance. In this workshop, the future demands and the potential technologies for metro optical transmission will be introduced and discussed by the speakers and attendees from operators, industries and academia.

Session chair:

Gordon Ning Liu, Huawei Technologies Co., Ltd.

Invited talks:

Guangquan Wang, China United Network Communications Group Co., Ltd ("China Unicom")

Guangquan Wang is the leader of network technology research department of network technology research institute in China Unicom. Working as Professor of Engineers, he takes charge of research and deployment of network technology, and focusing on the optical transport network. As a senior delegate of China Unicom to ITU-T meeting, Guangquan Wang is currently taking leadership of new recommendation (G.metro) development, and aiming at the standardization and popularization of metro WDM technology. He had been in charge of several national-wide fibre communication projects, the planning and designs of long haul backbone network in the main operators of China.

THE APPLICATION AND PROGRESS OF METRO WDM TECHNOLOGY

Abstract: The national "Broadband China" strategy aims to expand broadband coverage in both rural and urban areas, in order to boost information consumption and facilitate economic restructuring. With the national broadband development strategy, the bandwidth of fixed access and mobile access are increasing explosively, especially with the deployment of LTE and FTTx. To satisfy the increased bandwidth demand, metro WDM technology is the promising and cost-efficiency solution, aiming at the

comprehensive multi-service in the era of fixed and mobile convergence. The application of metro WDM are analyzed, including mobile fronthaul backhaul, high-end residential, leased line, and data center inter/intra connection. The general requirements of metro WDM technology are introduced briefly. With the metro WDM technology, lambda as a service (λaaS), to the antennas and users could be achieved cost-efficient, while every lambda could be upgraded without any affects on other lambdas.

This metro WDM technology has been discussed in ITU-T SG15 since 2011 plenary meeting, and the standardization work was initiated as the new Recommendation (G.metro) approval in 2014 plenary meeting, which is scheduled to be consented and published in 2016.

Adam Xiuzhong Chen, Alibaba Group

Adam Xiuzhong Chen is an optical engineer who focuses on the intra/inter-datacenter optical interconnect. He is the optical network architect in Alibaba. Before joining Alibaba, he was an optical network research engineer of China Academy of Information and Communications Technology (CAICT), and spent his Ph.D. graduate program in Beijing University of Posts and Telecommunications (BUPT) and University of California, Davis.

THE INTERCONNECTION FOR CLOUD DATACENTERS

Abstract: In order to connect two or more datacenters, we always build up the optical channel with or without DWDM. In this talk, I will share my opinion about some features of optical system. Some of them are ready in the commodity OTN/DWDM system, such as, 100G, protection, low latency, and transponder/muxponder. However, some of them are not there for our community, such as customized DWDM for short-reach/super-capacity interconnection of warehouse datacenter, monitoring of fibre, optical spectral intelligence, etc.

Alan Pak-tao Lau, Hong Kong Polytechnic University

Alan Pak Tao Lau received his B.A.Sc in Engineering Science (Electrical Option) and M.A.Sc. in Electrical and Computer Engineering from University of Toronto in 2003 and 2004 respectively. He obtained his Ph.D. in Electrical Engineering at Stanford University in 2008 and has joined the Hong Kong Polytechnic University as an Assistant Professor and. He worked at NEC Labs America in summer 2006 on receiver structures for multi-mode fiber systems. He is now an Associate Professor and his current research interests include various aspects of coherent fiber-optic communication systems and optical performance monitoring. He is currently the principle investigator and/or co-investigator of various governmental- and industry-funded research projects in various aspects of optical communications. He serves as a reviewer for various IEEE/OSA journals and technical program committee member for international conferences in the areas of Photonics and Communications.

DIRECT DETECTION VS COHERENT DETECTION FOR 100G UNAMPLIFIED LINKS

Abstract: Unamplified links are highly preferred for metro and short reach links. For such cost-sensitive applications, direct detection is preferred. We will review recent efforts in realizing 100G unamplified links and compare the pros and cons of direction

detection vs coherent detection.

Zhaohui Li, Jinan University

Prof. Zhaohui Li obtained his BS in the department of Physics and MSc in the institute of modern optics from Nankai University, China in 1999 and 2002 respectively, and his PhD from the Nanyang Technological University 2007. He joined the institute of Photonics Technology, Jinan University, China as professor in 2009.

His research interests are optical communication systems, optical signal processing technology and ultra-fine measurement systems.

LOW COST SHORT REACH OPTICAL INTER-CONNECTION

Abstracts: In this talk, we will introduce some new advances for optical inter-connections techniques in data center.

Liang Zhang , Huawei Technologies Co., Ltd.

Liang Zhang received the B.S. degree from Nanjing University of Post and Telecommunication (NUPT), China, in 2008, the M.S. degree and Ph.D. degree from Shanghai Jiao Tong University (SJTU), China, in 2011 and 2013. He worked as a visiting scholar in Georgia Tech from Sep. 2011 to Sep. 2012. He joined transmission technology research department of Huawei Technology in 2013. His research includes optical-wireless access networks, high-speed signal processing and optical metro network and so on. He has authored or coauthored over 50 publications in international journals and conferences. He is a regular reviewer of some top journals such as Optics Express, Optics Letters, and Photonic Technology Letters.

SOLUTIONS FOR 50GB/S AND 100GB/S TRANSMISSION OVER 80KM BASED ON LOW-COST DIRECT DETECTION

Abstract: The 4K video-based multimedia and recent-spread mobile front-haul services are demanding ultra-high data-rate transmission in data center (DC), access and metro point to point (p2p) networks. For these applications, direct detection is more attractive due to the lower power consumption and system cost. In the work, we summarize three schemes for 50Gb/s and 100Gb/s transmission over 80km SMF, named filter-SSB-DMT, DDMZM based SSB-DMT and DDMZM based Twin-SSB-DMT. Based on the Twin-SSB-DMT, for the first time, 112Gb/s data is successfully transmitted over 80km SMF with an OSNR of 27.2dB and the data-rate for the back to back is up to 200Gb/s.

Qi Yang, State Key Laboratory of Optical Communication Technologies and Network

Qi Yang received the B.E. and M.E. degrees in electronic and information engineering from Huazhong University of Science and Technology, Wuhan, China, in 2004 and 2006, and Ph.D. degree in electrical and electronic engineering at the University of Melbourne, Melbourne, Australia, in 2010, respectively.

From 2008 to 2009, he worked as intern student with Bell Labs, Alcatel-lucent Technologies, Murray Hill, NJ. Since 2010, he has been with the State Key Laboratory of Optical Communication Technologies and Networks, Wuhan, China. His current research interests include high speed coherent transmission. He has published more than 90

journal and conference papers.

GUARD-BAND SHARED 100GB/S DIRECT DETECTION USING ONLY A SINGLE-END PHOTO-DIODE

Abstract: We review recent process in 100G direct detection for medium-reach transmissions. We also propose a novel approach to simultaneously receive multi-band 100-Gb/s direct-detection optical signal using only one conventional 40-GHz photodiode. Only one guard band is required to accommodate the overlapped multi-band signal-to-signal beat interference (SSBI). The transmission distance over standard single mode fiber (SSMF) is up to 880 km.

Pat Day, Lumentum

Pat Day has over 25 years of telecom networking product development experience and at Lumentum is responsible for definition and development of products for data center, long haul and metro networking. He has led the development of key technologies through the evolution from 10G and 40G direct detection to coherent transponders at 40G & 100G and the transition to flexible WDM networks. Most recent responsibilities have included pluggable coherent optics and data center transceiver products.

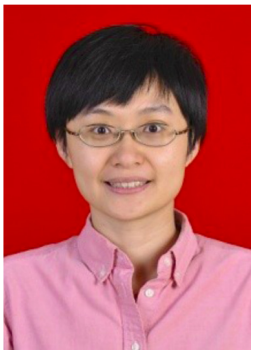
INVITED SPEAKERS

Qiaoliang Bao, Soochow University

Dr. Qiaoliang Bao received his Ph. D degree from Department of Physics, Wuhan University in 2007. From 2008 to 2012, he has started to work on graphene photonics in Graphene Research Centre, National University of Singapore (NUS). His main achievements include the invention of graphene-based mode-locked laser and graphene broadband polarizer. Dr. Bao's research is focused on 1) advanced low-dimensional optical materials and fundamental understanding of their optical properties; 2) photonic and optoelectronic devices based on two-dimensional functional materials including graphene, h-BN, layered transition metal dichalcogenides and topological insulators. He has received a few prestigious awards including *Lee Kuan Yew Postdoctoral Fellowship (Singapore, 2011), Discovery Early Career Researcher Award (DECRA, 2012, ARC)*, *Awardee of Thousand Young Talents Program (China, 2012).* Dr. Bao has over 90 peer-review journal publications which include 1 in *Nature Photonics*, 1 in *Nature Chemistry*, 2 in *Nature Communications*, 3 in *Advanced Materials*, 2 in *Advanced Functional Materials*, 4 in *JACS*, 10 in *ACS Nano*, *etc*. His publications have received >6700 citations, with an H-index of 39 as of July, 2015.

Jian Chen, Nanjing University of Posts and Telecommunications

Prof. Jian Chen received the B.S., M.S., and Ph.D. degrees in electronic engineering from Southeast University, Nanjing, China, in 1988, 1990, and 1994, respectively. From 1999 to 2001, he was with the Department of Electrical Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea. In 2002, he was a Member of the Technical Staff at the Institute for Communication Research, National University of Singapore (NUS). Since 2003, he has been a Research Scientist with the RF and Optical Department, Institute of Infocomm Research (I2R), Agency for Science, Technology and Research (A*Star), Singapore. He is currently a Professor with the Department of Communications, Nanjing University of Posts and Telecommunications (NUPT). His research interests include coherent optical communication, visible light communication, and optical access networks.



Lingling Chen, Shenzhen University

Lingling Chen was an Electronics and Information Science and Technology undergraduate at Peking University in 2003 and has continued as a M.S. student. She continued as a Ph.D. student and post-doctoral researcher at Imperial College London in 2010. She now is working as a member of the academic staff in Shenzhen University. Her research interests have evolved from ultrafast laser physics to interdisciplinary biomedical optics-based research including three-dimensional fluorescence imaging, coherence-gated imaging through turbid media and fluorescence lifetime imaging (FLIM) for applications in biology, drug discovery and clinical diagnosis. Her current research includes the development of multidimensional fluorescence imaging for microscopy and tomography.

Shih-Chi Chen, The Chinese University of Hong Kong

Shih-Chi Chen received his B.S. degree in Mechanical Engineering from the National Tsing Hua University, Taiwan, in 1999. He received his S.M. and Ph.D. degrees in Mechanical Engineering from the Massachusetts Institute of Technology, Cambridge, in 2003 and 2007, respectively. Following his graduate work, he entered a post-doctoral fellowship in the Wellman Center for Photomedicine, Harvard Medical School, where his research focused on biomedical optics and endomicroscopy. He is currently an Assistant Professor in the Department of Mechanical and Automation Engineering at the Chinese University of Hong Kong (CUHK). Before joining CUHK, he was a Senior Scientist at Nano Terra, Inc., a start-up company founded by Prof. George Whitesides at Harvard University, to develop novel methods and instruments for the control of various interface functionalities. His current research interests include precision engineering, biomedical devices/optics, MEMS, and nanomanufacturing. Prof. Chen is a Member of the American Society of Mechanical Engineers (ASME), American Society for Precision Engineering (ASPE), SPIE, and Optical Society of America (OSA). He is the recipient of a 2003 R&D 100 Award for the design of a microscale six-axis nanopositioner.

Daoxin Dai, Zhejiang University

Daoxin Dai received the B. Eng. degree from Department of Optical Engineering, Zhejiang University, China, and the Ph.D. degree from KTH, Sweden, in 2000 and 2005, respectively. Then he joined Zhejiang University as an assistant professor and became an associate professor in 2007, a full professor in 2011. He worked at the University of California at Santa Barbara as a visiting scholar from 2008 until 2011. His research interests include silicon photonic integrated devices and the applications. Dr. Dai has published >120 refereed international journals papers (including 7 invited review papers). He has been invited to give more than 20 invited talks and served as the program committee member or session chair for some top international conferences including OFC 2013~2015. Dr. Dai is serving as the Associate/Executive Editor of the Journals of *IEEE Photonics Technology Letters*, *Optical and Quantum Electronics* and *Photonics Research*.

Hai Ding, InnoLight Technology Corporation

Dr. Hai Ding is currently the vice president of InnoLight Technology (Suzhou) Ltd, a leading high speed optical transceiver supplier in China.

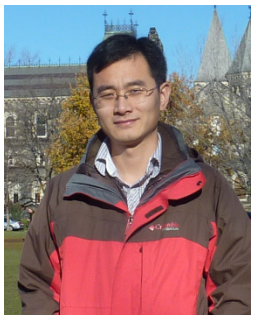
Dr. Ding is a recognized expert in semiconductor packaging. He started his career at Baird Corporation, a spectrometer manufacturer, as an optical engineer. After Ph.D. study, he joined the Assembly Technology Development of Intel Corporation, where he was a senior substrate engineer, and later held various management positions. He received Intel Achievement Award twice, and he owns two US patents. Dr. Ding received his Ph.D. on Mechanical Engineering & Master on Electronic Engineering from Georgia Institute of Technology, and Bachelor degree on Optical Instrumentation from Tsinghua University of China.

Zhihua Ding, Zhejiang University

Dr Ding, Director of Institute of Laser Biomedicine and a Professor at State Key Lab of Modern Optical Instrumentation and College of Optical Science and Engineering, Zhejiang University. He received his B.D. from Dept. of Optical Engineering at Zhejiang University (1989) and Ph.D. from Shanghai Institute of Optics and Fine Mechanics in China (1996). He was a Temporary Lecturer at Venture Business Laboratory of Shizuoka University in Japan (1998-2000) and a Senior Postdoctoral Fellow at Beckman Laser Institute of University of California at Irvine (2000-2002). From 2002 he joined the Dept. of Optical Engineering at Zhejiang University. He was enrolled as a member of New Century Excellent Talents in University (2004). He is an editorial board member of "Journal of Lasers, Optics & Photonics", an editorial board member of "Frontiers of Optoelectronics", an editorial board member of "Journal of Innovative Optical Health Sciences", an editorial board member of "Frontiers of Optoelectronics", an associated editor of "Acta Laser Biology Sinica", and an executive member of the editorial board for "Chinese Journal of Lasers". His research aims to investigate light/tissue (cell) interactions at micro to nano scale for high resolution and novel contrast, develop optical instruments for biomedical applications and fundamental researches. His current research foci are in vivo optical imaging and other in vitro optical method, especially in optical coherence tomography.

Xinyong Dong, China Jiliang University

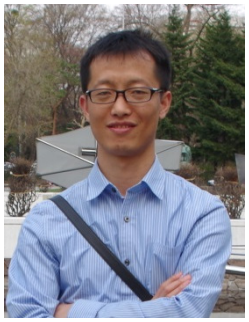
Xinyong Dong was born in Shandong, China, in 1975. He received PhD degrees in Optics from Nankai University, China, in 2002. He worked as a research assistant in the Hong Kong Polytechnic University (HKPU) for one year from May 2001 and became a research fellow in Nanyang Technological University, Singapore in Oct. 2002. He moved back to HKPU as a postdoctoral fellow in June 2006 and finally joined China Jiliang University as a full professor in June 2008. He is a member of IEEE, OSA and IMEKO-TC2, served in editorial boards of several international journals such as "Journal of Sensors" and "Photonics Sensors" and organized several conferences as session chairs or TPC members. His research interest covers fiber-optic sensors, optical fiber gratings, fiber amplifiers and lasers. To date, he has published 3 book chapters and more than 300 technical papers. He was awarded the Qianjiang Professorship of Zhejiang Province China in 2009, Young Scientist Award of the International Union of Radio Science in 2005, Postdoctoral Fellowship from the Singapore Millennium Foundation in 2004, Postdoctoral Fellowship from HKPU in 2006, and Wang Daheng's Optical Prize from the Chinese Optical Society in 2001.



Yongkang Dong, Harbin Institute of Technology

Yongkang Dong received the Ph.D. degree in Physical Electronics from Harbin Institute of Technology, Harbin, China, in 2008. During 2008 to 2011, he was working as a Post-doctoral Fellow in the Physics Department, University of Ottawa, Canada. He joined Harbin Institute of Technology in 2012 as a full professor. His current research interests involve nonlinear fiber optics and Brillouin scattering in optical fibers and its applications for sensing. He have authored and coauthored more than 60 journal papers and international conference presentations. He was the recipient of the First Prize in Heilongjiang Province Natural Science Award, and Third Prize in

Science and Technology Innovation Award of Chinese Society for Optical Engineering.



Jiangbing Du, Shanghai Jiao Tong University

Jiangbing Du received his Bachelor degree in 2005 and Master degree in 2008, from Nankai University, Tianjin, China. He obtained his PhD degree in 2011 from The Chinese University of Hong Kong, majored in electronic engineering.

He was with Huawei technologies from 2011 to 2012. He joined Shanghai Jiao Tong University as an assistant professor since 2012, and became an associate professor since 2014. He is the author or coauthor of over 50 journal and conference papers. His research interests include all-optical signal processing, fiber optic sensing, optical interconnection and transmission.

Daniel Elson, Imperial College London

Dr Elson is a Reader (associate professor) in the Hamlyn Centre for Robotic Surgery, Department of Surgery and Cancer and the Institute of Global Health Innovation at Imperial College London. Research interests are based around the development and application of photonics technology with endoscopy for surgical imaging applications, including multispectral imaging, polarization-resolved imaging, fluorescence, and laser speckle contrast imaging. Further projects include work on the development of illumination and vision systems for endoscopy combining miniature light sources such as LEDs and laser diodes with computer vision techniques for structured lighting and tissue surface reconstruction. These devices are finding application in minimally invasive and in the development of new flexible robotic assisted surgery systems. The research has been funded by the EPSRC, TSB, Wellcome Trust and the NIHR, as well as collaborations with industrial partners such as Karl Storz, Covidien, Cymtec and Intuitive Surgical. The Hamlyn biophotonics research group currently consists of five PhD students and five RAs, and Dr Elson has published over 60 peer reviewed journal articles, nine book chapters and has contributed to more than 200 conferences.

Hui Fang, Shenzhen University

Professor Hui Fang received the PhD degree in 2005 from Boston University. He then stayed in United States for the postdoctoral researches in Harvard Medical School from 2005 to 2006 and in Washington University at St. Louis from 2007 to 2008, where for the former he worked on the CLASS microscopy which can size biological particles with super-resolution, for the latter he worked on the photoacoustic Doppler flow sensing and imaging. From 2008-2014, he has been hired by Nankai Univeristy as a full professor, and from 2014 by Shenzhen University. His current new research interests include optical vector beam based metal nanoparticle trapping and manipulating as well as super-resolution gap-mode SERS imaging. He is a member of OSA, SPIE and Optical Society of China.

Shaobo Fang, DESY

Shaobo Fang received doctoral degree from Hokkaido University. Since 2011 he has been a research scientist in the framework of the Helmholtz Association Young Scientist Program at DESY CFEL. His research interests include sub-cycle waveform synthesis and novel monocycle pulse generation for attoscience and strong field physics.

Xinlu Gao, Beijing University of Posts and Telecommunications

Xinlu Gao received the B.S. degree in Physics and the Ph.D. degree in Information Optics from Beijing Normal University (BNU) , Beijing ,China, in 2010 and 2015, respectively.

She is currently a lecturer with Beijing University of Posts and Telecommunications (BUPT). Her current research interests include orbital angular momentum in radio frequency communication system, radio over fiber, microwave photonic phase shifter, optical true time delay.

Hao He, Shanghai Jiaotong University

Dr. Hao He is currently a full-time professor in the School of Biomedical Engineering, Shanghai Jiao Tong University. He got his B.S. degree from the University of Science and Technology of China in 2006 and PhD from the Chinese University of Hong Kong in 2010 respectively. After that, he joined in the Ultrafast Laser Laboratory in Tianjin University as an associate professor in 2011. In 2014, he migrated to Shanghai Jiao Tong University. His research interests including Biophotonics, cell signaling modulation by femtosecond laser, optical regulation of cellular functions, and multiphoton microscopy. His works concentrated on Biophotonics with ultrafast laser. Currently he was also an ImPACT project member in the University of Tokyo and working as the oversea fellowship of Japan Society for the Promotion of Science. He is also invited by the University of Tokyo as the Global Science Course Lectureship.

Rui Hu, Shenzhen University

Dr. Rui Hu received his Bachelor's degree from Chu Kochen Honors College of Zhejiang University in 2004 and his PhD in the Department of Optical Engineering in the same university in 2010. He has been a visiting scholar in the State University of New York at Buffalo for two years from 2007. After a three-year post-doctoral training in the Nanyang Technological University (Singapore), Rui settled himself with a lecture position in Shenzhen University. He has a multidisciplinary research background in chemistry, material science, optical engineering and biomedical science. His current research interests are with nanophotonics and biophotonics, with which, Rui has coauthored over 50 peer reviewed papers and a total citation of over 1200 (h-index 21). He has also been serving as regular reviewers for several international journals, such as Chemical Communications, Analyst, Journal of Materials Chemistry.

Weisheng Hu, Shanghai Jiao Tong University

Weisheng Hu, received BS (86), MS (89), and PhD (94) from Tsinghua, BUST, and Nanjing University. He joined WUST as assistant professor in 1989-94, SJTU as post-doctorate fellow in 1997-99, and as professor in 1999. He was director of SKL of advanced optical communication systems and networks (2003-07), member of coordinate task force of CAINONet and 3Tnet (1999-06), and technology forecast of Shanghai (2004-). He serves TPC for OFC, APOC, Optics East, LEOS/PS, CLEO/PS, ICICS, and editorial board for JLT, COL, and FOC.

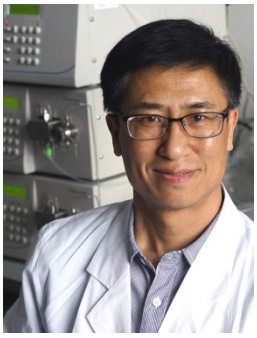
He led and participated 32 grants supported by NSFC, 863, MOE, and Shanghai. He published 78 peer journal papers, 26 OFC and ECOC conference papers. He gave 16 invited talks. He holds 38 patents. He received one National Award and three Provincial/Ministry Awards for Science and Technology Progress.

Junhao Hu, Darma Inc.

Dr. Junhao Hu is the founder and C.E.O. of Darma Inc. He earned his PhD in Optical Communication and Sensor Technology from the National University of Singapore. Dr. Hu worked as a research scientist in I2R, A-STAR for two years. Dr. Hu's passion lies at the intersection of improving health and advanced sensor technology. He has participated in accelerator programs at both the Founder Institute and HAXLR8R.

Nan Hua, Tsinghua University

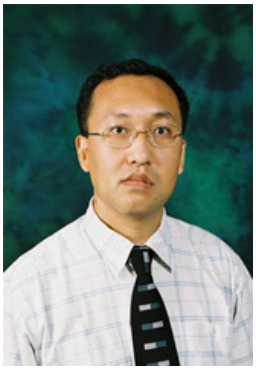
Nan Hua, Assistant Professor, was born in 1981. He received his B.S. and Ph.D. degrees in Electronics Engineering from Tsinghua University, Beijing, China, in 2003 and 2009, respectively. He is now an assistant professor with the Department of Electronic Engineering, Tsinghua University. He has authored or co-authored more than 80 papers and had 10 patents, His current research focuses on control and management of optical networks and all-optical switching technologies.



Zheng Huang, Fujian Normal University

Dr. Zheng Huang received his Bachelor Degree in Medicine from Suzhou Medical College, China (1978–1983), MSc Degree in Radiation Medicine from Suzhou Medical College (1983–1989), PhD in Microbiology/Immunology from King's College London, UK (1993–1997), and postdoctoral training in photochemistry/photobiology at the DOE National Renewable Energy Laboratory (1997–2000), USA. Dr. Huang worked as a staff medical scientist at HealthONE Alliance Denver, USA during 2000-2005, Associated Professor between 2006 – 2012 and senior researcher since 2012 at the University of Colorado Denver, USA. He jointed Fujian Normal University, China as a Professor and Director of Center for Biomedical Photonics in 2014. Dr. Huang is a board member of IPA and EPPM, and associate editor of Photodiagnosis and Photodynamic Therapy. He participated and co-organized several regional and international SPIE and IEEE conferences. Dr. Huang has been actively involved in basic, translational and clinical research of biomedical photonics since 2000. His current research is focused on light-based therapy of cancerous, skin, vascular and infectious diseases. Dr. Huang has published over 120 peer-reviewed articles and 5

book chapters on photomedicine and photodynamic therapy.



Wei Jin, The Hong Kong Polytechnic University

Wei Jin received a BEng degree from Beijing University of Aeronautics and Astronautics in 1984 and a Ph.D. degree from University of Strathclyde in 1991. Afterwards he was employed as a Postdoctoral Research Fellow at University of Strathclyde till the end of 1995. He joined the Department of Electrical Engineering of the Hong Kong Polytechnic University and is currently the Chair Professor of Photonic Instrumentation. His research interests includes photonic crystal fibers and devices; optical fiber sensors for strain, temperature, pressure, acoustic field, acceleration, gas, rotation and refractive index measurement; fiber lasers and amplifiers, condition monitoring of electrical power transformers and civil and mechanical structures. He authored/co-authored 2 books, over 250 journal papers and 10 patents in the area of fiber optic devices and sensors. He is a member of International Steering Committee of the international conference series on optical fiber sensors (OFS) and Technical Chainman of OFS-22.

Yuxin Leng, Shanghai Institute of Optics and Fine Mechanics

Yuxin Leng, received Ph.D. degree from Shanghai Institute of Optics and Fine Mechanics (SIOM), Chinese Academy of Sciences, Shanghai, China, in 2002. Now, he is a professor in State Key Laboratory of High Field Laser Physics at SIOM. He is currently investigating development and application of high field ultrafast laser, including optical parametric chirped pulse amplification (OPCPA); the ultra-intense and ultra-short laser based on Ti:sapphire chirped pulse amplifier; and carrier-envelopment phase (CEP) stabilized tunable high intense ultra-short infrared coherent radiation source and its applications.

Buhong Li, Fujian Normal University

Prof. Buhong Li is currently a professor in Biomedical Photonics at Fujian Normal University. He received his PhD degree in Optical Engineering from Zhejiang University in 2003. From 2005 to 2007, he was with Medical Imaging and Biophysics at Ontario Cancer Institute and University of Toronto as a visiting scientist. He joined in the Institute of Physics of Humboldt University of Berlin as a senior visiting fellow from April to August 2014. In 2015, he organized the first Sino-German Symposium on Singlet Molecular Oxygen and Photodynamic Effects. He has authored or coauthored more than 70 international journal and invited conference papers. His research focuses on optical monitoring for photodynamic therapy dosimetry, in particular the time- and spatial-resolved detection of singlet oxygen luminescence.

Han Li, China Mobile Research Institute

Han Li is the Deputy Director of the China Mobile Research Institute （CMRI）. He graduated from Beijing University of Posts and Telecommunications and received his Ph.D in 2002. He has led PTN, OTN, 100G WDM, GPON and Time Synchronization projects in China Mobile and has been rewarded the first prize of science and technology development of China Communications Standards Association (CCSA) two times. He is the Deputy Rapporteur of ITU-T SG15 Q9 and CCSA TC6 WG1. He holds more than 30 domestic and international patents and has published numerous scientific papers.

Jianqing Li, Macau Univeristy of Science and Technology

Jianqing Li received the Ph.D. degree from Beijing University of Posts and Telecommunications, Beijing, China, in April 1999. From 2000 to 2002, he was a visiting professor of Information and Communications University, Daejeon, Korea. From 2002 to 2004, he was a research fellow of Nanyang Technological University, Singapore. He joined the Macau University of Science and Technology in August 2004. Currently, he is a professor. His research interests are network architecture, network protocols, network security, performance analysis of telecommunication systems and fiber sensors. He is a senior member of the Institute of Electrical and Electronics Engineers (IEEE).

Juhao Li, Peking University

Juhao Li received the B.S. and Ph. D degrees from the Peking University, China in 1999 and 2009, respectively. During 1999-2000, he had been engaged in ZTE Corporation. In 2009 he worked in the State Key Laboratory of Advanced Optical Communication Systems & Networks at Peking University, firstly as a Postdoctoral Research Scientist, and as a Lecturer from 2011, and as an Associate Professor since 2012. He authored about 90 journal and conference papers.

Liangchuan Li, Huawei

Liangcuhan Li received the Ph.D. in Electronic Engineering from Beijing University of Posts and Telecommunications in 2007.

He joined Huawei in 2007 and his research interests include high speed coherent systems and DSP algorithms.

He has a dozen publications and patents in the areas of optical fiber communications systems and DSP algorithms

He is currently principle researcher in optical transmission area in fixed network research department.

He is also the chief expert of China's 863 subject project.

Xiaofeng Li, Professor, Soochow University

Xiaofeng Li is currently a professor and the deputy dean at School of Optoelectronic Information Science and Engineering, Soochow University (China). He received B.Eng. and Ph.D degrees from Southwest Jiaotong University (China), and has been working in Nanyang Technological University (Singapore) and Imperial College London (UK) for around 5 years. Since January of 2012, he joined Soochow University and was selected as the "Thousand Young Talents Program" of China in the same year. His research interests include photovoltaics, micro-nano photonics and devices. He has authored/co-authored around 100 journal papers, 10 patents, and more than 10 invited conference talks.

Changrui Liao, Shenzhen University

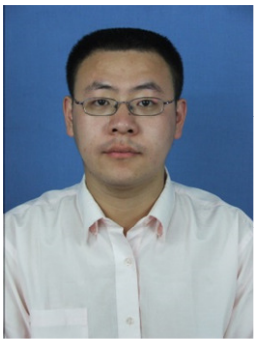
Dr. Changrui Liao received his B.Sc. degree in Optical Information Science and Technology, and M.Eng. degree in Physical Electronics from Huazhong University of Science and Technology, Wuhan, P. R. China, in 2005 and 2007, respectively. He obtained his Ph.D degree in Electrical Engineering at The Hong Kong Polytechnic University in 2012 and now is an assistant professor in Shenzhen University, China. His current research is focused on optical fiber sensors and femtosecond laser micromachining. He has coauthored over 50 peer reviewed papers and a total citation of over 1000 (Google Scholar).

Rongping Lin, University of Electronic Science and Technology of China

Dr. Rongping Lin received his B.Sc and M.Sc. from Southwest Jiaotong University and University of Electronic Science and Technology of China (UESTC), and a Ph.D. degree in Engineering from Nanyang Technological University in 2013. Dr. Lin was a senior researcher at City University of Hong Kong during 2012-2013. In October 2013 he joined School of Communications and Information Engineering, UESTC as a distinguished associate professor of network Engineering. Dr. Lin has published several papers on optical network communications in JLT, JOCN as first author. His research interests include: optical network engineering, software defined networks, packet and circuit integrated networks and optimization in communication networks.

Jianfei Liu, Hebei University of Technology

Jianfei Liu received his Ph.D. degree in communication and information systems from Tianjin University, China, in 2003. In 2003, he joined the Modern Optics Institute of Nankai University, China, as a Postdoctoral Research Fellow. In 2004 and 2009, he visited the Centre for Photonics and Photonic Materials of Bath University, UK, and CREOL of Central Florida University (UCF), USA, as a visiting scholar, respectively. He is a professor in electronic and communication engineering and now works in School of Electronics and Information Engineering, HeBei University of Technology. He has published more than 60 peer-reviewed papers in scientific journals and conference proceedings. His current research interests include optical fiber communication, optoelectronics and optical signal processing.



Kun Liu, Tianjin University

Kun Liu received his BEng degrees in opto-electronics information engineering and his MEng and PhD in optical engineering in 2004, 2006 and 2009 respectively, from Tianjin University. He pursued his Post-doctor research from 2009 to 2010 in Tianjin University, where he is currently an associate professor with the College of Precision Instrument and Optoelectronics Engineering. His research focuses on development of physics and chemistry sensing system based on optical fiber laser.

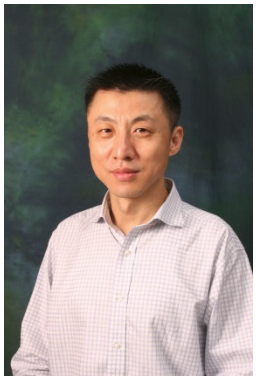
Meng Liu, Nanyang Technological University

Meng Liu received his M.S. degree in 2000 from Wuhan University of Science and Technology. In 2003 he got the master degree from Huazhong University of Science and Technology in physical electronics. Since 2010 he has joined JPT Electronics and engaged in the research and design on fiber laser. Now he is pursuing his Phd from Nanyang Technological University.

Xiaolong Liu, Mengchao Hepatobiliary Hospital of Fujian Medical University

Xiaolong Liu, was born in Shehong, China, on December 5, 1980. He received the Ph.D. degree in biophysics from Xi'an Jiaotong University, Xi'an, China, in 2008.

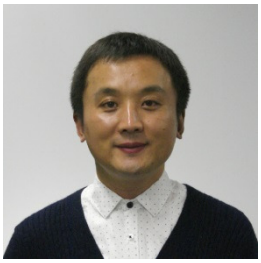
He currently is a Professor in Nanomedicine and the director of Liver Disease Research Institute at Mengchao Hepatobiliary Hospital of Fujian Medical University, as well as the Deputy Director of the United Innovation Key Laboratory of Fujian Province. His current research is focusing on biophotonics and nanomedicine for cancer diagnosis and therapy. He has published more than 40 scientific papers in the world recognized academic journals. He currently is also the adjunct Professor of Xi'an Jiaotong University, Fuzhou University and Chinese Academy of Sciences. He has received the "Alexander von Humboldt fellowship" in 2008, and the "Young Scientist Award" of Japanese Cancer Association in 2015.



Chao Lu, The Hong Kong Polytechnic University

Prof. Chao Lu obtained his BEng in Electronic Engineering from Tsinghua University, China in 1985, and his MSc and PhD from University of Manchester in 1987 and 1990 respectively. From 1991 to 2006, he was with School of Electrical and Electronic Engineering, Nanyang Technological University NTU), Singapore as Lecturer, Senior Lecturer and Associate Professor. From June 2002 to December 2005, he was seconded to the Institute for Infocomm Research, Agency for Science, Technology and Research (A*STAR), Singapore, as Program Director and Department Manager leading a research group in the area of optical communication and fibre devices. Since April 2006, he has been with the Department of Electronic and Information Engineering, The Hong Kong Polytechnic University as a Professor. Over the years, he has published more than 200 papers in major international journals such as Optics Express, Optics Letters, IEEE Photonic Technology Letters and IEEE/OSA Journal of Lightwave Technology. He has presented more than 100 papers and has given a number of invited talks in major international conferences. He has been organizer or

technical program committee member of many international conferences including a number of major conferences in the area. His research interests are in the area of optical communication systems and networks, fibre devices for optical communication and sensor systems. In addition to academic research work, he has had many industrial collaborative research projects and has a number of awarded patents. He is an associate editor of Optics Express and Chinese Optics Letters

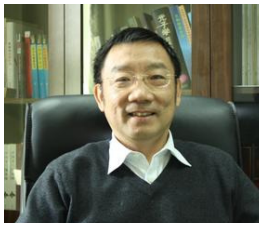


Guo-Wei Lu, Tokai University, Japan

Dr. Guo-Wei Lu received Ph.D. degree in Information Engineering from the Chinese University of Hong Kong (CUHK), Hong Kong, in 2005. From 2005 to 2006, he was a Postdoctoral Fellow at CUHK. From 2006 to 2009, he was an Expert Researcher in the National Institute of Information and Communications Technology (NICT), Tokyo, Japan. From 2009 to 2010, he was an Assistant Professor in Chalmers University of Technology, Göteborg, Sweden. During 2010 to 2014, he worked in NICT again as a researcher. Since April 2014, he joined Tokai University as an Associate Professor. He has authored or coauthored more than 142 peer-reviewed journal and conference publications. His current research interests include advanced optical modulation formats and photonic signal processing.

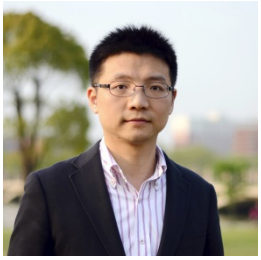
Zhi-Chao Luo, South China Normal University

Zhi-Chao Luo received the B.S. and Ph.D. degrees from the South China Normal University, Guangdong, China, in 2007 and 2012, respectively, both in optics. Since 2012, he has been with the School of Information and Optoelectronic Science and Engineering, South China Normal University, where he is currently an Associate Professor. He has authored or coauthored more than 80 international journal and conference papers. His current research interests include the 2-D materials-based photonic devices for ultrafast fiber lasers, soliton dynamics and nonlinear phenomena in fiber lasers, microfiber-based photonic devices, and design of tunable comb filters. Dr. Luo received the Wang Daheng Optics Award issued by the Chinese Optical Society in 2011, and also received the Guangdong Natural Science Funds for Distinguished Young Scholar in 2014.



Hui Ma, Tsinghua University

Hui Ma is a professor of the Division of Life Science and Health, Graduate School at Shenzhen, and Department of Physics, Tsinghua University. He obtained his PhD degree from Imperial College London in 1988. After two ost-doctoral employments in UK and China, he joined Department of Physics, Tsinghua University in 1991, then the newly established Tsinghua Graduate School at Shenzhen. His recent research interests include new techniques for polarization measurements and polarization data analysis, as well as new applications of these techniques to real problems such as diagnosis and staging of carcinoma tissues.



Lin Ma, Shanghai Net Miles Fiber Optics Technology

Lin Ma received the B.S. degree from Wuhan University of Technology, China, in 2003, and the M.S. and the Ph.D. degree in electrical communication engineering from Tohoku University, Japan, in 2006 and 2009, respectively. He served as a research scientist in NTT Laboratories, Japan, from 2010 to 2014. He is currently an associate professor with the Department of Electronic Engineering, Shanghai Jiao Tong University, and he is also the CTO of Shanghai Net Miles Fiber Optics Technology Co., Ltd. Net Miles Fiber Optics, established in 2014, is a joint venture between Hebei Sifang Telecommunication Equipment Co., Ltd. and Professor Zuyuan He with a registered capital of RMB 10 million yuan. Net Miles Fiber Optics' main business scope covers specialty optical fiber, optical interconnect and optical device. Presently, Net Miles Fiber Optics provides state-of-the-art 40/56/100-Gbps Active Optical Cable products and optical interconnect solutions for Data Center, High Performance Computing, and Storage Area Network applications.

Dong Mao, Northwestern Polytechnical University

Dong Mao was born in 1987. He received the B.S. degree in science from Northwestern Polytechnical University (NPU), Xi'an, China, in 2008, and Ph.D. degree in optical engineering from Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences, Xi'an, China, in 2014. He is currently an associate professor of Physics at School of Science, NPU, Xi'an, China. His research work mainly focuses on ultrafast optics, nonlinear fiber optics, novel mode locking materials, and nano-photonics, and he has published more than 50 journal papers with the total citation above 1500.

Hong Meng, Peking University

Prof. Hong Meng received his Ph.D from University of California Los Angeles (UCLA) in 2002.He has been working in the field of organic electronics for more than 20 years. His career experiences including working in the Institute of Materials Science and Engineering (IMRE) at Singapore, Lucent Technologies Bell Labs, DuPont Experimental Station. In 2012, Dr. Meng joined the laser printing industry company and conducted the new research area in chemical toner synthesis, special rubber composites and conducting ink formulations. He is a joint Professor in the Institute of Advanced Materials Nanjin Tech University. In 2014, he then moved to School of Advanced Materials Peking University Shenzhen Graduate School. Prof. Meng has contributed over 40 peer-reviewed papers (citation: 2500) in chemistry and materials science fields, filed over 46 US patents, 21 Chinese patents, published several book chapters and co-edited one book titled "Organic Light Emitting Materials and Devices". He was selected as one of The Recruitment Program of Global Experts (2013).

Li Pei, Beijing Jiaotong University

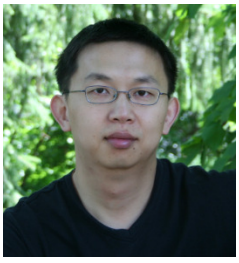
Li Pei, Professor of Beijing Jiaotong University,her current research interests include high speed optical telecommunication network, optical fiber sensor, ROF, key technology of optical fiber communication and so on. She has been a leader of more than 10 projects in China, include Hi-Tech research and Development Program of China, National Natural Science Foundation of China, and so on. She has (co)authored 1 book and more than 60 SCI papers, and she holds 97 patents and 61 software copyrights in her research fields.

Cibby Pulikkaseril, Finisar Australia

Cibby Pulikkaseril completed a B.Sc. (EE) at the University of Alberta, a M.Eng. (EE) at McGill University, and a Ph.D. (EE) at the University of Sydney, where his research topics was microwave photonic signal processing. In Canada, he worked for JDS Uniphase (now JDSU) in a research group focused on arrayed waveguide gratings, and is currently working as the technical lead at Finisar Australia on optical instrumentation, where he has part of the development team for the WaveShaper, an LCoS-based optical processor, and the WaveAnalyzer, a high-resolution optical spectrum analyzer.

Jochen Schröder, RMIT University

Dr. Schröder obtained his PhD in Physics from the University of Auckland, New Zealand in 2009 on the topic of mode-locked Raman lasers and nonlinear mixing. After his PhD he joined the ultrafast communications group of the Centre for Ultrahigh bandwidth Devices for Optical Systems (CUDOS) at the University of Sydney and became project leader for the Tbit/s project in 2012. In 2014 he moved to RMIT University as a Senior Lecturer. His research interests are LCOS-based technology and its applications to pulse-shaping, wavelength selective switches, space division multiplexing and turbid imaging as well as applications of linear and nonlinear signal processing for next generation communications systems. From 2012-2015 he has held an ARC Discovery Early Career Researcher Award (DECRA) and is the 2014 receipient of the Australian Optical Societies Geoff Opat Early Career Researcher Prize. He has published more than 40 journal articles and has given more than 10 invited talks at international conferences.



Kebin Shi, Peking University, Beijing China.

Dr. Shi received his Bachelor's and Master's degree from Nankai University in 1998 and 2001 respectively. He received his Ph.D degree at the Pennsylvania State University in 2007. Dr. Shi joined Peking University under the "Young Talent (BaiRen) Recruitment Program" as a professor in the Institute of Modern Optics in May 2011. Dr. Shi's research focuses on developing novel photonic systems and devices based on ultrafast/nonlinear optical principles for spectroscopy, imaging and applications. His recent accomplishments include holographic 3D CARS imaging, supercontinuum spectroscopy, nonlinear imaging and single particle spectroscopy. He currently serves as a co-chair of conference committee for Ultrafast Imaging and Spectroscopy Conference at SPIE annual meeting. In 2013, Dr. Shi was awarded "National Natural Science Funds for Excellent Young Scholar" by National Natural Science Foundation of

China (NNSFC).

Liang Song, Shenzhen Institutes of Advanced Technology

Liang Song, Ph.D., is Professor and founding director of the Research Lab for Biomedical Optics and Molecular Imaging at the Shenzhen Institutes of Advanced Technology, the Chinese Academy of Sciences. He also serves as the founding director of the Shenzhen Key Lab for Molecular Imaging. Prior to joining SIAT, he studied at Washington University in St. Louis and received his Ph.D. in Biomedical Engineering in 2010. He has authored >30 peer-reviewed journal articles in Biomaterials, Optics Letters, Optics Express etc., which have been cited by prestigious journals including Science and Nature Medicine. His Lab has invented and developed multiple novel photoacoustic imaging technologies, including optical-resolution intravascular photoacoustic imaging (IVPA) technology, reflection-mode photoacoustic/two-photon dual-modality in vivo microscopy with a spatial resolution of 320 nm, compressed-sensing based molecular photoacoustic imaging technology and multifunctional molecular probes for cancer theranostics. His research on photoacoustics has been supported by the National Natural Science Foundation of China, The Ministry of Science and Technology, and the Shenzhen Municipal governments.

Lipei Song, Nankai University

Lipei Song got her B.S and Master degrees in Optical Engineering from Tianjin University and Nankai University respectively. In 2013 she obtained her Ph.D degree from Department of Surgery and Cancer, Imperial College London in Biophotonic. Ms Lipei Song worked in multiple research fields including Optometry, Optical system design, and Opto-acoustic imaging. She is currently working in Institute of Modern Optics, Nankai University. Her main research interest is Laser speckle contrast imaging for tissue perfusion. She is also working with research groups in 3-D imaging and Quantum optics in China.

Yuxin Song, Shanghai Institute of Microsystem and Information Technology

Yuxin Song reveived Ph.D. from Photonics Laboratory, Department of Microtechnology and Nanoscience, Chalmers University of Technology in Sweden in Mar. 2012, and M.E. in Beijing University of Posts and Telecommunications in Jul. 2007. He was a postdoc researcher in Chalmers University of Technology (2012 Mar.-2013 Jun). He is currently an associate professor in Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences. His main research expertise is molecular beam epitaxy (MBE) of III-V, IV and other semiconductor materials and devices. He is currently working on dilute bismides, bismuth tellurides, group IV light emitter materials and 2D materials, and type-II superlattice (T2SL).

Abhishek Srivastava, Hong Kong University of Science and Technology

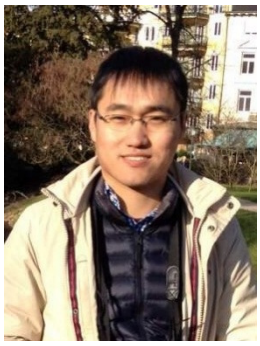
Dr. Abhishek Kumar Srivastava received his Ph.D. degree in 2009 from the University of Lucknow, Lucknow. Thereafter he joined the Optics Department of Telecom Bretagne, France as a post-doctoral fellow where he worked on active liquid crystals shutters for 3D cinema, liquid crystal composites and their electro-optical application. In 2009 he has been awarded by the young scientist fast track fellowship from the Department of Science and Technology of the Gov. of India. He has been awarded by ILCS Early-Career Award: The Michi Nakata Prize for his early career efforts in the field of ferroelectric liquid crystals and photo-alignment from International Liquid Crystal Society. Furthermore, his research efforts have also been recognized by many societies worldwide. Currently, He is working as Research Assistant Professor at Hong Kong University of Science and Technology, Hong Kong. His current research interest includes alignment of nano-materials and photo-aligned ferroelectric liquid crystals for advanced displays and photonic devices. He has published 103 research papers and holds 19 patents/patent applications.

Yikai Su, Shanghai Jiao Tong University

Yikai Su received the B.S. degree from the Hefei University of Technology, China, in 1991, the M.S. degree from the Beijing University of Aeronautics and Astronautics (BUAA), China, in 1994, and the Ph.D. degree in EE from Northwestern University, Evanston, IL, USA in 2001. He worked at Crawford Hill Laboratory of Bell Laboratories before he joined the Shanghai Jiao Tong University, Shanghai, China, as a Full Professor in 2004. His research areas cover micro and nano photonic devices for information transmission and signal processing. He has over 200 publications in international journals and conferences, including more than 30 invited papers, and 8 postdeadline papers. He holds 6 US patents and ~40 Chinese patents.

Prof. Su served as an advisory board member of Advanced Optical Materials (2015-), an associate editor of OSA Photonics Research (2013-2016), a topical editor of Optics Letters (2008-2014), a guest editor of IEEE JSTQE (2008/2011), and a feature editor of Applied Optics (2008). He is the chair of IEEE Photonics Society Shanghai chapter, a general co-chair of ACP 2012, a TPC co-chair of ACP 2011 and APCC 2009. He also served as a TPC member of a large number of international conferences including CLEO (2016-), ECOC (2013-2015), OFC (2011-2013), OECC 2008, CLEO-PR 2007, and LEOS (2005-2007).

Prof. Su is a senior member of IEEE and a member of OSA.



Zhenhua Sun, Shenzhen University

Dr. Zhenhua Sun got his B.S. and M.S. degrees from Wuhan University. In 2013 he graduated from the Hong Kong polytechnic University as a Ph. D.. Then he went to the Physics and Materials Study Laboratory in ESPCI, Paris to continue his research career as a postdoctoral scientist of Centre national de la recherche scientifique for two years. In 2015 he joined the college of optoelectronics engineering, Shenzhen University as an assistant professor. Dr. Sun has focused on the area of optoelectronics devices based on advanced semiconductors. He has ample experience in both devices study of photodetectors, solar cells and thin film transistors, and materials processing of graphene, conductive polymer and quantum

dots. Now he also includes single crystal in his research interests.

Yidong Tan, Tsinghua University, Beijing

Yidong Tan is an associate professor in the Department of Precision Instrument at Tsinghua University. He received his BS degree in 2003, MS and Ph.D. degree in 2008 both from the same university. Prof Tan's research interests include laser physics, metrology, and laser feedback sensing. Most recently, he and his students achieved ground-breaking results of laser feedback interferometer for uncooperative target based on their research of microchip solid state laser under frequency-shifted feedback. This is promising for non-contact measuring the micro-displacement, distortion, thermal expansion of nearly all kinds of materials, such as piezoelectric material, liquid, metal, carbon fiber composite. Another research thrust involves laser confocal feedback tomography and surface profilometry, a technology that can potentially realize large penetration depth in highly scattered medium, e.g. biological tissue, and nanometer accuracy profilometry with a large non-ambiguous range. These results will have profound impact to non-contact nanometer measurement.

Prof. Tan received Jin Guofan Prize for excellent youth of China Instrument Society Scholarships 2014, Electronic Information Science and Technology Award of Chinese Institute of Electronics 2013 (first class), Electronic Information Science and Technology Award of Chinese Institute of Electronics 2010 (second class), Excellent Postdoctoral for Tsinghua University 2009, Most Excellent Doctoral Dissertation by Tsinghua University 2008(second class), and Wang Daheng Prize for University Students of the Chinese Optical Society 2007.

Hengjing Tang, Shanghai Institute of Technical Physics

Hengjing Tang, PhD, Associate professor of Shanghai Institute of Technical Physics, Chinese Academy of Sciences. His work focuses on semiconductor device physics and technology, especially short wavelength infrared detector. He has been published more than 20 papers in Applied Physics Letters, Semiconductor Science and Technology, Applied Physics A, Journal of Applied Physic and so on.

Zhilie Tang, South China Normal University

Tang Zhilie, received the Ph.D. degree in Optics from South China Normal University, Guangzhou, China, in Jun 2005. He served as Professor of Physics at South China Normal University, China, from 2000 to 2015. In 2005, he became the director of Institute of Modern Optical Technology, South China Normal University. Since 2012, he has been the dean of School of Physics and Telecommunication Engineering, South China Normal University. He was a Vice President of Guangdong Physics Society, Chian. In recent years, he has been working in the area of biophotonics in particular confocal microscopy and photoacoustic imaging. He has published more than 30 papers in confocal microscopy and photoacoustic imaging. Recently, he has been working in the application of photoacoustic imaging.

Dongning Wang, China Jiliang University

D. N. WANG received the B.Sc. degree in Telecommunications from Beijing University of Posts and Telecommunications in 1983, the MBA degree from the University of Ulster, United Kingdom, in 1989, and Ph.D degree from City University, U.K. in 1995. His Ph.D research involved optical fiber sensors and white light interferometry.

From 1996 to 1997, he was a Postdoctoral Fellow in the Dept. of Electronics, the Chinese University of Hong Kong. From 1997 to 1998, he worked in China Telecom (Hong Kong) Ltd, where he was a Senior Telecommunication Engineer. From 1998 to 2015, he worked in the Dept. of Electrical Engineering, the Hong Kong Polytechnic University. He joined China Jiliang University in 2015. His main research interests are ultrafast optics, femtosecond laser micromachining, optical fiber communications and optical fiber sensors. He has more than 160 international journal publications.

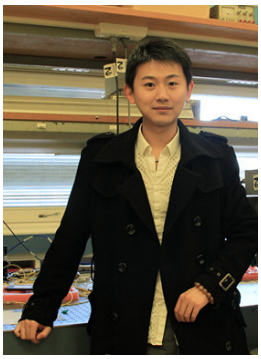
Jian Wang, Huazhong University of Science and Technology

Jian Wang received the Ph.D. degree in physical electronics from the Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, Wuhan, China, in 2008. He worked as a Postdoctoral Research Associate in the Department of Electrical Engineering, University of Southern California, Los Angeles, California, USA, from 2009 to 2011. He is currently a professor at the Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, Wuhan, China. He is the Assistant Director of Wuhan National Laboratory for Optoelectronics. He is also a Chutian Scholar Distinguished Professor in Hubei Province. He gained supports from the New Century Excellent Talents in University in 2011 and China National Funds for Excellent Young Scientists in 2012.

Jian Wang is the member of IEEE, OSA, SPIE and COS. He has more than 200 publications including 2 book chapters, 2 special issues, 2 review articles, 38 invited talks/papers, 8 postdeadline papers, and more than 90 journal papers published on Science, Nature Photonics, Scientific Reports, Applied Physics Letters, Optics Express, Optics Letters, etc. He is a frequent reviewer of Scientific Reports, Optics Express, Optics Letters, Optica etc. Jian Wang has devoted his research efforts to innovations in photonic integrated devices and frontier technologies for high-speed optical communications and optical data processing.

Jiannong Wang, Hong Kong University of Science and Technology

Prof. Jiannong Wang obtained her B.Sc. degree at Xian Jiao Tong University in China in 1982, M.Phil. degree at Institute of Semiconductors, Chinese Academy of Science in 1986, and Ph.D. degree at H. H. Wills Physics Laboratory, University of Bristol, UK in 1990. She stayed at H. H. Wills Physics Laboratory from 1990 to 1992 as a postdoc research assistant and then joined the Physics Dept., the University of Nottingham, UK as a post-doctoral research associate from 1992 to 1994. In October 1994, she joined the Physics Dept. of the Hong Kong University of Science and Technology as an assistant professor. Now, she is a full professor in Physics Dept. and the director of William Mong Institute of Nano Science and Technology of the Hong Kong University of Science and Technology.



Ke Wang, The University of Melbourne

Dr Ke Wang obtained the B.S. degree from Huazhong University of Science and Technology, China in 2009, and the PhD degree from the University of Melbourne, Australia in 2014. He is now a DECRA Fellow in the Centre for Neural Engineering (CfNE), Department of Electrical and Electronic Engineering, The University of Melbourne, Australia.

Dr Wang's major research areas include high-speed optical wireless communications, in-building/indoor personal area networks, reconfigurable optical interconnects, and silicon photonics integration. He has published over 65 papers in top journals and leading international conferences. He has received the IEEE Photonics Society Graduate Student Fellowship in 2012, the Marconi Society Young Scholar Award in 2013, and the Australian Research Council Discovery Early-Career Researcher Award in 2014.

Xudong Wang, Jinan University

Xudong Wang received the B.E. degree in electrical engineering from the Dalian University of Technology, Dalian, China, in 2007, and M. E. degree and Ph.D. degree from the University of Sydney, Sydney, Australia, in 2008 and 2014. He is currently working as a lecturer in the Institute of Photonics Technology at Jinan University in Guangzhou city in China. His research interest is microwave photonic signal processing, including notch filters, phase shifters, and frequency measurement.

Yiping Wang, Shenzhen University

Yiping Wang is a Distinguished Professor and a Pearl River Scholar in College of Optoelectronic Engineering, Shenzhen University, Shenzhen, China. He was born in Chongqing, China, in July 15, 1971. He received the B.S. degree in Precision Instrument Engineering from Xi'an Institute of Technology, Xi'an, China, in 1995, and the M.S. degree in Precision Instrument and Mechanism and the Ph.D. degree in Optical Engineering from Chongqing University, China, in 2000 and 2003, respectively, where he received the prestigious award of The National Excellent Doctoral Dissertations of China.

In 2003, he joined the Department of Electronics Engineering, Shanghai Jiao Tong University, China, as a postdoctoral research fellow and an associate professor. In 2005, he joined the Department of Electrical Engineering, Hong Kong Polytechnic University, Hong Kong, as a postdoctoral research fellow and a research fellow. In 2007, he joined the Institute of Photonic Technology, Jena, Germany as a Humboldt research fellow. In 2009, he joined the Optoelectronics Research Centre, University of Southampton, U.K. as a Marie Curie Fellow. Since 2012, he has been with Shenzhen University as a Distinguished Professor and a Pearl River Scholar. His current research interests focus on optical fiber sensors, in-fiber gratings, photonic crystal fibers, and fluid-filling technologies. He has authored or coauthored 1 book, 11 patent applications, and more than 180 journal and conference papers with a SCI citation of more than 1500 times.

Dr. Wang is currently a senior member of IEEE, the Optical Society of America, and

the Chinese Optical Society.

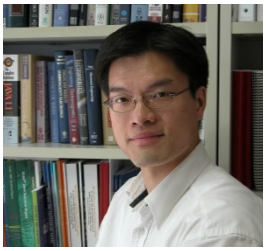
Xunbin Wei, Shanghai Jiaotong University

Dr. Xunbin Wei received his bachelor in Physics from University of Science & Technology of China in 1992. He received his PhD in Physiology & Biophysics from University of California, Irvine in 1999. He did his post-doctoral training with Prof. David Clapham in Harvard Medical School. From 2001-2005, Dr. Wei was a faculty member in Wellman Center for Photomedicine, Massachusetts General Hospital. From 2006-2010，he is a Professor and deputy director of Institutes of Biomedical Sciences, Fudan University. Currently, he is a Distinguished Professor at Med-X Research Institute, School of Biomedical Engineering, Shanghai Jiao Tong University. Dr. Wei's research interests include in vivo optical imaging for cancer and optical diagnostic device. He has published more than forty papers, including on Nature and PNAS. In addition, Dr. Wei has obtained three patents and one Chinese FDA approval for medical device. Currently, Dr. Wei is a SPIE Fellow.

Kam Sing Wong, Hong Kong University of Science and Technology

Professor Kam Sing Wong received the BSc (Hons.) degree in physics from King's College, University of London in 1983 and the D. Phil degree in solid-state physics from Clarendon Laboratory, University of Oxford in 1987. He then went on to do postdoc with R. R. Alfano and Z. V. Vardeny at City College of New York and University of Utah respectively.

He joined the Physics Department of Hong Kong University of Science and Technology (HKUST) in 1991 as the founding faculty. His main research interests include ultrafast lasers and nonlinear optics, time-resolved spectroscopy, semiconductor and polymer physics, photonic crystal and plasmonics. He has published over 150 peer-reviewed journal publications, 4 patents, total citations over 4500 and h-index of 38.



Kenneth K. Y. Wong, The University of Hong Kong

Dr. Kenneth Kin-Yip Wong received combined B.E. (1st class honor with medal award) degree in electrical engineering and B. S. degree in physics from the University of Queensland, Brisbane, Australia, in 1997. He received the M.S. degree in 1998 and the Ph.D. degree in 2003, both in electrical engineering at Stanford University. He was a member of the Photonics and Networking Research Laboratory at Stanford University. His research field included DWDM systems, fiber nonlinearity, fiber optical parametric amplifiers, microwave photonics, and biophotonics. He is author or coauthor of over 260 journal and conference papers. He worked in Hewlett-Packard Laboratories as research engineer and contributed in projects included parallel optics and VCSEL in 1998-99. He also worked as independent consultant in Innovation CORE (A Sumitomo Electric Company), CA, in 2004.

Dr. Wong is currently an Associate Professor in the Department of Electrical and Electronic Engineering in the University of Hong Kong, where he won the Best Teacher Award 2005-06, Outstanding Young Researcher Award 2008-09, and Outstanding Teaching Award 2012-13 (Team). He is also an Associate Editor of IEEE Photonics Technology Letters. During the 2009-10 academic year, he joined the Empower Teacher Program, organized by department of Electrical Engineering

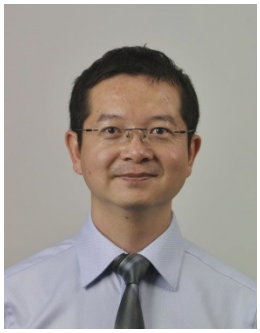
Computer Science (EECS) at the Massachusetts Institute of Technology (MIT) by co-teaching a sophomore course and living in a graduate residence. He was the recipient of OSA New Focus Student Award and IEEE/LEOS Graduate Student Fellowship, both in 2003 and participated in various student activities. He was the recipient of OSA New Focus Student Award and IEEE/LEOS Graduate Student Fellowship, both in 2003.

Changfeng Wu, Jilin University

Changfeng Wu is currently a professor of Biomedical Engineering at Jilin University. He completed his PhD in 2008 in the group of Prof. Jason McNeill at Clemson University and then carried out postdoctoral research with Prof. Daniel T. Chiu at the University of Washington. He was selected in the "Thousand Young Talents Program" in 2011 and joined the faculty of Jilin University in 2012. His current research is focused on the development of fluorescent nanoparticles, and spectroscopic and imaging techniques for biological applications.

Yong Wu, University of California, Los Angeles

Yong Wu received his Ph.D. in Physics from the University of Massachusetts at Amherst in 2006. In 2007, he joined the Department of Anesthesiology at the University of California, Los Angeles (UCLA) as a postdoctoral associate, where he started his work in optical microscopy and microscopic image analysis for biological applications. In 2013, he was appointed Assistant Researcher in the Department of Anesthesiology. His current research is focused on super-resolution light microscopy, nanomaterials, and their applications to the cardiovascular system. He is member of American Biophysical Society.



Peng Xi, Peking University

Dr. Peng Xi is an associate professor in Peking University. His current research interests are focused on research and development of optical nanoscopy, as well as confocal and multiphoton microscopy. Dr. Peng Xi has published over 80 scientific papers in peer-reviewed journals such as Nat. Photon., ACS Nano, Sci. Rep., Opt. Lett., Opt. Expr., etc., and holds 8 issued patents, including 2 US patents. He is a senior member of OSA. His research is sponsored by National Scientific Instrument Development Project, National Science Foundation of China, and National Basic Research Program of China ("973" Program). Dr. Peng Xi is on the editorial board of several SCI-indexed journals: Scientific Reports, Microscopy Research and Techniques, Micron, and Chinese Optics Letters. He has been serving as a reviewer for a series of peer-reviewed scientific journals such as: Nat. Comm., OL, OE, BOE, Sci. Rep., JOSA B, etc. He has been invited to give several invited talks in international conferences hosted by OSA and SPIE.

Guoqiang Xie, Shanghai Jiao Tong University

Dr. Guoqiang Xie is a distinguished researcher in Department of Physics and Astronomy of Shanghai Jiao Tong University. His research interest includes ultrafast laser, novel photonic materials, and nonlinear optics. So far, He has published 60 peer review papers and had citations of beyond 800.

Ke Xu, Harbin Institute of Technology Shenzhen Graduate School

Prof. Ke Xu received B. Eng. degree from Huazhong University of Science and Technology, Wuhan, China, in 2010. He obtained his Ph.D. degree from Department of Electronic Engineering, The Chinese University of Hong Kong, Shatin, Hong Kong, S. A. R. in 2014. He was a visiting researcher in Department of Photonics, National Chiao Tung University, Taiwan in August, 2012 and a visiting researcher in Department of Electrical Engineering, Yale University from September, 2013 to January, 2014. He was awarded with the IEEE Photonics Society Graduate Student Fellowship in 2013 and the Hong Kong Young Scientist Award in 2014. He is currently working as an associate professor in Shenzhen Graduate School, Harbin Institute of Technology, Shenzhen, China. His research interest includes silicon photonics, optical interconnects, and mid-infrared photonics.

Shanhui Xu, South China University of Technology

Shanhui Xu received the B.S. and M.S. degree in optics from the South China University of Technology (SCUT), Guangzhou, China, in 1998 and 2001, respectively, and the Ph.D. degree in microelectronics and solid electronics from South China Normal University, Guangzhou, China, in 2009. From 2001 to 2003, he was a Research Engineer in Huawei Technologies Co., Ltd. He is currently a Professor in the Institute of Optical Communication Materials and State Key Laboratory of Luminescent Materials and Devices, SCUT. His current research interests include areas of fiber lasers and laser physics.

Ping Xue, Tsinghua University

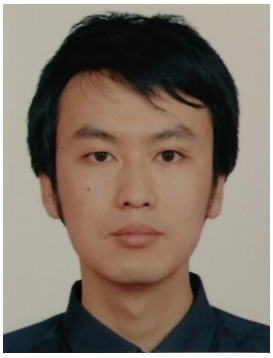
Prof. Xue received his B.S. and Ph.D. from Tsinghua University; while he has been as Visiting Scientist at Massachusetts Institute of Technology, USA (2001-2002); Since then prof. Xue has become professor at the department of Physics, Tsinghua University.

Prof. Xue is Deputy Director State Key Laboratory of Low-Dimensional Quantum Physics, China since 2011 and he also as Deputy Director, Committee for Science Popularization, Chinese Physical Society since 2008.

Prof Xue focuses upon optical coherence tomography and its application, biomedical optics and physics, laser physics and spectroscopy and optical sensing and computing. Authored or co-authored more than 120 papers, 15 patents and 20 invited talks at international conferences.

Minghong Yang, Wuhan University of Technology

Minghong Yang is Division Director at the National Engineering Laboratory for Fiber Optic Sensing Technology, WuhanUniversity for Technology, China. From July 2003 to December 2005, he was with the Fraunhofer Institute for Applied Optics and Precision Mechanics in Jena, Germany, after that he worked in the Berlin University of Technology, Germany as research fellow till 2009. He was with Virginia Tech, USA as visiting professorship in 2013 and with Fredirch-SchillerUniversity, Jena, Germany as guest professorship in 2014. He is TPC member of OFS-23, OFS-24, conference chair of the 4th Asia-Pacific Optical Sensors (APOS 2013) and ISC member of APOS 2015. He has published more than 100 journal papers and conference presentations. His current research interests include sensitive coatings and materials for optical fiber sensing.

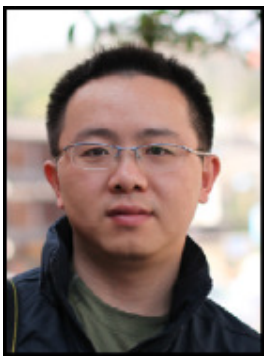


Yanfu Yang, Harbin Institute of Technology

Dr. Yanfu Yang obtained his BSc in Applied Physics from Xi'an Jiaotong Univerisity in 2002 and his PhD from Tsinghua University in 2007. From Sep 2007 to Feb 2011, he worked as a postdoctoral fellow in the Department of Electronic and Information Engineering, Hong Kong Polytechnic University. Since Feb 2011, he has been an Associate Professor in the School of Electronic and Information Engineering, Shenzhen Graduate School, Harbin Institute of Technology. His research interests are intelligent optical communication networks.

Yuanhong Yang, Beihang University

Prof. Yuanhong Yang received his B.Sc. degree in Optical Engineering from Huazhong University of Science and Technology, Wuhan, and M.Sc. in Instrumental Science and Ph.D. degree in Material from Beihang University, Beijing. Currently he is a profressor at Beihang University, Beijing . Where he works on research activities related to new fiber optical gyroscope and relative technology. His main research interests include optical gyroscopes, optical fiber sensing and optical fiber laser. He is author and co-author of more than 150 publications and holds more than 30 patents.



Jian Ye, Shanghai Jiao Tong University

Jian Ye received his B.E. degree (2000) and M.S. degree (2003) in Polymer Science and Engineering from Zhejiang University, China, and his Ph.D. degree (2010) in Chemistry from KU Leuven, Belgium. From 2003 to 2005, he worked at Intel Products (Shanghai) Ltd. as a material engineer. From 2005 to 2010, he performed his Ph.D. research project in Interuniversity Microelectronics Center (IMEC), Belgium. Before he joined Shanghai Jiao Tong University, he was a senior researcher in IMEC (2010-2013) supported by the Postdoctoral Fellowship of the Research Foundation–Flanders (FWO) in Belgium. In 2011 (Mar–Sep), he worked in the nanophotonics group of Prof. Naomi Halas at Rice University as a visiting scholar. He joined the Shanghai Jiao Tong University as a Special Research Professor in 2013. He has received the "National 1000 Young Scholar" Award from Chinese Central Government, the 2009 Chinese Government Award for Outstanding Self-Financed Students Abroad, and the 2009 IMEC Scientific Excellence Award. He has authored or

ca-authored more than 40 peer-reviewed journal papers, 1 book chapter, and 4 patents. His research interests include design, fabrications and biomedical applications of plasmonic nanostructures.

Tong Ye, Clemson University

Dr. Tong Ye is currently an Assistant Professor of Bioengineering at Clemson University with joint appointment in the Department of Cell and Regenerative Medicine at the Medical University of South Carolina (MUSC). He earned his Ph.D. in Optics from Xi'an Institute of Optics and Precision Mechanics, Chinese Academy of Sciences (CAS) in 1995. He previously worked in the field of ultrafast spectroscopy and now focuses on developing fast and 3D imaging methods for high resolution functional imaging.

Changyuan Yu, National University of Singapore

Dr. Changyuan Yu joined Dept. of Electrical and Computer Engineering, National Univ. of Singapore (NUS) in 12/2005. He has founded and led the Photonic System Research Group in NUS since then. He is also a 25% joint senior scientist with A*STAR Institute for Infocomm Research (I2R). He received B.S. in Applied Physics and B. Economics in Management from Tsinghua Univ., China in 1997, M.S. in Electrical and Computer Engineering from the Univ. of Miami, USA in 1999, and Ph.D. in Electrical Engineering from the Univ. of Southern California, USA in 2005. He was a visiting researcher at NEC Labs America in 2005. His research focuses on photonic devices, subsystems, and optical fiber communication and sensor systems. Dr. Yu has authored/co-authored 6 book chapters and over 240 research papers on the peer reviewed journals and the prestigious conferences (39 invited, including OFC2012 in USA). He has served in technical program committee or organizing committee for 50+ international conferences (including TPC member of OFC2014-2016, Chair of SPPCom2015, and TPC chair of SPPCom2014 in USA). His group won 6 best paper awards in conferences and the championship in biomedical area in the 3rd China Innovation and Entrepreneurship Competition 2014.

Haohai Yu, Shandong University

Haohai Yu was born in Jinan, China, on October 16, 1981. He received the Ph.D. degree from Shandong University, Jinan, in 2008. He is currently with the State Key Laboratory of Crystal Materials and Institute of Crystal Materials, Shandong University. His current research interests include crystal growth, diode-pumped solid-state lasers, and nonlinear optics based on the new crystals.

Yu Yu, Huazhong University of Science and Technology

Yu Yu received the Bachelor's degree and Ph.D. degree in 2003 and 2009, respectively, both from the Huazhong University of Science and Technology (HUST), Wuhan, China. From 2009 to 2010, he was with the Centre for Photonic Systems, Department of Engineering, University of Cambridge, Cambridge, U.K., as a Research Associate. He is currently with the Wuhan National Laboratory for Optoelectronics (WNLO) and School of Optical and Electronic Information, HUST, as an Associate Professor. He is the author or co-author of more than 70 journal and conference papers. His research interests include Silicon Photonics, all-optical signal processing and related integrated devices.

Feng Yun, Xi'an Jiaotong University

Feng Yun, Ph.D., Professor, School of Electronics & Information Engineering, Xi'an Jiaotong University.

Prof. Yun is the director of Key Lab of Physical Electronics & Devices, Ministry of Education, China. He is also the founding director of Solid State Lighting Engineering Research Center at Xi'an Jiaotong University, specialized in wide bandgap semiconductor materials and devices. His recent research interests are III-nitride based optoelectronic devices such as high power LEDs.

Haiyi Zhang, China Academy of Information and Communication Technology

Haiyi Zhang joined RITT (Research institute of telecommunications transmission), CAICT (China Academy of Information and Communication Technology) in 1996. Now she is working as director of the transport and access research department. She was experienced on the research of transport network standard, technical consultation, network equipment evaluation and field trial. She also acted as deputy director of CCSA(China Communications Standards Association) TC6 WG1(transport group).She won national science and technology prize three times and several other prizes. Now she is focusing on the research of technology and standard such as high speed transmission, OTN, PTN and etc.

Xuping Zhang, Nanjing University

Prof. Xuping Zhang worked in ETH-Zurich as a visiting professor in 1999 and joined University of Texas at Austin as a research scientist from 2000-2002. She is currently a professor in Nanjing University. She is the founder of the Institute of Optical Communication Engineering in Nanjing University and the director of Jiangsu Optical Communication System and Network Technology Research Centre. She has published more than 200 journal and conference papers. Her research interests include fully-distributed fiber sensors, structure health monitoring (SHM) technology and microelectronic devices.

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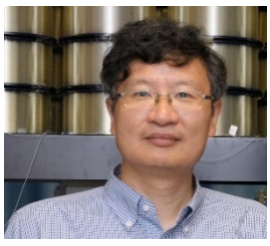
Yongli Zhao, Beijing University of Posts and Telecommunications

Yongli Zhao is an associate professor of state key laboratory of information photonics and optical Communications at Beijing University of Posts and Telecommunications(BUPT). He received the B.S. degree in communication engineering and Ph.D. degree in electromagnetic field and microwave technology from BUPT, respectively in 2005 and in 2010. He is sponsored by above ten projects of Chinese government. 8 books and more than 140 articles have been published. 14 patents have also been granted. He serves as one of TPC members in GlobeCom2013/2014 workshop, ICC2014/2015 workshop and so on. His research focuses on software defined optical networking, elastic optical networks, and packet transport networks and so on.

Wei Zheng, Shenzhen Institutes of Advanced Technology

Dr. Wei Zheng received his B.S. degree in Optical Engineering from Zhejiang University in 2003, and received his Ph.D. in Electronic and Computer Engineering from Hong Kong University of Science and Technology in 2011. He is currently an associate professor in Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences. Zheng's research focuses on developing advanced optical imaging techniques, including time-resolved two-photon microscopy, super-resolution microscopy and multimodality microscopy.

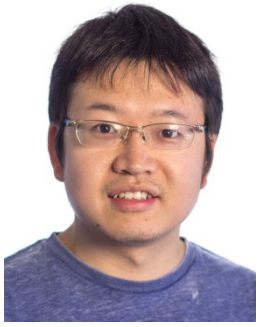


Xiaoping Zheng, Tsinghua University

Xiaoping Zheng, born in Aug. 6, 1965, received BS from Sun Yat-Sen University in 1986, MS from Southeast University in 1994, and PhD from Tsinghua University in 1998. Now He is tenure professor of Tsinghua University on optical networking and microwave photonics. He has authored and co-authored more than 150 papers, gained 30 patents, and is the winner of 3 provincial and ministerial Awards. He is the executive member of the council of the Optical Society of Beijing.

Linjie Zhou, Shanghai Jiao Tong University

Dr. Linjie Zhou received his B.S. degree in microelectronics from Peking University in 2003. He received his Ph.D. degree in electronic and computer engineering from the Hong Kong University of Science and Technology in 2007. From 2007 to 2009, he worked as a postdoctoral researcher at University of California, Davis. Currently he is an associate professor in the State Key Lab of Advanced Optical Communication Systems and Networks in Shanghai Jiao Tong University. His research interests include silicon photonics, micro/nano plasmonics, and optical integration. He is the principle investigator of multiple national programs including the National Natural Science Foundation of China (NSFC), the National High Technology Research and Development Program ("863"Program), and the Scientific Research Foundation of Ministry of Education. He has served on multiple conferences as track co-chairs and TPC members, including OECC2015, GFP2015, CIOEC2015, etc. He has published more than 100 peer-reviewed international journal and conference papers, and has given more than 20 invited talks in international conferences. He was granted the award of "National Science Fund for Excellent Young Scholars of China" in 2014, the award of “Shanghai Rising-Star Program” in 2014, and the SMC Excellent Young Faculty Award of Shanghai Jiao Tong University in 2014 and 2010. Dr. Zhou is a member of the Institute of Electrical and Electronic Engineers (IEEE) and the Optical Society of America (OSA).



Yue Zhou, Beijing University of Posts and Telecommunications

Yue Zhou received the B. Eng. degree in electronic engineering from Shanghai Jiao Tong University, Shanghai, China, in 2008, and the Ph.D. Degree from the Department of Electrical and Electronic Engineering, the University of Hong Kong, Hong Kong SAR, China, in 2012. He was a postdoctoral researcher at the Research Laboratory of Electronics, Massachusetts Institute of TEchnology, USA and the Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron, Germany during 2013-2014. He is currently an associate professor in the Institute of Information Photonics and Optical Communications, Beijing University of Posts and Telecommunications, China. His current research interests include ultrafast fiber optics, fiber lasers and frequency combs, biophotonics and microwave photonics.

Dr. Zhou has authored and co-authored more than 40 papers in leading technical journals and international conferences, including eight first-author papers in peer reviewed journals. He was the recipient of the 2012 IEEE Photonics Society Graduate Student Fellowship, and the Outstanding Research Postgraduate Student award of the University of Hong Kong in 2013. He serves as reviewer for Optical Letters, Optics Express and Journal of Modern Optics.

PROGRAM ABSTRACT

S1. LASER TECHNOLOGY

MID-INFRARED PULSED LASER WITH GRAPHENE AS OPTICAL MODULATOR

Guoqiang Xie, Shanghai Jiao Tong University, China

Abstract: In this talk, we will introduce the recent progress on mid-infrared pulsed laser in our group. We develop graphene-gold film saturable absorber mirror (GG-SAM) with demonstrated saturation absorption bandwidth of beyond 1700 nm. With GG-SAM as mid-infrared optical modulator, we realized femtosecond mode locking at 2 um, 2.4 um and Q-switching at 2.7 um. At 2 um wavelength, the Tm:CLNGG laser emitted mode-locked pulses with pulse duration of 354 fs, pulse repetition rate of 98 MHz, and average output power of 97 mW. At 2.4um wavelength, the mode-locked Cr:ZnSe laser generated ultrashort pulses with pulse duration of 116 fs, pulse repetition rate of 99 MHz, average output power of 66 mW, and wavelength tuning range of 116 nm. Also, we realized uJ-level Q-switched pulse generation at 2.7um wavelength by use of GG-SAM. The mid-infrared pulsed lasers will open some applications such as molecules spectroscopy, mid-infrared pump-probe experiment, mid-infrared nonlinear frequency conversion, etc.

TUNABLE ULTRAFAST PULSE LASER GENERATION AND ITS APPLICATIONS

Yuxin Leng, State Key Laboratory of High Field Laser Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, China

Abstract: The intense laser pulses have many applications in ultrafast optical science. Based on the previous works, we have developed the tunable femtosecond OPA instruments of the higher energy in NIR as the frontend of high powerful laser system. Further, the tunable ultrafast laser is used to generate few cycle pulse compression in hollow core fiber from 800nm to 1800nm. Then the related pulse transmission in hollow core fiber was studied.

Finally, we report an ultrafast pulse laser generation in UV region based on only OPA process. Based on the UV pulse laser source, ultrafast carrier dynamics in Al2O3/SiO2 high reflectors has been investigated before it is damaged. To the best of our knowledge, this is the first study on the femtosecond UV laser-induced pre-damage dynamics in UV high reflector.

ADVANCES IN VANADATE LASER CRYSTALS

Haohai Yu, State Key Laboratory of Crystal Materials and Institute of Crystal Materials, Shandong University, China

Abstract: Vanadate crystals, such as YVO4, GdVO4, LuVO4, possess the ZrSiO4 structure with space group I41/amd. Among the laser materials, vanadate crystals have been identified to be excellent gains due to their excellent mechanical, thermal, physical and chemical properties and become important matrix of small and medium power laser materials. Based on our research in recent years, this paper summarizes the research progress of neodymium and ytterbium doped vanadate crystals, including crystal growths, spectral properties and laser characteristics. Finally, the development direction and further work of vanadate research have been proposed.

HIGH-ENERGY SUB-CYCLE OPTICAL WAVEFORM SYNTHESIS

Shaobo Fang, DESY Center for Free-Electron Laser Science (CFEL), Germany

Abstract: A novel multi-mJ 3-channel parametric synthesizer driven by a Ti:sapphire CPA will be presented. This system is a prototype parametric synthesizer architecture, which is directly transferred to cryo-cooled Yb pump-laser technology to overcome pulse-energy and average-power bottlenecks for advanced applications. Second, a CEP-stable 1.7-mJ waveforms generation using IPM in a two-color-driven

hollow-core-fiber compressor will be discussed. These waveforms are expected to be straightforwardly compressible to the sub-fs FWHM Fourier limit with a 255-as FWHM short central spike. Such intense optical waveforms custom-sculpted within an optical cycle open up new horizons for controlling strong-field interactions in atoms, molecules, solids and nanostructures.

GRAPHENE IN PHOTODETECTION

Zhenhua Sun, Shenzhen University, China; Feng Yan, The Hong Kong Polytechnic University, Hong Kong; Zhuoying Chen, Centre national de la recherche scientifique, France

Abstract: Grapehen has attracted enormous attentions in electronics and optoelectronics application due to its excellent material properties. Among those properties, outstanding mechanical property and high carrier mobility make graphene a good material candidate for high performance photodetectors. A near-infrared photodetector based on PbS quantum dots-graphene hybrid, and a plasmonic enhanced visible photodetector based on perovskite-graphene-gold nanoparticles hybrid are presented here. In spire of different features of these two works, graphene plays the same role in them, which is the carrier transport material. Graphene here displays high compatibility with different materials to hybridize for multifunctional compounds, and this kind of hybridization shows huge application potential for optoelectronics devices with planar structure.

PHOTONICS OF TWO-DIMENSIONAL MATERIALS: GRAPHENE AND BEYOND

Qiaoliang Bao, Soochow University, China

Abstract: Here we would like to review our recent progresses on the photonic applications of graphene and other two-dimensional (2D) layered materials.[1-3]

Firstly, we report that the synergetic integration of graphene and Bi2Te3 by epitaxial growth affords tunable optical properties by controlling the coverage of Bi2Te3. We further developed it as saturable absorbers and incorporated into a 1.5 μm fiber laser for both Q-switching and mode-locking pulse generation.[4] In another work, black phosphorus is encapsulated by polymer matrix to effectively avoid the oxidization and degradation. Our experiments suggest that black phosphorus could be another efficient saturable absorber to generate high energy Q-switched pulse in fiber laser.[5]

Secondly, we fabricated a highly efficient hybrid photodetector that consists of graphene covered with dispersive organolead halide perovskite (CH3NH3PbBr2I) islands. A photoconductive gain of ~10E9 electrons per photon and a responsivity of ~6.0×10E5 A/W were achieved, which is attributed to the effective charge transfer and photo-gating effect.[6] We also demonstrated a broadband photodetector based on graphene-Bi2Te3 heterostructure. The device not only shows greatly enhanced responsivity (up to 35 A/W at 532 nm) and an ultra-high photoconductive gain (up to 83), but also has the capability for broadband photodetection from visible to NIR wavelengths.[7] Furthermore, we developed new methods to grow and transfer large area single crystal WS2 [8] and continuous MoS2 thin film [9]. In an n-n heterostructure photodetector based on multilayer MoS2 film covered with graphene quantum dots, a photoresponsivity of 10E4 A/W and a photogain of 10E7 electrons per photon were achieved.[10] Last, due to good CMOS-compatibility of 2D materials [11], we fabricate chip-integrated resonator devices and incorporate 2D heterostructure for the signal modulation and processing. The advances of photonics of 2D materials may pave the way for the integration of next generation hybrid silicon photonic circuit.

ULTRAFAST FIBER LASERS MODE LOCKED WITH TRANSITION METAL DISULFIDES

Dong Mao, Northwestern Polytechnical University, China

Abstract: Graphene-like two dimensional materials, such as transition metal disulfides, are highly anisotropic layered compounds that have attracted growing interest from basic research to practical applications. Similar with graphene, few-layer MoS2 and WS2 nanosheets have remarkable physical properties. We demonstrate that MoS2 and WS2 nanosheets exhibit ultrafast nonlinear saturable

absorption property and high optical damage threshold. Soliton mode-locking operations are achieved separately in an erbium-doped fiber laser using MoS2 or WS2-based saturable absorbers. One type of saturable absorber is fabricated by depositing transition metal disulfides nanosheets on a D-shaped fiber, while the other is synthesized by mixing transition metal disulfides solution with polyvinyl alcohol, and then evaporating them on a substrate. Using D-fiber based WS2 saturable absorber, dissipative soliton at 1.06 and 1.55 μm can also be achieved in the fiber laser, indicating that the WS2 can act as a broadband high-power mode locker. At the maximum pump power of 600 mW, two saturable absorbers can work stably at mode-locking state without damage, indicating that few-layer transition metal disulfides are promising high-power flexible saturable absorbers for ultrafast optics. Numerous applications may benefit from the ultrafast nonlinear features of MoS2 or WS2 nanosheets, such as high-power pulsed laser, materials processing, and frequency comb spectroscopy.

TWO-DIMENSIONAL TRANSITION METAL DICHALCOGENIDES MOS2, MOSE2, WS2, AND WSE2 FOR ULTRAFAST PHOTONIC APPLICATIONS

Kan Wu, Shanghai Jiao Tong University, China

Abstract: Two-dimensional (2D) semiconductors have attracted intense interest for their unique optoelectronic and photonic properties created by confined electron motion and weak interlayer perturbation. Among various kinds of 2D materials, transition metal dichalcogenides (TMDs) nanosheets, e.g., MoS2, MoSe2, WS2 and WSe2, have been research hot spot due to their ultrafast optical dynamic and high optical nonlinearity. In this work, we discuss the optical properties of TMD based saturable absorbers, their preparation, characterization and applications in ultrafast photonic applications such as mode-locked lasers and Q-switched lasers.

DISSIPATIVE SOLITON RESONANCE IN ULTRAFAST FIBER LASERS

Zhi-Chao Luo, South China Normal University, China; Ai-Ping Luo, South China Normal University, China; Wen-Cheng Xu, South China Normal University, China

Abstract: Ultrafast fiber lasers, as powerful tools for generation of ultra-short pulse, have been intensively investigated due to their wide applications in fields such as material processing, microscopy, medicine, optical communications, and sensing. However, as a key parameter of a mode-locked fiber laser, the pulse energy is generally limited by the overdriven nonlinear effect. Recently, a novel concept known as dissipative soliton resonance (DSR) was proposed to increase the single-pulse energy from a fiber laser. In this talk, we review our recent results on the investigations of the DSR phenomena in the ultrafast fiber lasers operating in various regimes. Our findings may be helpful for further understanding the DSR phenomena, and also indicate that the passively mode-locked fiber lasers could be indeed good platforms for observing various nonlinear soliton dynamics.

METHOD TO GENERATE HIGH-ORDER GROUP VELOCITY LOCKED VECTOR SOLITONS IN FIBER LASERS

Luming Zhao, Jiangsu Normal University, China; Xinxin Jin, Jiangsu Normal University, China; Lei Li, Jiangsu Normal University, China; Zhichao Wu, Huazhong University of Sci&Tech (HUST), China; Songnian Fu, Huazhong University of Sci&Tech (HUST), China

Abstract: We propose a method to generate high-order group velocity locked vector solitons (GVLVS) based on the fundamental GVLVS and experimentally demonstrate it in a fiber laser. With the help of an external polarization controller, a GVLVS with a two-humped pulse along one polarization while a single-humped pulse along the orthogonal polarization could be obtained. The phase difference between the two humps along one polarization could be 180°.

REPETITION RATE OPTIMIZATION FOR PASSIVELY MODE-LOCKED FIBER LASER BASED LINEAR OPTICAL SAMPLING

Jue Song, Next Generation Internet Access National Engineering Lab (NGIA), School of optical and electronic information, Huazhong University of Sci&Tech (HUST), China; Songnian Fu, Next Generation Internet Access National Engineering Lab (NGIA), School of optical and electronic information, Huazhong University of Sci&Tech (HUST), China; Bin Liu, Next Generation Internet Access National Engineering Lab (NGIA), School of optical and electronic information, Huazhong University of Sci&Tech (HUST), China; Ming Tang, Next Generation Internet Access National Engineering Lab (NGIA), School of optical and electronic information, Huazhong University of Sci&Tech (HUST), China; Perry Shum, School of EEE, Nanyang Technological University, Singapore; Deming Liu, Next Generation Internet Access National Engineering Lab (NGIA), School of optical and electronic information, Huazhong University of Sci&Tech (HUST), China China

Abstract: We investigate repetition rate constraint of passively mode-locked fiber laser for linear optical sampling based M-ary PSK constellation characterization. When the ratio of signal linewidth and repetition rate is under 1.5×10-3, QPSK constellation can be obtained with high fidelity.

SELF-PULSING IN ERBIUM-DOPED FIBER LASER

Nanxi Li, Massachusetts Institute of Technology, United States

Abstract: We report the study of self-pulsing behavior in erbium-doped fiber laser due to the ion-pair formation and scattered feedback. We observed the high doping concentration of the laser to be the main cause of the pulsing phenomenon. We also demonstrate that the self pulsing can be suppressed by resonance pumping.

S2. OPTICAL COMMUNICATIONS AND NETWORKS

A COOPERATIVE ELECTRONIC AND OPTICAL ARCHITECTURE FOR FUTURE NETWORK

Weisheng Hu, Shanghai J, China

Abstract: This paper will discuss a cooperative electronic and optical architecture for the future network, which has mega data center, backbone and metro network, and broadband access network as well. It is expected to reduce the network complexity and cost by employing the advantage of both electronic and optical technology together.

FLEXIBLE HIGH-ORDER QAM TRANSMITTERS FOR ELASTIC OPTICAL NETWORKS

Guo-Wei Lu, Tokai University, Japan

Abstract: In order to adapt to the dynamics in the future optical networks, we propose and experimentally two flexible high-order quadrature amplitude modulation (QAM) transmitter schemes: i) a flexible transmitter using a tandem in-phase/quadrature (IQ) modulators for generating 16QAM, 32QAM, 64QAM signals; and ii) a scheme based on monolithically-integrated quad Mach-Zehnder inphase/quadrature (QMZ-IQ) with binary driving electronics for synthesizing minimum phase-shift keying (MSK), quadrature phase-shift-keying (QPSK), 8-ary phase-shift-keying (8PSK), and 16QAM. These schemes provide different approaches to configure a flexible high-order QAM transmitter, either using cascaded off-the-shelf modulators, or via highly-integrated monolithic modulator. These flexible and re-configurable transmitter schemes provide the network operators different flexible transmitter solutions suitable for different application scenarios in elastic optical networks.

A UNIFIED CONTROL ARCHITECTURE AND KEY TECHNOLOGIES FOR HYBRID PACKET-OPTICAL NETWORKS

Xiaoping Zheng, Tsinghua Universtiy, China; Nan Hua, Tsinghua Universtiy, China; Zhizhen Zhong, Tsinghua Universtiy, China

Abstract: The heterogeneity of current networks seriously affects dynamic network inter-connection, and becomes the major bottleneck hindering the development of the network. Network heterogeneity exists in two forms: inside the core optical transport networks, and between optical networks and IP networks. In recent years, with depth research on heterogeneous optical networks is gradually thorough, architectural solutions and key technologies for heterogeneous optical networks inter-connection become mature. However, inter-connection between optical networks and IP networks is more difficult because of their intrinsically different switching mechanisms, and such research has just begun. This paper discusses the inter-connection problem between core optical transport networks and IP networks, and presents a unified control architecture with some key technologies for hybrid packet-optical networks based on the analysis of their different switching features and positions, to finally realize fast and seamless end-to-end connection establishment.

NON-ORTHOGONAL OPTICAL TRANSMISSION WDM SYSTEMS

Liangchuan Li, Huawei T, Worldwide

Abstract: Limited by shannon theory, current high spectral efficiency(SE=4&8) WDM systems can not achieve a long distance as 100G optical transmission. We propose novel non-orthogonal WDM concept,which packs higher baudrate and lower order modulation format signal into less optical spectrum spacing.

It is a promised solution to realize long haul WDM systems with high SE.

A LINEWIDTH-TOLERANT TWO-STAGE CPE ALGORITHM BASED ON ENHANCED MAXIMUM LIKELIHOOD DETECTION FOR 64-QAM COHERENT OPTICAL SYSTEMS

Yin Chen, Guangdong Provincial Key Laboratory of Nanophotonic Functional Materials and Devices, South China Normal University, China; Xu Guang Huang, Guangdong Provincial Key Laboratory of Nanophotonic Functional Materials and Devices, South China Normal University, China; Wei Heng Su, Guangdong Provincial Key Laboratory of Nanophotonic Functional Materials and Devices, South China Normal University, China

Abstract: A novel linewidth-tolerant two-stage carrier phase estimation algorithm based on enhanced maximum likelihood (EML) detection is proposed for 64-ary quadrature amplitude modulation (64-QAM) coherent optical systems. The simulation results show that the linewidth tolerance performance of the proposed algorithm is higher than that of the VVPE + ML algorithm at high Δυ·T_s values. The proposed CPE algorithm can obtain a combined laser linewidth symbol duration product as high as 5.6× 〖10〗^(-5) at a target BER of 1× 〖10〗^(-2) with 1 dB SNR sensitivity penalty.

SIGNAL QUALITY IMPROVEMENT IN OPTICAL PPM-CDMA SYSTEMS BASED SIC SCHEME

Naif Alsowaidi, Multimedia university Malaysia, Malaysia; Tawfig Eltaif, Faculty of Engineering & Technology, Multimedia University, 75450, Bukit Beruang, Melaka, Malaysia, Malaysia; M. R. Mokhtar, Faculty of Engineering, Multimedia University, 63100, Cyberjaya, Selangor, Malaysia, Malaysia

Abstract: An optical pulse position modulation-code division multiple access (PPM-CDMA) system with an interference rejection scheme is theoretically analyzed. Successive interference cancellation (SIC) scheme has the ability to suppress the overlapping between the users by subtracting the strongest one from the original received signals one by one until all users detected. Different optical codes have been used for the comparison purpose; results show that the system with SIC scheme using modified quadratic congruence codes has better performance than the system using modified prime code as signature codes. In addition, the system with SIC scheme significantly superior to the one without SIC scheme.

IMPACT OF PMD AND BAND BANDWIDTH ON 112 GB/S DIRECT-DETECTION MB-OFDM METROPOLITAN NETWORKS

Artur Duarte, Universidade de Lisboa, Instituto de Telecomunicações, Lisboa, Portugal; Tiago Alves, Instituto de Telecomunicações, Lisboa, Portugal; Adolfo Cartaxo, Universidade de Lisboa, Instituto de Telecomunicações, Lisboa, Portugal

Abstract: The performance of a 112 Gb/s single-side band direct-detection (DD) multiband orthogonal frequency-division multiplexing (MB-OFDM) metropolitan network in presence of polarization mode dispersion (PMD) for different band bandwidths is evaluated through numerical simulation. The results show that the impact of PMD on the system performance of bands with 2.3 GHz bandwidth can be neglected for standard single mode fiber link lengths up to 400 km.

INFLUENCE OF ASE NOISE ON THE SIGNAL OSNR AND ERROR VECTOR MAGNITUDE IN COHERENT OPTICAL COMMUNICATIONS

Xiaosheng Xiao, Tsinghua University, China; Huaqiang Qin, Tsinghua Universtiy, China

Abstract: In coherent optical communications, the amplified spontaneous emission (ASE) noise is one of the most important factors affecting the signal quality. In this presentation, the effect of ASE noise on the optical signal quality [characterized by optical signal to noise ratio (OSNR) and the error vector magnitude (EVM)] is studied.

ALL-OPTICAL CDMA SYSTEM WITH ENHANCED SECURITY BASED ON VARIABLE TWO-CODE KEYING

Hongxia Zheng, Shenzhen University, Worldwide; ji jianhua, S, China

Abstract: Abstract—We put forward the first all-optical optical code-division multiple-access(OCDMA) system with 2 users based on variable code shift keying(CSK). The all-optical exclusive OR logical gate in the system employs the ultrafast performance of optical fiber nonlinear effect and operates without wavelength transforming. In our system, the data rate is 10Gb/s and the transmission distance in optical fiber of G.652 is 20 km. A quantitative analysis of data confidentiality is presented. Compared with other secure systems, our system can greatly improve the confidentiality of the transmitted information.

SIMULTANEOUS ALL-OPTICAL WDM MULTICAST AND UNICAST SCHEME FOR WDM OPTICAL ACCESS NETWORK BASED ON SOA AND AWG

Ze Li, Beijing University of Posts and Telecommunications, China; Min Zhang, Beijing University of Posts and Telecommunications, China; Danshi Wang, Beijing University of Posts and Telecommunications, China; Yue Cui, Beijing University of Posts and Telecommunications, China

Abstract: A simultaneous all-optical WDM multicast and unicast scheme with large bandwidth for WDM optical access network by using a multicast module based on FWM in SOA has been proposed and verified. Two strategies of setting the multicast module have been discussed to apply this scheme to passive optical network and active optical network. One-to-four WDM multicasts of 10Gb/s NRZ-OOK signal are successfully obtained through FWM with two pumps in SOA, and all the four multicast signals achieve error-free performance with power penalty less than 4.3 dBm under BTB condition and over 20 km fiber transmission in both strategies. This scheme is suitable for processing the multicast services with sudden burst characteristic and real-time demand to support with high speed, fast service provisioning and high resource efficiency and may also play a role of physical backup in case of the big data migration or the network disaster.

MODULATION AND DETECTION TECHNIQUES FOR SHORT REACH OPTICAL COMMUNICATION SYSTEMS

Chao Lu, The Hong Kong Polytechnic University, Hong Kong

Abstract: The ever increasing traffic for inter and intra data centre communications has created the need for low cost and high capacity short reach optical communication systems. Unlike long hual system where spectral efficiency and reach are the most important concerns, short reach system often have to use low cost optical components to achieve maximized transmission capacity. In the presentation, we will discuss our recent work on exploring different modulation and equalization schemes for realizing beyond 100Gbit/s short reach communication systems. These include PAM-n, DMT, CAP and direct detected polarization multiplexed systems. Possible future developments are discussed.

SWITCHING IN SPACE DIVISION MULTIPLEXING USING LCOS TECHNOLOGY

Jochen Schröder, RMIT University, Australia; Joel Carpenter, University of Queensland, Australia; Benjamin Eggleton, The University of Sydney, Australia

Abstract: Space Division Multiplexing (SDM) has received considerable attention for its promise to overcome the fundamental capacity limitations of single mode fibre. However, in order for SDM to become a viable solution we need to develop SDM-capable alternatives to current single-mode subsystems and devices, at similar or increased performance. In this talk I will review our work on using Liquid Crystal in Silicon devices as switching and multiplexing devices for mode division multiplexing (MDM). In particular I will present our results on a 1x11 MDM wavelength selective switch, and it's ability for spectral pulse-shaping and mode-dependent gain equalisation.

EVALUATION OF KEY PARAMETERS OF 400 GBPS WDM SYSTEM

Junsen Lai, Communications Standards Research Institute, China Academy of Telecommunication Research (CATR) of MIIT,, China; Rui Tang, Communications Standards Research Institute, China Academy of Telecommunication Research (CATR) of MIIT,, China; Wenyu Zhao, Communications Standards Research Institute, China Academy of Telecommunication Research (CATR) of MIIT,, China; Haiyi Zhang, Communications Standards Research Institute, China Academy of Telecommunication Research (CATR) of MIIT,, China

Abstract: With worldwide deployment of 100Gbps coherent DP-QPSK, beyond 100G optical communication technology, which is featured by high-order modulation, spectral compression, flex grid, and super-channel, has become one focus of industry. The new features of physical interface lead new challenge on the system performance test and evaluation. Based on the discussion of test results of two kinds of typical 400Gbps solutions, which are different in spectral efficiency and transmission distance, we proposed and investigated several novel and practical test schemes to evaluate the key parameters of 400Gbps WDM system, including OSNR evaluation in super-channel multiplexed scenario, flex-grid optical channel spectrum analysis, and EVM related parameters measurement with transmitter impairments.

WHAT APPLICATIONS CAN BE DEVELOPED WITH SOFTWARE DEFINED ELASTIC OPTICAL NETWORKS？

Yongli Zhao, Beijing University of Posts and Telecommunications, China; Xiaosong Yu, Beijing University of Posts and Telecommunications, China; Jie Zhang, Beijing University of Posts and Telecommunications, China

Abstract: In recent years, software defined elastic optical networks (SDON) has gained a lot of attention from both academic and industry because it can adjust the parameters of optical layer flexibly, schedule the bandwidth resource globally, and provide the customers with various novel applications. On the one hand, just like APPs on the smart phone, innovational applications are the main concern of customers and of great value. On the other hand, innovational applications are the main driving forces for the development of SDON and related technologies. Standing at the forefront of SDON development, this paper describes the promising innovational applications with software defined elastic optical networks. The concepts of spectrum defragmentation, virtual optical networks (VON) provisioning, time-aware bandwidth on demand, as well as virtual resource migration are introduced.

APPLICATION-AWARE ROUTING IN HYBRID PACKET/CIRCUIT SWITCHING NETWORKS

Rongping Lin, University of Electronic Science and Technology of China, China; Xingqiu He, University of Electronic Science and Technology of China, China

Abstract: Given the growth, complexity and various characteristics of applications, there is a need for high efficiency hybrid packet/circuit switching to achieve cost effective operations of the networks. Electrical packet switching operates based on packets and benefits from statistical multiplexing, while optical circuit switching is efficient for static large volume of traffic. With the hybrid switching technology, we will achieve the balance between them to meet the quality of service requirements and the efficiency of network resource. Column generation method is use to solve this large scale problem, master problem and pricing problem are iterated to achieve the final optimal solution.

ADD/DROP AND SWITCHING FUNCTIONALITIES FOR OPTICAL MODES

Juhao Li, Peking University, China; Zhangyuan Chen, eking, China; Yongqi He, pek, China

Abstract: Recently optical modes have been introduced into optical high-speed transmission systems to significantly enhance transmission capacity and distance. However, crosstalk among different modes are always very large in most studies, so there have few works that modes are used to be an individual granularity for optical switching. In this paper, we experimentally demonstrate add/drop and switching functionalities for optical modes. The experimental results imply that optical mode can be combined with

other granularities to construct more flexible switching networks.

ADVANTAGES OF SDM OPTICAL NETWORKS: A CAPEX ANALYSIS

Nan Hua, Tsinghua Universtiy, China; Yao Li, Tsinghua Universtiy, China; Xiaoping Zheng, Tsinghua Universtiy, China

Abstract: CapEx minimization for space division multiplexing (SDM) networks is studied by modeling and solving the CapEx-minimized planning problem. Physical layer constraints, including the mode-binding constraint in few-mode fiber (FMF) transmission system and the inter-core crosstalk constraint in multi-core fiber (MCF) transmission system are considered. Numerical results show that SDM networks has CapEx advantage compared with conventional single-core/mode WDM networks when specific switching structures and crosstalk suppression signal processing methods are used, while this benefit is sensitive to network traffic.

OPTICAL PERFORMANCE MONITORING BASED ON FILTERING EFFECTS

Changyuan Yu, National University of Singapore, Singapore

Abstract: Optical performance monitoring (OPM) is an important topic of optical communication systems. A robust OPM scheme offers a great assistance to the system performance management of dynamic optical networks. In this paper, the OPM methods based on filtering effects are reviewed, which exhibit the merits of low cost and simple operation.

A FAST POLARIZATION-STATE TRACKING SCHEME BASED ON RADIUS-DIRECTED LINEAR KALMAN FILTER

Yanfu Yang, Harbin Institute of Technology, China; Guoliang Cao, Harbin Institute of Technology, China; Kangping Zhong, The Hong Kong Polytechnic University, China; Xian Zhou, The Hong Kong Polytechnic University, China; Yong Yao, Harbin Institute of Technology, China; Alan Lau, The Hong Kong Polytechnic University, China; Chao Lu, The Hong Kong Polytechnic University, China

Abstract: A fast polarization tracking scheme based on radius-directed linear Kalman filter is proposed and demonstrated experimentally. It has the advantages of fast convergence and is inherently insensitive to phase noise and frequency offset effects. Compared to conventional polarization tracking methods, the scheme can achieve better polarization tracking capability with more than one order of magnitude improvement in the cases of polarization multiplexed QPSK and 16QAM signals. The influences of the filter tuning parameters on tracking performance are also investigated in detail. The scheme is suitable to deal with rapidly time-varying polarization-state signals, accurate metrology of PDM signals, and burst-mode coherent receiver.

TECHNOLOGIES AND APPLICATIONS OF NEXT GENERATION METRO WDM SYSTEM

Shikui Shen, China United Network Communications Group Company Limited(China Unicom), China; Guangquan Wang, China United Network Communications Group Company Limited(China Unicom), China; Haijun Wang, China United Network Communications Group Company Limited(China Unicom), China

Abstract: With the national broadband development strategy, the bandwidth of fixed access and mobile access are increasing rapidly, especially with the deployment of LTE. This paper introduces a new solution named as NGM-WDM (Next Generation Metro WDM) which meets the multi-service access requirements in the era of fixed and mobile convergence in low cost. Some candidate technologies for NGM-WDM are introduced and compared at first, and the general attributes of NGM-WDM system including architecture, port rate, system capacity and reach are introduced briefly. After that the main application scenarios of NGM-WDM for comprehensive access are analyzed, including fronthaul and backhaul of mobile access, fixed access for residential customers and leased lines. Finally the network evolution towards all photonic broadband access will be given for proposal. With the proposed NGM-WDM system, lambda to the antennas and users could be achieved cost-efficient, while every lambda could be upgraded without any

affects on other lambdas.

S3. INFRARED TECHNOLOGIES AND APPLICATIONS

MULTIWAVELENGTH AND SINGLE-LONGITUDINAL-MODE FIBER LASERS BASED ON FP-LD INJECTION LOCKING

Xinhuan Feng, Jinan University, China

Abstract: Novel multiwavelength and single frequency fiber lasers have been proposed and successfully demonstrated based on FP-LD injection locking. On the one hand, FP-LD in the laser cavity can effectively alleviate the mode competition induced by homogeneous gain broadening in erbium-doped fibers, on the other hand, FP-LDs under injection locking can effectively narrow the line-width of the injected multi-longitudinal-mode input. As a result, multiwavelength erbium-doped fiber laser or single longitudinal-mode fiber laser can be obtained.

FIBRE-OPTIC GAS SENSORS WITH IR LASERS

Wei Jin, The Hong Kong Polytechnic University, China

Abstract: Recent advances in optical fibre gas sensors with near infrared semiconductor laser sources are reported. Sensors based on different principles such as direct absorption, photoacoustic and photothermal spectroscopy are discussed and contrasted in terms of detection sensitivity, dynamic range, and system complexity.

FLOW VELOCITY MONITORING BASED ON FLOATING FIBRE RING VORTEX SENSOR

Wenjian Yang, The University of Sydney, Australia; Xiaoke Yi, The University of Sydney, Australia

Abstract: A novel and compact optical vortex flow meter is presented and experimentally demonstrated. The proposed structure can monitor the open area liquid flow velocity based on the von Karman vortex street and floating fibre ring vortex sensor. The optical fibre ring with floating foam sphere is attached behind a bluff body to measure the vortex shedding frequency in the liquid flow. This structure of flow meter occupies less area in the liquid channel, owing to very low consumption of the optical power loss of the sensor head, the flow meter is high power efficiency. Experimental results verify the new technique and demonstrate a vortex water flow meter at room temperature based on the fibre bending ring sensor is sensitive to liquid flow change.

AN ORBITAL ANGULAR MOMENTUM RADIO FREQUENCY COMMUNICATION SYSTEM BASED ON MICROWAVE PHOTONIC PHASE SHIFT TECHNOLOGY

Xinlu Gao, Beijing University of Posts and Telecommunications, Worldwide; Shanguo Huang, Beijing University of Posts and Telecommunications, China

Abstract: A scheme for generating and/or receiving the orbital angular momentum (OAM) of radio frequency (RF) signals based on the photonic phase shift technology is proposed. The central structure is the photonic phase shift unit connected with circular antenna arrays (CAAs) which can provide or compensate the azimuthal and helical phase variation precisely. Thanks to the orthogonality of the OAM states, the proposed scheme can achieve an increase in capacity and spectral efficiency of the RF communication system. Also, it can be effectively optimized by two intensity controlled masks to get an increased transmission distance and a stronger received signal intensity. Simulated and experimental results are matched.

MANIPULATING POLARIZATION AND LIGHT PROPAGATION BASED ON SUBWAVELENGTH STRUCTURES

Jinhui Shi, Harbin Engineering University, China

Abstract: The field of metamaterials has been developing rapidly in recent years. Metamaterials with

subwavelength elements can control properties of electromagnetic wave to realize desirable amplitude, phase-shift or polarization conversion in unconventional way that can be unachievable using traditional materials. For instance, chiral metamaterials and metasurfaces, as promising candidates, hold great advantages and flexibilities to manipulate the polarization state. Substantial efforts have been devoted to the exploration of gradient metasurfaces, leading to the demonstration of wave-front shaping, photonic spin Hall effect, optical vortex plate, broadband optical retardation, propagating-to-surface-wave conversion, flat lenses and mirrors, super-oscillatory focusing and optical holograms. I will present experimental results of manipulating polarization properties using chiral metamaterials. We demonstrated that in slabs of linear material of sub-wavelength thickness optical manifestations of birefringence and optical activity can be controlled in the coherent technique. In addition, reflection and refraction effects on phase gradient metasurfaces can be coherently controlled. Such control can be exerted at arbitrarily low intensities, thus arguably allowing for fast handling of electromagnetic signals without facing thermal management and energy challenges.

HIGH-SPEED OPTICAL WIRELESS COMMUNICATIONS IN PERSONAL AREAS

Ke Wang, The University of Melbourne, Australia; Tingting Song, The University of Melbourne, Australia; Ampalavanapillai Nirmalathas, The University of Melbourne, Australia; Christina Lim, The University of Melbourne, Australia; Efstratios Skafidas, The University of Melbourne, Australia

Abstract: In this paper the recent research progress on high-speed personal area infrared optical wireless communications is reviewed. A 10 Gb/s downlink and up to 2 Gb/s uplink are experimentally demonstrated. The indoor localization function is also summarized.

IMPROVING SPECTRUM SLICED SOURCES WITH LCOS-BASED OPTICAL PROCESSORS

Cibby Pulikkaseril, Finisar, Australia; Qing Li, Finisar, Australia; Patrick Blown, Finisar, Australia; Ralf Stolte, Finisar, Australia; Simon Poole, Finisar, Australia

Abstract: Spectrum sliced sources are a low cost alternative to multiple laser transmitters, but are comparatively low power, with poor noise extinction. We demonstrate that spectrum sliced sources can be significantly improved by optimizing the use of LCoS-based optical processors

FIBER LASER BASED INFRARED SOURCES AND THEIR APPLICATION IN MICROWAVE PHOTONICS

Yue Zhou, Beijing University of Posts and Telecommunications, China

Abstract: Infrared laser sources are an enabling technology for a whole range of fundamental and applied research areas. In this talk, infrared sources generation technique based on fiber lasers will first be presented. In the meantime, the applications of infrared lasers in microwave photonics will also be reviewed and discussed, such as ultra-low noise microwave generation, femtosecond timing distribution and synchronization between RF and optical systems, high precision photonic analog-to-digital conversion and balanced optical-microwave phase detection.

NOVEL DILUTE BISMIDE MATERIALS FOR INFRARED LIGHT EMITTING APPLICATIONS

Yuxin Song, Shanghai Institute of Microsystem and Information Technology, CAS, China

Abstract: Dilute bismides are a group of emerging materials with unique properties. Incorporation of a small amount of Bi in common III–V host materials results in large band-gap reduction and strong spin-orbit splitting, leading to potential applications in mear- and mid-infrared optoelectronics. In this talk, the recent progresses on epitaxy and characterizations of novel bismides, i.e., GaSb1 − xBix, InSb1 − xBix, In1-xPBix are reviewed. Although these dilute bismides have been successfully grown, to obtain high Bi incorporations and retain high crystal quality is still very challenging.

THE USE OF UNCOOLED FP LASER IN MICROWAVE PHOTONIC FILTERS

Jianqiao Ren, The University of Sydney, Australia; Cibby Pulikkaseril, Finisar, Australia; Xiaoke Yi, The University of Sydney, Australia

Abstract: A microwave photonic filter that uses an uncooled Fabry-Perot (FP) laser as the optical source is presented, which can realize low-pass magnitude response and wide passband characteristic, by optically shaping the laser signal. The confi-guration can overcome the frequency and power drift of the uncooled FP laser by using a feedback structure. Experimental results demonstrate a 6-tap microwave photonic filter with a free spectral range (FSR) of 2.5 GHz.

METHOD FOR IMPROVING ALIGNMENT OF ANGLE-POLISHED FIBERS TO SILICON PHOTONIC WAVEGUIDES

Keith Powell, The University of Sydney, Australia; Xiaoke Yi, The University of Sydney, Australia

Abstract: A novel method for measuring rotation of anglepolished optical fiber for applications of packaging submicrometer silicon waveguides is presented. Experimental results show a high correlation between the actual angle and the measured angle using the new technique, with a resolution of 0.14 degrees achievable, which confirms the validity of this technique for packaging grating coupled silicon waveguides with minimal insertion loss.

LOW TEMPERATURE SILICON NITRIDE DEPOSITION BY INDUCTIVELY COUPLED PLASMA CVD FOR THE EXTENDED WAVELENGTH INGAAS DETECTOR

Hengjing Tang, Shanghai Institute of Technical Physics，CAS, China

Abstract: InGaAs detectors can shift the cut-off wavelength from 1.7μm to 2.5μm with the higher fraction of indium in the ternary InxGa1-xAs material grown on InP. The extended InGaAs detector covers 1.0-2.5μm detection waveband, which plays an important role in weather forecast, resource observation, low light level systems, astronomical observation and so on.In order to suppress dark current of the extended InGaAs detector, low temperature silicon nitride deposition by inductively coupled plasma CVD (ICPCVD) was investigated systematically. The SiNx process parameters were optimized and the N/Si ratio was obtained by SIMS measurement, then its passivation effect was verified by using different perimeter-to-area (P/A) measurement photodiodes, and the passivation mechanism was studied by using MIS structure device. The results indicate that, compared with plasma enhanced CVD (PECVD) method, the dark current decreases obviously by using ICPCVD SiNx, and this was caused by suppression of the surface leakage current. And finally, the extended InGaAs focal plane arrays (FPAs) were also fabricated by using ICPCVD passivation method.

S4. PRECISION OPTICS

THIN FILM-BASED OPTICAL FIBER SENSING TECHNOLOGIES

Minghong Yang, Wuhan University of Technology, China

Abstract: Some achievements concerning optical fiber sensors with sensitive thin films developed at the National Engineering Laboratory for Fiber Optic Sensing Technology has been presented, new concepts of optical sensors combined micro-machining of novel fiber structure with sensitive thin film are also proposed and discussed.

STUDY AND APPLICATION OF ALL-FIBER ACOUSTO-OPTIC TUNABLE FILTER

Li Pei, Beijing Jiaotong University, China

Abstract: Along with the communication field gradually into the all optical fiber network era, the rapid development of optical fiber communication system is put forward higher requirements on the performance of the fiber optic filter. It is necessary to develop a fiber optic tunable filter with simple structure, wide tuning range and fast tuning speed. In this paper, optical fiber acousto-optic filter and its application are studied. We propose and demonstrate a highly sensitive axial strain fiber laser sensor， and a fiber Bragg grating demodulation system based on all-fiber acousto-optic tunable filter, respectively.

OPTICAL FIBER LASERS BASED ON RAYLEIGH SCATTERING FEEDBACK

Xinyong Dong, China Jiliang University, China

Abstract: Optical fiber lasers based on Rayleigh scattering feedback instead of cavity mirrors have attracted lots of research interest in recent years. The research progress will be introduced, as well as the basic principle and laser properties. Our recent results in this area by using erbium-doped fiber as gain media will also be introduced.

PLASMONIC WAVEGUIDE-COUPLED GRADED NANO-RODS AS NANO-OPTICAL CONVEYOR BELT

Zhoufeng Ying, Nanjing, China; Guanghui Wang, Nanjing University, China; Xuping Zhang, Nanjing University, China; Ho-Pui Ho, The Chinese University of Hong Kong, Hong Kong; Ying Huang, A*STAR (Agency for Science, Technology and Research), Singapore

Abstract: We propose a plasmonic nano-optical convey belt for peristaltic transport of nano-particles. Instead of illumination from the top, waveguide-coupled excitation is used for trapping particles more precisely and flexibly. Graded nano-rods with individual dimensions are designed on the waveguide to produce addressable hot-spots coded with different resonant wavelength. Thus, by switching the excitation wavelength sequentially, particles can be transported to adjacent optical traps along the waveguide. Three-dimensional finite-difference time-domain method and Maxwell stress tensor method are used to analyze the feasibility of our proposed design. Simulation results show that this system is capable to excite addressable traps and convey particles in a peristaltic fashion, and the position is well controlled within subwavelength, which provides an alternative design integrating optical manipulation with optical waveguides.

POLARIZATION DE-MULTIPLEXING ALGORITHM BASED ON TWICE REAL-VALUED FASTICA

Jianfei Liu, School of Electronic and Information Engineering, Hebei University of Technology, China; Beilei Liu, School of Electronic and Information Engineering, Hebei University of Technology, China; Xiangye Zeng, School of Electronic and Information Engineering, Hebei University of Technology, China; Jia Lu, School of Electronic and Information Engineering, Hebei University of Technology, China; Huimin Shi, School of Electronic and Information Engineering, Hebei University of Technology, China

Abstract: Twice real-valued FastICA (TR-FastICA) algorithm is proposed in this paper to eliminate crosstalk between the two polarization multiplexed complex-valued higher-order quadrature modulation format such as QPSK signals induced by polarization mode coupling with polarization mode dispersion (PMD) and polarization dependent loss (PDL) for the coherent optical polarization division multiplexing (CO-PDM) system. The proposed algorithm has much lower computation complexity meaning simpler hardware implementation compared with algorithm based on complex maximization of non-Gaussianity (CMN). Simulation results show that the proposed TR-FastICA algorithm can eliminate crosstalk between the two polarization signals effectively and improve the transmission performance.

FULLY DISTRIBUTED OPTICAL FIBER SENSING TECHNOLOGY AND ITS APPLICATION IN OPTICAL COMMUNICATION CABLE

Xuping Zhang, Nanjing University, China; Yixin Zhang, Nanjing University, China; Guanghui Wang, Nanjing University, China

Abstract: Optical communication cable plays a more and more important role in modern communications technology. Unfortunately, optical cables are often damaged by natural disasters and human interventions such as fisher ship's anchoring, engineering construction. If a fault occurs within the cable, especially submarine cable, the communication woldwide may interrupt, which makes the real-time monitoring of optical cable a crucial problem to be solved.

In this talk, a new designed fully distributed micro-disturbance field fiber sensing system is presented. Methods have been proposed for correlating and synchronous demodulation of a highly coherent Rayleigh backscattering light. Not only the intensity, but also the frequency, phase angle and polarization state of the lightwave are obtained. Stable identification of disturbance event is achieved by support vector machine (SVM) even with sample pool of small scale. Acoustic vibration field theory and the inverse source analysis method are explored to further extract the unusual behavior of vibration source. Characteristics such as the location, size, spectrum and type are also analysised. The the fully distributed sensing on the micro-disturbance field induced by both high strength destructuive vibration source (such as nearby mining, subsidence, blasting, earthquakes, landslides, etc.) and low strength weak vibration source (such as thefting, eavesdropping, intrusion, etc.) could be realized.

STUDY ON CONDITION CONSTRAINTS OF CLASSICAL CAMERA CALIBRATION

Jiaqi Chen, University of shanghai for science and technology, China; guorong sui, University of shanghai for science and technology, China; Shuangping Su, University of shanghai for science and technology, China

Abstract: Camera Calibration is a crucial task in computer vision. It aims to get internal and external parameters of camera from images. Currently, classical calibration techniques are widely used in measurement and monitor, especially the method proposed by Zhang Z.Y. In this paper, it is demonstrated that classical method is rather inaccurate in some certain conditions-different distance. Experiment results on real images are analyzed and compared with theoretical prediction. Meanwhile the method is carried out for hundreds times with different numbers of images to point out the inaccuracy of the method involved with iterative algorithm. This work provides the basis for further development in camera calibration, and plays a significant role for close-range calibration in engineering.

SUPER-RESOLUTION DEEP IMAGING BY USING BESSEL BEAM STED MICROSCOPE

Kebin Shi, Peking University, China

Abstract: In stimulated emission depletion (STED) microscopy, helical phase modulation should be maintained for the STED beam to achieve doughnut shaped stimulated depletion, which results in highly localized excitation. However the achievable resolution will degrade inevitably with depth from the surface due to the scattering and specimen-induced phase aberrations. In this talk, we will discuss a Bessel beam STED scheme with greatly improved lateral resolution in deep imaging. The experiments show the improved imaging depth up to ~150 μm with consistent super resolution of ~118 nm, which is a 3-fold improvement of standard STED microscopy at the same imaging depth.

S5. LIGHTINGS AND DISPLAYS

DISPLAY AND IMAGING APPLICATIONS USING AGGREGATION-INDUCED-EMISSION MOLECULES

Kam Sing Wong, Department of Physics, Hong Kong University of Science and Technology, Hong Kong

Abstract: Invited talk abstract for S5 Lightings and Displays session

It is well known that common light emitting dyes such as Rhodamine will drastically reduce their photoluminescence quantum efficiency at high concentration when in solution or in solid state form. Furthermore, they can easily bleached under intense and/or prolong excitation. On the other hand, aggregation–induced-emission (AIE) molecules have very high emission efficiency in aggregate state or condensed matter form [1]. The AIE molecules are also more stable under intense/prolong light exposure, thus they are more suitable for many display and imaging applications compared to the common dye molecules [2]. In this talk, I will discuss the nonlinear optical properties of some families of AIE molecules for applications in two-photon excited imaging of living cells, as well as using AIE molecules for hybrid white light emitter and circularly polarized light emitting liquid crystal displays [3-5].

WIDER COLOR GAMUT LIQUID CRYSTAL DISPLAYS WITH ENGINEERED QUANTUM-DOT LIGHT CONVERTING DEVICE

Wengang Bi, Hebei University of Technology, China; Fei Zhao, Najing Technology Corporation Ltd., Worldwide; Xiaofang Jiang, Najing Technology Corporation Ltd., China

Abstract: We report much improved color gamut liquid crystal displays (LCDs) with specially engineered low-reabsorption, narrow emission spectrum and high quantum yield colloidal quantum-dot light converting device (QLCD) and its applications to TV displays. By theoretical and experimental optimizations, color gamut as wide as 120% NTSC standard is demonstrated. QCLD has also been tested for stability under conditions with an average blue light flux of 1.1 W/cm2 and an internal temperature of 125℃ for the QLCD. No statistical change in color coordinates CIEx or CIEy is observed after 2750 hours continuous aging test, which demonstrates the great potential for using the QLCD for next generation LCD TV with much improved performance.

ELECTRICALLY SUPPRESSED HELIX FERROELECTRIC LIQUID CRYSTALS FOR MODERN DISPLAYS AND PHOTONICS

Abhishek Srivastava, State Key Lab on Advanced Displays and Optoelectronics, Hong Kong University of Science and Technology, Hong Kong

Abstract:

The latest demand of the community, which has changed dramatically in recent time, includes high-resolution displays (i.e. close to the human eye limits), low power consumption and undoubtedly the cost effective display and photonic devices. This is a big challenge for both scientists and engineers. The ferroelectric liquid crystal (FLC), because of the fast switching speed and low power consumption, is considered to be one of the potential candidates to serve as the building block for the modern devices. However, due to several limitations i.e. geometrical, optical and mechanical defects, these structures are less popular among the research and industrial regime. Recently, we have established that the Nano-scale photo-alignment technology could be used to improve characteristics of FLC systems. The photo-alignment, by different irradiance doses, offers good control on the anchoring energy and therefore provides good balance for elastic energy of the helix and the normalized anchoring energy. This balanced energy with proper selection of material parameter, that offer helix unwinding only in the presence of electric field i.e. ESHFLCs, offer high contrast ratio of >10K: 1 at the driving frequency of >5kHz.

By leveraging potentials of the Nano-scale photo-alignment and ESHFLCs, a concept for the field sequential color display (FSCD) has been developed that is characterized by the less power consumption, color triangle ~ 130% of NTSC and high contrast ratio. In addition to the FSCD some photonic elements have also been

proposed that includes FLC grating, Fresnel lens, CD grating etc. Thus, these systems could find applications in variety of modern devices and modify the energy consumption statistics and image perceptions up to a large extent. The proposed ESHFLC has also shown a great potential to offer a better alternative for the IPS and FFS displays with any complecated fabrication procedure.

RECENT PROGRESS IN HIGH POWER GAN-BASED LIGHT EMITTING DIODES BY NOVEL DESIGNS OF EPITAXY AND ADVANCED CHIP STRUCTURE （INVITED)

Feng Yun, Xi'an Jiaotong University, China

Abstract: The fast penetration of solid state light sources with cost-driven market growth in recent years calls for further technology improvements for both luminous efficiency and longevity. In this invited talk, novel designs of epitaxial structure utilizing chirped MQWs and micro-defects inside MQWs are reviewed for their benefits in hole injection improvements and in curbing the internal quantum efficiency droop in GaN-based light emitting diodes (LEDs). Advanced chip structural design such as nanofabrication utilizing localized surface plasmon effects and vertical current flow by laser-liftoff thin film LED processing techniques are reported. The latest research results and technology trend are also discussed.

STUDY OF LATERAL SCHOTTKY CONTACTS IN WSE2 AND MOS2 FIELD EFFECT TRANSISTORS USING SCANNING PHOTOCURRENT MICROSCOPY

Jiannong Wang, Department of Physics, Hong Kong University of Science and Technology, Hong Kong

Abstract: Although two-dimensional (2D) transition metal dichalcogenides (TMDCs) are very promising for future applications in nano-electronics or valley spintronics, the metal contacts to TMDCs are usually not ohmic, which greatly limits the device performance, as well as the study of intrinsic spin and valley physics of TMDCs. Considering the 2D nature of TMDCs thin films, the Schottky contact would have an in-plane lateral depletion region along the channel, distinctively different from convention Schottky contacts with vertical depletion regions extending into the bulk of semiconductors. In this work, we use scanning photocurrent microscopy (SPCM) to directly visualize the in-plane lateral depletion regions of Schottky contacts in 2D WSe2 and MoS2 FET devices. Due to the large exciton binding energy and the submicron exciton diffusion length in 2D TMDC semiconductors, the length of depletion region extending into the channel is estimated as several micrometers. The photocurrent of our FET devices also shows strong dependence on the gate bias, the drain-source bias, as well as the laser incident position. Our work not only directly probes the lateral Schottky depletion region, but also reveals the important role of it in mediating the photoresponse of 2D material optoelectronic devices.

S6. FIBER-BASED TECHNOLOGIES AND APPLICATIONS

100 MW LINEARLY POLARIZED SINGLE-FREQUENCY TM3+-DOPED GERMANATE FIBER LASER AT 1.95 MM

Shanhui Xu, South China University of Technology, China; Changsheng Yang, South China University of Technology, China; Zhongmin Yang, South China University of Technology, China

Abstract: Based on a short DBR configuration and a 21-mm-long homemade Tm3+-doped germanate glass fiber, we demonstrated an output power of > 100 mW and a laser linewidth < 6 kHz in a compact linearly polarized single-frequency Tm3+-doped germanate fiber laser at 1.95 μm. The measured relative intensity noise of < −135 dB/Hz at frequencies of over 5 MHz, the signal-to-noise ratio of > 72 dB and the polarization extinction ratio of > 22 dB are obtained.

IMPROVING FIBER OPTIC SENSING BY ALL-OPTICAL SIGNAL PROCESSING

Jiangbing Du, Shanghai Jiao Tong University, China; Jiaxiong Li, Shanghai Jiao Tong University, China; Lu Li, Shanghai Jiao Tong University, China; Xinyu Fan, Shanghai Jiao Tong University, China; Qingwen Liu, Shanghai Jiao Tong University, China; Zuyuan He, Shanghai Jiao Tong University, China China

Abstract: We demonstrated the use of optical signal processing to enhance the performance of optical fiber sensors, including FBG sensor and OFDR. Regarding FBG sensors, FWM in a HNLF to enhance the sensitivity of a fiber sensor is demonstrated based on frequency chirp magnification. Meanwhile, OFDR with improved spatial resolution is realized assisted by high power modulation, FWM and RFS. The use of the all-optical signal processing opens a new window for advanced fiber optic sensing. Since the method only processes the signal and thus it can be applied to a wide range of sensors without changing the sensor itself.

INVESTIGATION OF GAS DETECTION BASED ON FIBER LASER INTRACAVITY ABSORPTION SPECTROSCOPY

Kun Liu, Tianjin University, China; Tiegen Liu, Tianjin University, China; Lin Yu, Tianjin University, China; Junfeng Jiang, Tianjin University, China; Tao Wang, Tianjin University, China

Abstract: Fiber gas sensors have various applications in process control and environmental monitoring. Thereinto, intracavity sensor has the advantages of wide spectral coverage and high sensitivity. Gas cell is inserted into the laser resonant cavity in intracavity detection system. As a result, many passes through the cell during laser formation increase effective absorption length and sensitivity greatly. Rare-doped fiber laser is usually used as the optical source and able to be tuned over dozens of nanometers. The absorption spectra of several gases can be detected using one sensor. Thus, intracavity gas detection has attracted a lot of interest. In this paper, we repot our research progress on intracavity gas detection, including the module-based design of sensor, the general procedure of signal processing, as well as the method for stability improvement and sensitivity enhancement.

STUDY ON THERMAL POLING IN OPTICAL FIBER WITH THREE CHARGE DYNAMICS MODEL

Lin Huang, Institute of Lightwave Technology, Beijing Jiaotong University, Beijing 100044, China, China; Guobin Ren, Institute of Lightwave Technology, Beijing Jiaotong University, Beijing 100044, China, China

Abstract: Home-made twin-hole optical fibers were thermally poled and etched, a three layer nonlinear region was demonstrated. The two dimensional three charge dynamics model was applied to show the migration and distribution of charge carriers and revealed that the three layer nonlinear region is consistent with the distribution of the charge carriers. The simulation results also showed an inconsistent of width of electric field region and nonlinear region, the width of electric field region depends on the width of the Li+ ions depletion region.

HIGH-PERFORMANCE DISTRIBUTED BRILLOUIN OPTICAL FIBER SENSORS AND THEIR COMMERCIALIZATION

Yongkang Dong, Harbin Institute of Technology, China

Abstract: In this presentation, I will introduce the development of the high-performance distributed Brillouin optical fiber sensors in Harbin Institute of Technology (China) and University of Ottawa (Canada). Then content includes long-rang distributed Brillouin optical fiber sensing with a 150km sensing range, high-spatial-resolution distributed Brillouin optical fiber sensing with a 2-cm resolution, dynamic distributed Brillouin optical fiber sensing, and their applications in structure health monitoring. We will also introduce the new released commercial Brillouin optical fiber strain/temperature analyzer, which has a 5cm spatial resolution and a 5km sensing range.

APPLICATION RESEARCH OF DISTRIBUTED OPTICAL FIBER RAMAN TEMPERATURE SENSOR IN THE SECURITY OF OIL DEPOT

Shalu Zhu, China Jiliang University, Worldwide; Hui Ge, China Jiliang University, China; Jianfeng Wang, China Jiliang University, China

Abstract: Abstract: Research and application of distributed optical fiber Raman temperature sensor (DTS) is briefly introduced in this paper. The current situation of domestic oil and gas storage and transportation security is analyzed. In the instance of the application in the project of Rizhao Port oil tank area, a field test is conducted. The experimental results show that the various points' temperature that depot tanks and transmission lines possess can be measured in a real-time online way by distributed optical fiber Raman temperature sensor and temperature points' location can be pinpointed. Due to these functions, oil depot fire caused by high temperature can be prevented effectively. In the Engineering Application, there are some important parameters that sensing fiber length is 30 km, the spatial resolution is 2 meters, and the temperature of uncertainty is 1 Celsius degree.

THE FIBER OPTIC SAGNAC INTERFEROMETER AND IT SENSING APPLICATION

Yuanhong Yang, Beihang Universuty, China

Abstract: The fiber optic Sagnac interferometer which comprise of a broadband source, a fiber optic coupler and special sensing fiber has great application potentiality. The characteristic of output spectrum was investigated and a spectrum interrogation methods based on absolution phase interrogation were demonstrated. Based on this fiber optic Sagnac interferometer, high precision polarization maintaining (PM) fiber beat length measurement was achieved. Hydrogen concentration and pressure sensor with PM photonic crystal fiber was demonstrated.

DISRUPTIVE FIBRE-BASED MAGNETIC FIELD SENSOR

Mengying Zhang, School of EEE, Nanyang Technological University, Singapore; Xinyong Dong, School of Materials Science and Engineering, Nanyang Technological University, Singapore; Ping Shum, NTU, Singapore; Dora Juan Juan Hu, Institute for Infocomm Research, Agency for Science, Technology and Research, Singapore; Haibin Su, School of Materials Science and Engineering Nanyang Technological University, Singapore; Wen Siang Lew, School of Physical and Mathematical Science, Nanyang Technological University, Singapore; Lei Wei, School of Electrical and Electronics Engineering, Nanyang Technological University, Singapore

Abstract: Due to its remarkable magneto-optic properties such as birefringence, tunable refractive index and Faraday Effect, magnetic fluid has attracted much attention in sensing applications. Magnetic fluid comprises magnetic nanoparticles that coated with surfactant. It is recognized by the phase transitions under variable applied magnetic field. When the external magnetic field ramps up, the magnetic particles gradually aggregate into chain-like clusters and eventually evolve into columns along the field direction due to dipole-dipole interactions. The phase transitions experienced by magnetic fluid lead to the change of optical properties that can be detected by immersed optical fibers. In our proposed sensor, long-period fiber

grating (LPG) fabricated by ultraviolet (UV) irradiation method is adopted as the sensing fiber due to its high sensitivity to the change of ambient medium. The LPG is sealed in a capillary tube that filled with magnetic fluid and then subjected to a perpendicular magnetic field that increments from 0 to ~110 Gauss. We observe that as the applied field strength increases, the transmission minimum and the resonant wavelength of the LPG spectrum varies accordingly. The steep and linear increase of transmission minimum indicates the high sensitivity and low threshold of our proposed magnetic field sensor.

ALL-OPTICAL PHOTONIC MICROWAVE PHASE SHIFTER BASED ON TWO RF MODULATION SIDEBAND AMPLITUDE AND PHASE CONTROL

Xudong Wang, Jinan, China; Erwin Chan, Charles Darwin University, Australia; Xinhuan Feng, Jinan, China

Abstract: Two novel photonic microwave phase shifters (PMPS) are presented. One largely extends the operating bandwidth while the other largely increases the output RF signal power compared to the conventional structures. They are based on controlling the amplitude and phase of two RF phase modulation sidebands via a Fourier-domain optical processor. The novel PMPS have a simple structure and only involve optical components. Experimental results demonstrate the full 0 to 360 phase shift over a wide 7.5 GHz to 26.5 GHz frequency range, and 14-dB increase in the output RF signal power compared to a conventional phase shifter.

HIGH-SENSITIVITY GAS PRESSURE SENSING APPLICATIONS BASED ON MICROSTRUCTURED OPTICAL FIBER DEVICES

Yiping Wang, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, China; Changrui Liao, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen; Shen Liu, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen; Bing Sun, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen; Zhengyong Li, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen; Jian Tang, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen; Xiaoyong Zhong, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen

Abstract: We proposed and experimentally demonstrated four kinds of high-sensitivity gas pressure sensors based on in-fiber devices, including a fiber-tip air bubble, a polymer-capped Fabry-Perot interferometer, an inflated long period fiber grating and a twin-core fiber-based Mach-Zehnder interferometer, which exhibited a sensitivity of 1036, 1130, 1680, 9600 pm/MPa, respectively.

OPTICAL FIBER DEVICES FABRICATED BY FEMTOSECOND LASER MICROMACHINING

Changrui Liao, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen; Yiping Wang, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, China

Abstract: Fiber gratings and in-fiber microstructures have been successfully fabricated in our lab by using femtosecond laser micromachining. In the first part, three types of grating inscription methods (phase mask, line scanning, point scanning) are introduced. In the second part, femtosecond laser drilling is used to fabricate the in-fiber microstructure to obtain a fiber in-line Mach-Zehnder interferometer but the laser drilled surface is too rough. To overcome it, femtosecond laser assisted splicing and femtosecond laser assisted etching methods are proposed and demonstrated to improve the surface quality.

A HIGH SENSITIVE GLUCOSE SENSOR BASED ON GOD-IMMOBILIZED FIBER MICROPROBE

Qizhen Sun, Huazhong University of Sci&Tech (HUST), China; Yanpeng Li, School of Optics and Electronic Information, Huazhong University of Science and Technology, China; Haipeng Luo, School of Optics and Electronic Information, Huazhong University of Science and Technology, China

Abstract: A high sensitive glucose sensor using microfiber based Mach-Zehnder interferometer（MZI）is proposed. Microfiber is firstly immobilized with glucose oxidase (GOD) and then employed as sensing probe in MZI. By tracking the shift of the interference spectrum, a high sensitivity up to 2.46 nm·(mg/ml)−1 is achieved at the glucose concentration range of 0-3mg/ml.

THEORETICAL ANALYSIS ON THE TURNING POINT OF REFRACTIVE INDEX BASED ON MULTIMODE MICROFIBER

Qizhen Sun, Huazhong University of Sci&Tech (HUST), China; Haipeng Luo, School of Optics and Electronic Information, Huazhong University of Science and Technology, China

Abstract: We comprehensively analysis the refractive index (RI) sensing principle based on the multimode microfiber (MMMF). To the authors’ knowledge, we firstly find that the RI sensitivity of the MMMF will reach to $\pm\infty$ when the group effective RI difference (G) approaches to zero. The diameters of the turning point at surrounding RI (SRI) of 1.3320, 1.3420, and 1.3520 are 4.01μm, 4.16μm, and 4.32μm, respectively.

OPTIC LENSES MANUFACTURED ON FIBER ENDS

Wenxin Zheng, AFL, United States

Abstract: Abstract: Different types of fiber lenses have formed a large family of fiber components in fiber laser, medical, and telecom industries. By using CO2 laser fusion technology, many components with extreme geometries and critical requirements, which were very hard to make in the past, can now be easily manufactured. These newly developed fiber lenses are reviewed and discussed for their merits and key features in this article.

S7. OPTOELECTRONIC DEVICES AND APPLICATIONS

PROPOSAL OF AN INP-BASED MONOLITHICALLY INTEGRATED FEW MODE TRANSMITTER BASED ON MULTIMODE INTERFERENCE COUPLER

Zhaosong Li, Key Laboratory of Semiconductor Material Sciences, Institute of Semiconductors, Chinese Academy of Sciences, China; Dan Lu, Key Laboratory of Semiconductor Material Sciences, Institute of Semiconductors, Chinese Academy of Sciences, China; Limeng Zhang, Key Laboratory of Semiconductor Material Sciences, Institute of Semiconductors, Chinese Academy of Sciences, China; Xing Dai, Key Laboratory of Semiconductor Material Sciences, Institute of Semiconductors, Chinese Academy of Sciences, China; Lingjuan Zhao, Key Laboratory of Semiconductor Material Sciences, Institute of Semiconductors, Chinese Academy of Sciences, China; Jiaoqing Pan, Key Laboratory of Semiconductor Material Sciences, Institute of Semiconductors, Chinese Academy of Sciences, China China

Abstract: We propose an InP-based monolithically integrated few mode transmitter structure based on multimode interference coupler (MMI), and demonstrate an integrated mode converter and multiplexer (converter-multiplexer). This converter-multiplexer can convert the TE0 mode to either TE0 or TE1 mode and multiplex the two modes into a common output port. The device can be potentially used in mode division multiplexing system.

ULTRA-HIGH BANDWIDTH GE-ON-SI PHOTODETECTOR

Yu Yu, Hua, China

Abstract: We report CMOS compatible ultrahigh speed germanium on silicon photodetector (PD) with bandwidth up to ~ 70 GHz. By engineering the parasitic parameters, the PD bandwidth can be improved significantly without degrading other performance. Several schemes are presented and demonstrated to achieve the desired high bandwidth. The parameters optimization is also discussed.

SILICON-PLUS PHOTONIC INTEGRATED DEVICES

Daoxin Dai, State Key Lab of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou 310027, China

Abstract: Abstract: Silicon photonics has become very popular because of their compatibility with mature CMOS technologies while it is still very difficult to realize various photonic functional devices for realizing large-scale photonic integration by utilizing the material system of pure silicon due to the intrinsic properties of silicon. Silicon-puls photonics, which includes other materials to complement the disadvantages of silicon, is playing very important role currently and in the future. In this paper, we give a review and discussion on the progresses and future development of silicon-plus photonics, including the structures, devices and applications.

RECENT PROGRESS IN ON-CHIP OPTICAL COMPUTING

Jian Wang, Huazhong University of Science and Technology, China

Abstract: On-chip optical signal processing using photonic integrated circuits provides an ultra-compact and ultra-fast solution to flexibly and efficiently manipulate the data information in the optical domain. Silicon photonics offers a promising cost-effective integration platform for on-chip optical signal processing. Optical computing is a basic optical signal processing function. In this talk, we review our recent progress in the fabrication of silicon nanophotonic devices and their applications in on-chip optical signal processing. In particular, by exploiting degenerate and non-degenerate four-wave mixing (FWM) processes in silicon waveguides, we demonstrate two-input and three-input on-chip high-base optical computing (addition, subtraction).

DUAL-WAVELENGTH DISTRIBUTED FEEDBACK LASER FOR PHOTONIC MICROWAVE GENERATION

Liangshun Han, Institute of Semiconductors, Chinese Academy of Sciences, China; Song Liang, Institute of Semiconductors, Chinese Academy of Sciences, China; Daibing Zhou, Institute of Semiconductors, Chinese Academy of Sciences, China; Biwei Pan, Institute of Semiconductors, Chinese Academy of Sciences, China; Songtao Liu, Institute of Semiconductors, Chinese Academy of Sciences, China; Hongliang Zhu, Institute of Semiconductors, Chinese Academy of Sciences, China; Wei Wang, Institute of Semiconductors, Chinese Academy of Sciences, China

Abstract: We present a compact and simple approach to realize dual-wavelength distributed feedback laser by introducing two distributed feedback (DFB) lasers, in series, with different ridge widths and uniform gratings. Each laser emits single longitudinal mode and an electro-absorption modulator (EAM) has been integrated within the laser cavity in order to stabilize the beating signal by nonlinear four-wave mixing and lock phase of the two optical signals. A stable 74.9GHz beating signal was obtained within a wide range of bias parameters in terms of drive currents to two DFB lasers. By down-conversion technique, the beating signal has been observed by electrical spectrum analyzer.

STUDY OF BLACK PHOSPHORUS ANISOTROPY ON PHOTONIC WAVEGUIDE

Che Chen, University of Minnesota, United States; Nathan Youngblood, University of Minnesota, United States; Mo Li, University of Minnesota, United States

Abstract: Abstract: Due to its unique crystal structure, black phosphorus (BP) shows anisotropic electric and optical properties. In this work, we demonstrate its optical anisotropy by measuring its absorption of TE and TM mode on silicon photonic waveguides. When BP crystal armchair axis is aligned perpendicularly to waveguide, the measured absorption coefficients for TE and TM are 0.821 dB/μm and 0.413 dB/μm, respectively. The result matches well with our calculated absorptions of 1.075 dB/μm and 0.581 dB/μm for TE and TM modes. By carefully selecting BP thickness and orientation, it is possible to selectively absorb either TE or TM mode and the TE/TM contrast can reach to 1.1 dB/μm when BP thickness is 100 nm.

CO2 LASER WRITING OF LONG PERIOD FIBER GRATING IN AIR-CORE PHOTONIC BANDGAP FIBER AS GAS PRESSURE SENSOR

Jian Tang, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, China; Yiping Wang, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, China; Shen Liu, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, China; Guolu Yin, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, China; Xiaoyong Zhong, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, China; Changrui Liao, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen China

Abstract: We reported a gas pressure sensor based on CO2 laser induced long period fiber grating (LPFG) in an air-core photonic bandgap fiber (PBF).The LPFG was inscribed by use of an improved CO2 laser system with an ultra-precision two-dimensional scanning technique, which produced single side periodic collapses in the micro-structured cladding of the air-core PBF. Such LPFG was utilized to measure the gas pressure with a sensitivity of -137 pm/MPa. A simulation model was built to study the gas pressure response mechanism of this kind LPFG. The stress distribution along the LPFG revealed that the outer gas pressure can lead to a stress concentration at the collapsed area and then transfer into the silica wall of the air-hole, which finally results in a shift of the resonant wavelength.

LOSS UNIFORMITY IMPROVEMENT FOR CYCLIC ARRAYED WAVEGUIDE GRATING BASED ON SILICON NANOWIRE WAVEGUIDES

Xiang Xia, State Key Lab of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou 310027, China; Yang Chen, State Key Lab of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou 310027, China; Jun Zou, State Key Lab of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou 310027, China; Tingting Lang, China Jiliang University, China; Jian-Jun He, State Key Lab of Modern Optical Instrumentation, College of Optical Science and Engineering, Zhejiang University, Hangzhou 310027, China

Abstract: A cyclic arrayed waveguide grating (AWG) router based on silicon nanowire waveguides with uniform channel insertion loss is designed and experimentally demonstrated. Different from conventional design, the directions of arrayed waveguides are no longer pointed to the central output waveguide, but are adjusted according to a distribution function. The experimental results show that the channel insertion loss non-uniformity is reduced from 2.7 dB to 1.1 dB. This uniform loss design does not change the overall construction of AWGs, and does not increase the device size.

LARGE SPECTRAL BANDWIDTH (0.9-2.8MM) RESPONSE CALIBRATION BASED ON THE STANDARD DETECTOR

Qingfa Li, ShanghaiTech University, China; Xue Li, Shanghai Institute of Technical Physics, CAS, China; Hnegjing Tang, Shanghai Institute of Technical Physics，CAS, China; Xiumei Shao, Shanghai Institute of Technical Physics, CAS, China; Haimei Gong, Shanghai Institute of Technical Physics, CAS, China

Abstract: Accurate response spectrum is an important parameter of the photoelectric detectors, for it not only can be used to calculate quantum efficiency and detectivity, but also it is useful in application area especially in remote sensing. In this paper, in order to obtain accurate response spectrum at large spectral bandwidth (0.9-2.8μm) of the short-wavelength InGaAs measurement detector, benchmark transfer method was proposed, and the grating spectrum monochrometer and Fourier Transform Infrared (FTIR) Spectrometer were used to measure the under-test detector and standard detector for checking the reliability of benchmark transfer method. The results indicate that the response spectrum can be calculated accurately.

NANO-SCALE PHOTOALIGNING AND PHOTOPATTERNING TECHNOLOGY: APPLICATIONS IN DISPLAYS AND PHOTONICS

Vladimir Chigrinov, State Key Lab on Advanced Displays and Optoelectronics, Hong Kong University of Science and Technology, Hong Kong

Abstract: The advantages of LC photoalignment technology in comparison with common “rubbing” alignment methods tend to the continuation of the research in this field [1]. Almost all the criteria of perfect LC alignment are met in case of azo-dye layers. Nowadays azo-dye alignment materials can be already used in LCD manufacturing, e.g. for the alignment of monomers in LCP films for new generations of photonics and optics devices.

Recently the new application of photoaligned technology for the tunable LC lenses with a variable focal distance was proposed. Thin photo-patterned micropolarizer array for CMOS image sensors for in-situ analysis of the four Stokes parameters of the output optical signal are also envisaged.

New optically rewritable (ORW) liquid crystal photonics devices with a light controllable structure may include LC plane waveguides, LC polarization dependent elements, such as lenses and wave plates, LC polarization rotators and polarization controllers, light and voltage controllable diffraction gratings for optical filters etc.

We are sure, that the common rubbing alignment technology will be totally replaced by a photoalignment in the near future, thus increasing the quality of LCD. Photoalignment is definitely the only technology, which enable non-defect LC orientation inside superthin tubes (tunable photonic crystal/liquid crystal fiber

structure) and on tiny rings (Si micro-ring resonators).

Fast ferroelectric liquid crystal devices (FLCD) are achieved through the application of nano-scale photo aligning (PA) layers in FLC cells. The novel photoaligned FLC devices may include field sequential color (FSC) FLC with a high resolution, high brightness, low power consumption and extended color gamut to be used for PCs, PDAs, switchable goggles, and new generation of switchable 2D/3D LCD TVs, as well as photonics elements. The FSC FLC micro display is now one of the most advanced technologies for the high resolution fast micro-displays and pico-projectors with a high brightness and low power consumption.

INTEGRATED SILICON COMPONENTS FOR MICROWAVE PHOTONIC SIGNAL PROCESSING

Ke Xu, Harbin Institute of Technology Shenzhen Graduate School, China; Hon Ki Tsang, The Chinese University of Hong Kong, Hong Kong; Chi-Wai Chow, National Chiao Tung University, Taiwan

Abstract: Microwave photonic processing and transmission has the potential to extend the reach of microwave signal distribution. Generating and processing the microwave such as ultrawideband (UWB) pulses and millimeter wave signal in optical domain would be desired to better fit the optical fiber networks. Here we demonstrate the silicon based photonic integrated circuits for UWB and mm wave signal processing which might be a low cost solution for short reach wireless signal distribution.

HIGH-THROUGHPUT SILICON PHOTONIC SWITCHES AND MODULATORS

Linjie Zhou, Shanghai Jiao Tong University, China

Abstract: We report our recent progress on high-throughput silicon photonic switches and high-speed low-power optical modulators. 4x4 and 16x16 nonblocking optical switches are built using either Mach-Zehnder interferometers (MZIs) or double-ring assisted Mach-Zehnder interferometers (DR-MZIs) as the basic switch elements. Silicon resistive heaters and p-i-n diodes are both integrated in the switch elements for thermo-optic phase error correction and GHz-speed electro-optic (EO) switching, respectively. Silicon quadrature phase-shift keying (QPSK) modulators based on two nested MZIs with single-drive push-pull travelling wave electrodes have also been demonstrated. 64 Gb/s QPSK modulation is successfully achieved with an estimated power consumption of 7.1 pJ/bit.

RELIABILITY OF HIGH POWER SEMICONDUCTOR LASERS ON BONDING AND MOUNTING DESIGN

Yuchen Chen, National Chiao Tung University and Union Optronics Corporation, Taiwan; Gray Lin, National Chiao Tung University, Taiwan

Abstract: Reliability of high-power semiconductor lasers can be underestimated because of imperfect bonding and improper mounting. The C-mount package of Cu material is replaced with CuW material and high power laser chips are bonded above without AlN submount. For the burn-in test, liquid-metal alloy is applied between C-mount and heatsink to improve thermal contact. The estimated lifetime of 4 W, 808 nm lasers is therefore greatly increased to over 3600 hours.

A WEB-BASED REMOTE LABORATORY FOR THE COLLEGE OF OPTOELECTRONIC ENGINEERING OF ONLINE UNIVERSITIES

M.M. Kamruzzaman, Shenzhen University, China

Abstract: In this paper, an architecture of remote laboratory for the college of optoelectronic engineering is proposed. Any university which wants to establish distance education for the college of optoelectronic engineering can use the proposed architecture or hardware and software to manage experimental assignments from any location. There are four main parts of the proposed remote laboratory: remote users, internet, server Setup and laboratory setup. Remote users can use desktop, laptop, tablet or mobile to conduct the experiments remotely. Roles of different types of remote users have also expalined in this paper. A reliable and secure server is considered to implement the system. List of reliability and security issues cosidered to design the system is also mentioned here. Laboratories like 3D Digitization and Modeling

lab, 3D Imaging and Metrology of Micro Objects lab, Face/Person Tracking lab, Optical Communications and Networks lab, Visible Light Communication lab, Lab on Laser Technologies, Lab on Infrared Technologies, Lab on Lightings and Displays, Lab on Biophotonics etc will be connected under the main server. At present, the proposed architecture is implemented at Shenzhen University and 3D Imaging and Metrology of Micro Objects lab is connected to the main server to conduct experiment remotely which is currently tested from the University of Stuttgart, German. The outputs generated from remote users are also described in this paper. The proposed system can be used from website http://210.39.14.102.

IMPROVED OPTICAL ABSORPTION AND PHOTOCONVERSION IN HIGHLY COMPACT NANOWIRE PHOTOVOLTAIC DEVICES

Zhenhai Yang, Soochow University, China; Aixue Shang, Soochow University, China; Cheng Zhang, Soochow University, China; Shaolong Wu, Soochow University, China; Yaohui Zhan, Soochow University, China; Dang Yuan Lei, The Hong Kong Polytechnic University, Hong Kong; xiaofeng li, Soochow University, Hong Kong

Abstract: Benefitted from the unique morphology characteristics and the antenna effect, single nanowires (NWs) have been widely applied in applications including sensing, photodetection, photovoltaics, etc. Especially, single-nanowire solar cells (SNSCs) have attracted tremendous recent attention due to their outstanding potentials in efficient light-harvesting and well-controlled carrier collection process. However, the optical and electrical performance of these newly emerging cells remains far from the expectation. In this study, we present several designs for SNSCs by re-shaping the nanowire cross-section (symmetry-breaking designs) as well as introducing the electrical confinement (window) layers. The new designs (including crescent, co-axial, and off-axial core/shell nanowire designs) exhibit optical and electrical benefits. Optically, the extraordinary light-harvesting capability can be obtained and maintained over a broad spectral band at a wide range of incident angle, with the reduced material consumption. Electrically, we mimic the carrier generation, transportation, recombination and collection processes, enabling accessing both macroscopic and microscopic characteristics of the highly nanostructured photovoltaic devices. The electrical parameters, i.e., the light-conversion efficiency, output power, short-circuit current density, open-circuit voltage, etc, have been evaluated comprehensively. It is found that the designed SNSCs show much higher electrical performance with the new designs. The designs open up possibilities for achieving highly compact and efficient optoelectronic devices.

1 MICROMETER WAVELENGTH PULSE FIBER LASER ASSISTED BLACK MARKING ON THE SURFACE OF ALUMINUM OXIDE

Meng Liu, NTU, Singapore; Meng Zhang, NTU, Worldwide; Shaoxiang CHEN, NTU, Singapore; Zhiyu Yan, NTU, Singapore; Ping Shum, NTU, Singapore; Qijie Wang, NTU, Singapore; Xueping Cheng, NTU, Singapore

Abstract: The blackening of the aluminum oxide surface by a nanosecond pulse fiber laser with 1 micrometer wavelength has been investigated. The blackening effect is strongly depending on the laser parameters such as pulse energy, repetition rate, scanning speed, hatching etc. By measuring the CIE L* value, the relationship and to what extent these laser parameters affecting the blackening effect is investigated. The reflectivity of the blackening area is also measured.

SILICON PHOTONIC DEVICES FOR SIGNAL MODULATION, SWITCHING AND ANALOG PROCESSING

Yikai Su, Shanghai Jiao Tong University, China; Ciyuan Qiu, Shanghai Jiao Tong University, China; Jiayang Wu, Shanghai Jiao Tong University, China

Abstract: We experimentally demonstrate a silicon spatial light modulator and a silicon-graphene ring modulator. We further propose a high speed nanobeam modulator. We then experimentally demonstrate wavelength selective switching using nested pair of silicon ring resonators for reconfigurable optical add-drop multiplexers. We also show analog signal processing functions including tunable first- and second-order differential equation solvers, and microwave photonic processing covering notch filtering/tunable microwave generation using self-coupled mode split resonators, as well as phase shifter

based on a micro-disk resonator.

4×25-GB/S MONOLITHICALLY INTEGRATED LIGHT SOURCE IN THE DATA CENTRE

Fei Guo, Institute of Semiconductors, Chinese Academy of Sciences, China; Mengdie Sun, Institute of Semiconductors, Chinese Academy of Sciences, Beijing, China; Huitao Wang, Institute of Semiconductors, Chinese Academy of Sciences, China; Dan Lu, Institute of Semiconductors, Chinese Academy of Sciences, China; Ruikang Zhang, Institute of Semiconductors, Chinese Academy of Sciences, China; Chen Ji, Institute of Semiconductors, Chinese Academy of Sciences, China China

Abstract: We report a monolithically integrated 4×25-Gb/s device for the data center applications. Lasing wavelengths are aound 1.55 μm with averaging channel spacing about 600 GHz. 3-dB frequency bandwidths are around 15 GHz.

MONOLITHICALLY INTEGRATED 1.55-MM DUAL-WAVELENGTH DISTRIBUTE FEEDBACK LASER AND SEMICONDUCTOR OPTICAL AMPLIFIER ARRAY FOR TERAHERTZ MODE-BEATING SIGNAL GENERATION

Mengdie Sun, Institute of Semiconductors, Chinese Academy of Sciences, China; Shaoyang Tan, Institute of Semiconductors, Chinese Academy of Sciences, China; Songtao Liu, Institute of Semiconductors, Chinese Academy of Sciences, China; fei Guo, Institute of Semiconductors, Chinese Academy of Sciences, Beijing, China; Dan Lu, Institute of Semiconductor,CAS, China, China; Chen Ji, Institute of Semiconductors, Chinese Academy of Sciences, Beijing, China China

Abstract: A 1.55-μm dual-wavelength distributed feedback (DFB) laser diode array with integrated semiconductor optical amplifiers (SOAs) and multimode interference (MMI) coupler is demonstrated to realize widely tunable continuous-wave terahertz (THz) mode-beating signal generation. DFB lasers, SOAs, MMI coupler and spot-size converters (SSCs) have been integrated on the same InP based substrate. By electrically tuning the wavelength of the two single mode lasing DFB lasers, the chip shows a wide optical mode-beating frequency ranging from 40 GHz to 0.8 THz.

MOLECULAR ENGINEERING OF ORGANIC SEMICONDUCTORS FOR ORGANIC THIN FILM TRANSISTORS

Hong Meng, Peking University Shenzhen Graduate School, China; Osamu Goto, Peking University Shenzhen Graduate School, China; Lijia Yan, Nanjing Tech University, China

Abstract: Organic electronics based on the thin film devices, including organic thin film transistors (OTFTs), organic light emitting diodes (OLEDs), organic photovoltaics (OPVs) and organic electrochromic devices (OECs) are envisioned both great interest in academia and industry. The properties of organic semiconductor materials are directly governed by the molecule structures. In this talk I will present the resent work conducted in our labs for molecule design strategies. Examples include searching high mobility organic semiconductors with unique properties for OTFT applications, fine tuning color efficiency of electrochromic materials for military camouflage applications, and energy level controlling of hole transport materials for perovskite solar cell applications. Detailed studies on the electrochemical and photoelectronic properties as well as the device performance of these new semiconductors are discussed.

S8. BIOPHOTONICS

MULTIFUNCTIONAL SEMICONDUCTING POLYMER DOTS FOR BIOMEDICAL IMAGING

Changfeng Wu, Jilin Univeristy, China

Abstract: We present a novel type of fluorescent nanoparticles called semiconducting polymer dots (Pdots) for biological imaging and sensing applications. The Pdots exhibit superior properties such as high fluorescence brightness, fast emission rate, excellent photostability and biocompatibility, which make Pdots promising for biological imaging applications. Our recent research is focused on the development of multifunctional Pdots for various biomedical applications. Specific efforts are made to develop: 1) highly efficient Pdot photosensitizer for photodynamic therapy; 2) implantable glucose sensors for long-term continuous glucose monitoring; 3) highly bright probes for stem cell labeling and tracking. The fluorescent Pdot materials have also been demonstrated in ultra-stable fluorescence patterning and anti-counterfeiting applications.

DUAL-SLIT CONFOCAL LIGHT SHEET MICROSCOPY FOR IN VIVO WHOLE-BRAIN IMAGING OF ZEBRAFISH

Ling Fu, 1 Britton Chance Center for Biomedical Photonics, Wuhan National Laboratory for Optoelectronics-Huazhong University of Science and Technology, Wuhan 430074, China 2MoE Key Laboratory for Biomedical Photonics, Department of Biomedical Engineering, Huazhon, China

Abstract: A dual-slit confocal LSM is developed to obtain the SNR enhanced images using dual-beam illumination and confocal dual-slit detection. In vivo whole brain structural imaging stacks of zebrafish and the functional imaging sequences of single slice were obtained for analysis of calcium activities at single-cell resolution. A two-fold increase in imaging speed makes it possible to capture the sequence of the neurons' activities. Combined with the recent introduction of light-sensitive actuators such as channelrhodpsin, further development of LSM based photostimulation system for generation of various light patterns in space and time can help reveal the functional and behavioral connections in the whole zebrafish's brain.

REFRACTIVE INDEX SENSOR BASED ON SIDE-POLISHED FIBER BRAGG GRATING

Changrui Liao, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen; qiao wang, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen,, China

Abstract: We experimentally demonstrated the fabrication of fiber Bragg gratings by using femtosecond laser point-by-point inscription. It is easy to create fiber Bragg gratings with different grating periods by changing the translation speed of the optical fiber. Firstly, laser pulse energy was optimized to improve the transmission spectra of fiber Bragg gratings. Then, a fiber Bragg grating was inscribed in a side-polished fiber to work as a refractive index sensor based on the evanescent field. There is a nonlinear relationship between Bragg wavelength and surrounding refractive index, where a refractive index sensitivity of ~30 nm/RIU has been achieved at 1.450. Thus, such side-polished FBGs could be used to develop a promising biochemical sensor.

STUDYING THE PHOTOACOUSTIC WAVE GENERATION FROM A BIOLOGICAL PARTICLE WITH SPHEROIDAL WAVE FUNCTIONS

Hui Fang, Shenzhen University, China

Abstract: Biological particles are usually better approximated by spheroids rather than spheres, and their morphology can be gauged by conventional methods such as the light scattering along with the T-matrix calculation. We considered the new approach which depends on measuring the photoacoustic waves produced by a biological particle. Based on the sphereoidal wave functions, we derived the analytic solution of photoacoustic wave generation from a spheroidal droplet, and also carried out the numerical calculation for two representative types of biological particles: red blood cells and cell nuclei.

A VERSATILE BREATHING LASER FOR ULTRAFAST IMAGING APPLICATIONS

Xiaoming Wei, The University of Hong Kong, Hong Kong; Jingjiang Xu, The University of Hong Kong, Hong Kong; Andy Lau, The University of Hong Kong, Hong Kong; Kevin Tsia, The University of Hong Kong, Hong Kong; Kenneth Kin-Yip Wong, The University of Hong Kong, Hong Kong

Abstract: Wavelength-swept light source, or simply known as swept source, gains its popularity in a wide range of biomedical applications, primarily ultrafast imaging. The sweep rate, however, is usually limited by the speed of the mechanical moving parts, typically 10's–100's kHz. We here demonstrate a MHz all-fiber breathing laser as inertia-free swept source (BLISS) in both 1.0-um and 1.55-um wavelength windows by leveraging an ultra-compact design, for the newly-emerged ultrafast imaging modalities, such as time-stretch microscopy, optical coherence tomography (OCT) and beyond.

APPLYING STAND-OFF LIBS FOR PALEOCLIMATIC RESEARCH: A CASE STUDY GEOCHEMICAL CONTENT OF CARBONATE ROCKS

Menghan Wang, Shenzhen University, China; Qi Wang, Shenzhen University, China; Ming Zhu, Shenzhen University, China; Luogeng Sun, Xidian University, China; Junle Qu, Shenzhen University, China

Abstract: Carbonate rocks, mainly calcite rock and dolomite rock, make up 10% to 15% of sedimentary rocks in the Earth. Geochemical content of carbonate rocks could reflect a series of key geological information of environment long time ago, such as temperature, precipitation, salinity and geologic event. Stand-off LIBS provides an approach to rapidly, accurately and nondestructively determining the elemental concentration in difficult sampling carbonate rocks, such as cliff rocks, small reefs and karst caves.

In this study, we determined Mg/Ca ratio, Sr/Ca ratio, Si and Al in calcite and dolomite rocks from Xinjiang and Yunan in the distance of 15m. 2D Mapping ratios of rocks from Yunnan clearly exhibited spatial variation of geochemical content. These variation were correlated to temperature changes along the geologic time, which affected Magnesium incorporation of rock. Large concentrations of Si and Al are indicative of flood events.

SURGICAL IMAGING, BIOPHOTONICS AND ENDOSCOPY

Daniel Elson, Imperial College London, United Kingdom

Abstract: Surgical imaging describes the application of a range of imaging, vision and optical techniques to assist surgeons in intrasurgical decision making. In this talk I will describe how various biophotonics and optical imaging approaches may be adapted for surgical endoscopic application, including the use of multispectral imaging and polarization resolved imaging. Furthermore, the integration of these approaches with existing and new robotic platforms will be described, allowing improved ergonomics as well as better mechanical scanning of optical spectroscopic probes for more accurate optical diagnostics. A new approach for endoscopic structured lighting has also been developed for the detection of tissue surface curvatures during surgery. This work is driven by the need to provide a higher degree of control and vision for the surgeon, and to complement the standard white light reflection images.

OPTICAL FIBER-BASED CA2+ IMAGING IN FREELY MOVING MOUSE

Han Qin, 1 Britton Chance Center for Biomedical Photonics, Wuhan National Laboratory for Optoelectronics-Huazhong University of Science and Technology, Wuhan 430074, China 2MoE Key Laboratory for Biomedical Photonics, Department of Biomedical Engineering, Huazhon, China; Zhou Zhou, 1 Britton Chance Center for Biomedical Photonics, Wuhan National Laboratory for Optoelectronics-Huazhong University of Science and Technology, Wuhan 430074, China 2MoE Key Laboratory for Biomedical Photonics, Department of Biomedical Engineering, Huazhon, China; Ling Fu, 1 Britton Chance Center for Biomedical Photonics, Wuhan National Laboratory for Optoelectronics-Huazhong University of Science and Technology, Wuhan 430074, China 2MoE Key Laboratory for Biomedical Photonics, Department of Biomedical Engineering, Huazhon, China

Abstract: Functional imaging of specific brain microcircuits for certain behaviors requires real-time observation in freely moving animals. Recent development in imaging and optogenetics techniques allows high resolution imaging and artificial control of neural circuits in vivo. However these imaging techniques cannot be used in freely moving situation. Here we developed a lightweight fiber-based Ca2+ imaging system (2g mass). It achieved a subcellular resolution (1.23 μm) by coupling a GRIN lens at the tip. It also had a FOV of 170 μm and a working distance of 150 μm. Combined with genetically encoded Ca2+ indicator, we could investigate the functional activity of specific brain circuits in cortical surface in freely moving mice.

MULTI-SCALE FUNCTIONAL AND MOLECULAR PHOTOACOUSTIC IMAGING

Liang Song, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China

Abstract: Photoacoustic imaging has broken through the optical diffusion limit to allow us seeing intact biological tissue in vivo at unprecedented depths (up to several cm) with rich optical contrasts. In this talk, we present our development of several acoustic- and optical-resolution photoacoustic microscopy and endoscopy technologies that can offer multi-scale molecular and functional information about intact biological tissue. In particular, three novel photoacoustic imaging technologies—optical-resolution photoacoustic endomicroscopy, reflection-mode subwavelength resolution photoacoustic/two-photon multi-modality microscopy, and photoacoustics-based cancer theranostic platform—developed in our lab will be discussed in detail.

MULTI-PARTICLE PARALLEL TRACKING APPROACH WITH LARGE IMAGING DEPTH AND ITS APPLICATION IN LIVE CELL STUDYING

Gaixia Xu, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen, Guangdong Province,, China; Bin Yu, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen, Guangdong Province,; Heng Li, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen, Guangdong Province,, China; Danni Chen, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen, Guangdong Province,, China; Xiaomei Wang, School of Medicine, The Research Institute of Urinary and Reproduction, The Engineering Lab of Synthetic Biology, Shenzhen Key laboratory of Biomedical Engineering, Shenzhen University, Shenzhen; Hanben Niu, Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education and Guangdong Province, College of Optoelectronic Engineering, Shenzhen University, Shenzhen, Guangdong Province,, China China

Abstract: The direct visualization of individual biomolecule in motion can transform our view of important biophysical and cellular processes. Generally, cells are three-dimensional objects and intracellular trafficking pathways are not constrained to one focal plane, which brings a big challenge for researchers to develop novel optical imaging methods that can perform with nano-resolution, fast imaging speed and thicker imaging depth for single molecule tracking in live cells.

In this talk, we proposed a novel approach based on a bifunctional phase mask designed for multi-particle tracking simultaneously with 3D nano-resolution in a sample with thickness of a-whole-cell size. Distorted

grating (DG) function and Double Helix Point Spread Function (DH-PSF) function were combined with single one phase mask. DG in the detection path is of capabilities to extend the effective Depth of Field (DOF) by several times than that in traditional microscope. Particles within the certain DOF range can be localized with 3D nano-resolution by DH-PSF function. Simulated results in the manuscript demonstrated that, with this approach, multi-particle within ten microns in depth can be imaged and localized simultaneously with only one snapshot, no matter where the particles are located. Based on the simulation results, such a specially designed phase mask was fabricated successfully and mounted at the Fourier plane in a relay 4f device attached on a commercial optical microscope. The resolution and tracking ability of the modified microscope was then tested. Results demonstrated that, three dimensional tracking with nano-resolution and ten-microns responding range in z axis is achieved successfully. Real multi-particle tracking in live cell was also achieved with this microscope. Several quantum dots moving in a live macrophage were tracked simultaneously.

SURFACE-ENHANCED RAMAN SCATTERING-BASED BIODETECTION

Jian Ye, Shanghai Jiao Tong University, China

Abstract: Surface-enhanced Raman scattering (SERS) effect boosts the Raman signals of adsorbates on the surfaces of metallic nanostructures when their plasmon resonances and consequently an enhanced near field are excited at the wavelength of the stimulating laser beam. Two important features of SERS of (1) a large enhancement factor up to 10^11 (even a single molecule detectable) and (2) high specificity due to the “fingerprint” Raman vibrational bands, enable its promising application in the detection of biomolecules.

In this talk, several strategies for the design and fabrication of SERS substrates to achieve high SERS performance will be discussed. We have also examined the strong localization of SERS on single symmetry-reduced plasmonic nanoparticles using carbon nanoparticles made by the e-beam induced deposition (EBID) method as a Raman reporter. The investigation of the spatial inhomogeneity of SERS is of high importance for its theoretical interpretation and use for single molecular detection. With suitable substrates, SERS-based detection of three types of biological units including small molecules, DNAs, and cancer cells have been demonstrated.

OPTICAL REGULATION OF PROTEIN EXPRESSION IN TARGETED CELLS BY FEMTOSECOND LASER IRRADIATION

Hao He, Shanghai Jiaotong University, China

Abstract: Direct regulation of cell signaling is a very attractive challenge to life science by which people can control positively cellular processes and thus benefit to biological research and potential medical application such as cell biology, cell development, gene therapy, and biopharmaceutical production [1]. In traditional biological research, a lot of biochemical approaches have been developed for modulation of cell signaling pathways, functions, and physiology, for example, transfection, gene knockdown, siRNA, optogenetics and stimulation with specific signaling proteins. A main drawback of those methods is the concern of biological safety, which greatly limits the clinical application to human beings because those methods are all invasive and out of control [2]. In this report, we present an all-optical method to modulate cell signaling and processes simply by femtosecond laser irradiation. Cellular Ca2+ store and reactive oxygen species (ROS) can be released and regulated by a short flash of photostimulation. The cellular level of Ca2+ and ROS can be controlled [3]. Therefore we developed an optical method to regulate gene expression since some transcription factors can be activated by this optical treatment, by which some specific differentiation regulators in mesenchymal stem cells are upregulated for potential induced differentiation [4], as shown in Fig. 1.

Fig. 1. Proposed mechanism of femtosecond-laser-induced gene transcription. The Ca2+-sensitive signaling pathways like NFAT and/or CREB can be activated to initiate corresponding gene transcription by photostimulation. The cellular oxidative stress can be also controlled optically for activation of corresponding signaling like mitogen-activated protein kinases (MAPK). In this way, it is possible to use

femtosecond laser to activate/modulate gene expression in targeted cells.

The tightly focused femtosecond laser can further induce precise insult and oxidative flashes at single-mitochondrion level. Mitochondrial dynamics, including morphological changes, mitochondrial permeability transition pores, and mitochondrial membrane potential can be thus controlled by the precise stimulation. Localized translocation of Bax and cytochrome C as well as flashes of mitochondrial ROS can be regulated by such photostimulation. Hence we propose that femotosecond laser has a promising application potential in cell research, mitochondrial diseases, gene therapy, and stem-cell medicine.

TISSUE OPTICAL CLEARING FOR ENHANCING IN VIVO OPTICAL IMAGING

Dan Zhu, Huazhong University of Sci&Tech (HUST), China

Abstract: The optical technology has provided significant tool for molecular imaging and medical diagnosis with high sensitivity and resolution. However, the high scattering of turbid biological tissues limits the penetration of visible and near-infrared light in tissue, which affects its applicability in life science. The tissue optical clearing technique based on immersion of tissues into optical clearing agents with high refractive indices, hyperosmolarity and biocompatibility allows one to effectively control optical properties of tissues, leads to essential reduction of scattering, therefore, enhances the depth to which light penetrates in tissue, and currently attracts great attentions. This technique, combined with microscopical techniques has shown a great power for obtaining in vitro tissue microstructure with high resolution. enhancing the capabilities of optical imaging,. During the last several years, we have been focusing on developing in vivo tissue optical clearing methods, which could enhance capabilities of various optical imaging, such as imaging contrast, sensitivity and imaging depth, including laser speckle imaging for blood flow, hyperspectral imaging for blood oxygen, fluorescence imaging for cells, et al.

FUNCTIONAL NANOMATERIALS FOR MUTIMODAL IMAGING AND PHOTOTHERAPY OF HEPATOCELLULAR CARCINOMA

Ming Wu, Mengchao Hepatobiliary Hospital of Fujian Medical University, China; Xiaolong Liu, Mengchao Hepatobiliary Hospital of Fujian Medical University, China

Abstract: We have developed a series of multifunctional nanoprobes for targeted Hepatocellular Carcinoma (HCC) photothermal/photodynamic therapy and multimodal imaging. These nanoprobes have excellent biocompatibility, extremely low systematic toxicity, and could specifically target HCC cancer cells in vitro as well as specifically accumulate in tumor tissues with high dose in vivo. High imaging contrast enhancing ability and resolution, as well as excellent tumor-killing efficiency of these nanoprobes have been proved both in vitro and in vivo. Thus, these liver cancer targeting nanoprobes, which combine the functions of multimodal imaging and phototherapy, would be very promising agents for clinical applications.

OPTICAL COHERENCE TOMOGRAPHY (OCT) IN DERMATOLOGY

Zheng Huang, Fujian Normal University, China

Abstract: Optical coherence tomography (OCT) is a noninvasive cross-sectional imaging method that offers a high resolution 3-D structural view into the superficial layers of the skin. Modern OCT based on low-coherence interferometry employing a near-infrared or infrared light source allows a better penetration into the skin, a scattering medium. OCT can provide useful diagnostic information for numerous clinical conditions, therefore a valuable addition to other imaging modalities such as dermoscopy, high-frequency ultrasound, and confocal laser scanning microscopy. We have investigated the usefulness of different OCT systems and techniques for the evaluation of various skin lesions in animal models. This presentation will provide an overview on our ongoing study.

NANO GOLD: ONE MOST PROMISING INORGANIC NANOMATERIAL FOR CLINICAL TRANSLATION

Rui Hu, Shenzhen University, China; Junle Qu, Shenzhen University, China

Abstract: Nanomaterials have shown great potential in translational medicine for disease treatment due to their theranostic advantages. In recent years, inorganic nanomaterials have been receiving increasing attention for their size-dependent physicochemical properties. Among these inorganic nanomaterials, gold nanoparticles showing unique optical properties have been considered as one of the most promising candidates for clinical translation. In this talk, the advantages of using gold nanoparticles for biomedical applications will be introduced, where some recent results using gold nanoparticles for bioimaging and drug delivery will be discussed. In addition, challenges, especially the toxicity related issues of using gold nanoparticles will also be included.

DEVELOPING OPTICAL PROJECTION TOMOGRAPHY FOR 3-D IMAGING OF MESOSCOPIC SAMPLES

Lingling Chen, Shenzhen University, China

Abstract: There is an increasing trend in biomedical research towards in situ measurements, both ex vivo and in vivo, employing 3-D structural and functional imaging. For samples in the “mesoscopic” regime (1-10 mm), such as animal/embryo/engineered tissue, a number of imaging techniques have been developed including optical projection tomography (OPT). In this talk, I will describe the development of OPT systems, such as angular multiplexed OPT and remote focal scanning OPT, designed to improve image quality, resolution and acquisition time. I will also show a number of applications using the OPT system and its extension to obtain useful information in “mesoscopic” samples.

FUNCTIONAL NANOMATERIALS FOR MUTIMODAL IMAGING AND PHOTOTHERAPY OF HEPATOCELLULAR CARCINOMA

Ming Wu, Mengchao Hepatobiliary Hospital of Fujian Medical University, China; Xiaolong Liu, Mengchao Hepatobiliary Hospital of Fujian Medical University, China

Abstract: We have developed a series of multifunctional nanoprobes for targeted Hepatocellular Carcinoma (HCC) photothermal/photodynamic therapy and multimodal imaging. These nanoprobes have excellent biocompatibility, extremely low systematic toxicity, and could specifically target HCC cancer cells in vitro as well as specifically accumulate in tumor tissues with high dose in vivo. High imaging contrast enhancing ability and resolution, as well as excellent tumor-killing efficiency of these nanoprobes have been proved both in vitro and in vivo. Thus, these liver cancer targeting nanoprobes, which combine the functions of multimodal imaging and phototherapy, would be very promising agents for clinical applications.

ULTRAHIGH SPEED OPTICAL COHERENCE TOMOGRAPHY IMAGING

Ping Xue, Tsinghua University, China

Abstract: Optical coherence tomography (OCT) has attracted much attention after it was introduced in the 1990s. This cross-sectional imaging technique may provide depth-resolved information of bio-tissues with micron-scale resolution in a non-invasive manner and therefore has been widely used in clinic. Nowadays, there is an increasing need for real-time volumetric imaging in OCT-based clinical diagnosis.

However, the slow data acquisition of early time-domain OCT systems in the range of ~1 kHz A-scan rate limited the imaging speed to only several frames per second. The introduction of frequency-domain or Fourier-domain (FD) detection techniques, categorized in two main classes as spectral-domain OCT (SD-OCT) and swept-source OCT (SS-OCT), has led to a dramatic increase in imaging speed and sensitivity. However, to realize real time 3D optical coherence tomography imaging, there are still several challenges in optical source, detection scheme, data processing and etc., due to the acquisition and processing of massive data of >1GB/s required by real time 3D display.

In this talk, I will discuss and demonstrate some new progress on the solutions related to these challenges.

TEMPORAL FOCUSING PARALLEL FABRICATION AND HIGH SPEED PULSE SHAPING BASED ON DIGITAL MICROMIRROR DEVICES

Shih-Chi Chen, The Chinese University of Hong Kong, Hong Kong

Abstract: This seminar presents (1) the development of a depth-resolved parallel laser machining method based on temporal focusing, and (2) a digital micromirror device (DMD)-based Ultrafast Pulse Shaper, i.e. DUPS. Both techniques are realized through the application of a DMD in combination with ultrashort pulse lasers. In the first part, we will demonstrate submicron resolution arbitrary 2D/3D patterning on silicon and metal substrates, where depth control capability is theoretically and experimentally proved. In the second part, we demonstrate the superior speed advantages of DUPS, modulating high repetition rate laser sources at up to 32 kHz with high damage threshold that is critical for high pulse energy or high average power laser applications.

LABEL-FREE AND NONINVASIVE DETECTION OF MELANOMA METASTASIS BY PHOTOACOUSTIC FLOW CYTOMETRY

Xunbin Wei, Shanghai Jiao Tong University, China

Abstract: Melanoma is the most serious type of skin cancer in the world. It accounts for about 80% of deaths of all skin cancer. For cancer detection, circulating tumor cells (CTCs) serve as a marker for metastasis development, cancer recurrence, and therapeutic efficacy. Melanoma tumor cells have high content of melanin, which has high light absorption and can serve as endogenous biomarker for CTC detection without labeling. Here, we have developed an in vivo photoacoustic flow cytometry (PAFC) to monitor the metastatic process of melanoma cancer by counting CTCs of melanoma tumor bearing mice in vivo. To test in vivo PAFC's capability of detecting melanoma cancer, we have constructed a melanoma tumor model by subcutaneous inoculation of highly metastatic murine melanoma cancer cells, B16F10. In order to effectively distinguish the targeting PA signals from background noise, we have used the algorithm of Wavelet denoising method to reduce the background noise. The in vivo flow cytometry (IVFC) has shown a great potential for detecting circulating tumor cells quantitatively in the blood stream. Compared with fluorescence-based in vivo flow cytometry (IVFC), PAFC technique can be used for in vivo and noninvasive detection of circulating tumor cells (CTCs).

VOLUMETRIC IMAGING IN SCATTERING MEDIA WITH TWO-PHOTON EXCITATION AND SCANNED BESSEL BEAMS

Tong Ye, Clemson University, United States

Abstract: We introduce a new volumetric imaging method that uses the principle of stereoscopy and the extended depth of field (EDOF). To demonstrate the method, we use Bessel beams to replace the commonly used Gaussian beams in two-photon excitation fluorescence microscopy. The EDOF of the Bessel beam and two-photon excitation provides an efficient way to acquire volumetric images of scattering samples. We have also implemented a novel scanner and written related scanning control software so that 3D stereoscopic imaging can be performed with tilted Bessel beams. This design has dramatically improved focusing qualities and imaging speed so that the two-photon fluorescence stereomicroscopy (TPFSM) can be performed potentially in real-time to provide 3D visualization in scattering media without post image processing.

LASER SPECKLE CONTRAST ANALYSIS FOR MEASURING TISSUE PERFUSION

Lipei Song, Nankai University, China; Daniel Elson, Imperial College London, United Kingdom; Xueyan Wang, Second Affiliated Hospital of Tianjin University of TCM, China; zhen zhou, Second Affiliated Hospital of Tianjin University of TCM, China

Abstract: Laser speckle contrast analysis (LASCA) provides a quick and objective method to explore the mechanism of dermal disorders, stroke, retinal diseases, etc., and to evaluate the treatment effect based on monitoring the changes in blood circulation in the lesions. However LASCA measurement is sensitive to the detection environment, hence it is a qualitative method. In this presentation, the application of LASCA to monitoring blood circulation will be reviewed. Then the influence of optical parameters of LASCA system on contrast values as well as the compensation methods will be investigated so as to remove the detection bias.

HIGH-RESOLUTION OPTICAL MICROSCOPY SYSTEMS FOR LIVING CELL AND TISSUE STUDY

Wei Zheng, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China

Abstract: Developing high-resolution optical microscopy system which could capture structural and functional information from living cells and tissues will be desirable to biological studies. In this report, I will introduce three types of our new developed optical microscopy system which are time-resolved two-photon microscope, re-scan confocal microscope, and two-photon/photoacoustic multimodality microscope. Each one can provide high-resolution imaging capability to identify capillary vessels, cells and even subcellular organelles. Furthermore, each system can be employed in living cell and tissue studies. Some primary results about living cells and tissues using these microscopy systems will be presented and discussed.

DUAL MODE BASED MOLECULAR ROTORS FOR INTRACELLULAR MICROVISCOSITY IMAGING

Zhigang Yang, Shenzhen University, China; Junle Qu, Shenzhen University, China

Abstract: Abstract: Viscosity, as a crucial factor relating to diffusion controlled processes, plays an essential role in different biological activities, as well as in chemistry and related fields. Marked diffusion events generally occur in the interface region of heterogeneous fluid systems. In particular, in biological systems, viscosity plays a major role in determining various biological activities at the organismal and cell levels.1 For example, viscosity within cells is critical in manipulating transportations of nutrients and metabolic wastes, transduction of intra/intercellular signals, and interactions between biomacromolecules. A series of fluorescent molecular rotors with single detecting mode (e.g. FLIM or Fluorescence Ratiometry) have been recently developed to sense local viscosity inside cells, however, the precision and accuracy of the detecting results by such molecular rotors have never been concerned.2 And furthermore, the viscosity distributions in various sub-organelles were not discussed as well. For example, microviscosity in mitochondria has a great impact on the respiratory state and tricarboxylic cycles, indicating that mitochondrial matrix viscosity changes may largely interfere with mitochondrial metabolism.3 Abnormal variations of viscosity have been considered a pivotal contributor to or indicator of various severe diseases, such as atherosclerosis, diabetes, Alzheimer's disease, and even cell malignancy.4 We herein discuss the research progress in our group on novel molecular rotors with dual mode for biological viscosity measurement.5,6 The new molecular rotors can be used to sense the local viscosity in vitro/in vivo by FLIM and fluorescence ratiometry, simultaneously. The detection results are able to self-calibrate through the comparison of the results obtained by FLIM and fluorescence ratiometry, respectively.

APPLICATION OF SD-OCT IN IMAGING OF TUMOR BLOOD VESSELS IN MOUSE DORSAL SKIN WINDOW CHAMBER MODEL

Xiao Peng, Shenzhen University, China; Shaozhuang Yang, Shenzhen University, China; Bin Yu, Shenzhen University, China; Qi Wang, Shenzhen University, China; Danying Lin, Shenzhen University, China; Yiqun Ma, Shenzhen University, China; Peiqi Zhang, Shenzhen University, China; Junle Qu, Shenzhen University, China

Abstract: Optical coherence tomography (OCT) has been used to obtain microstructure images of tissue or blood vessel samples with several advantages, such as non-destructiveness, real-time imaging, high resolution and high sensitivity. Here, we built up a Spectral Domain OCT (SD-OCT) system with higher sensitivity and signal-to-noise ratio (SNR). Then, we used this system to observe the blood vessel distribution and blood flow in the dorsal skin window chamber of the nude mouse tumor model. To obtain a continuous data, we recorded the distribution images of blood vessels from the same mouse before and after tumor injection. Finally, we have obtained in vivo continuous distribution images of blood vessels of the tumor mouse model during around two weeks.

PREPARATION, CHARACTERIZATION AND PHOTO-THERMAL THERAPY APPLICATIONS OF THE FACILE SYNTHESIZED AG DECAHEDRAL NANOPARTICLES

Xiao Peng, Shenzhen University, China; Shuai Ye, Shenzhen University, China; Linchun Chen, Shenzhen University, China; wang guangsheng, Shenzhen University, China; Wei Yan, Shenzhen University, China; Jun Song, Shenzhen University, China; Junle Qu, Shenzhen University, China

Abstract: Ag nanoparticles with various nanostructures have been proved to be useful in chemo-thermotherapy in recent studies. Here, we developed a facile preparation of Ag decahedral nanoparticles which are structurally robust and biocompatible. The decahedral structure of these nanoparticles enables it to achieve high efficiency of light-heat transition. Therefore, the light of 488-nm wavelength activated photothermal conversion showed high efficacy of the Ag decahedral nanoparticles as a promising nanomaterials to inhibit cell growth or kill cancer cells, suggesting further chemo-thermotherapy applications.

SUPER-RESOLUTION FLUORESCENCE IMAGING OF MICROTUBULES DURING C2C12 CELL DIFFERENTIATION

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Abstract: The single molecule localization super-resolution microscopy, including stochastic optical reconstruction microscopy (STORM), photoactivated localization microscopy (PALM) etc., has been developed on the characteristics of molecules that can switch between “off” and “on” state in response to the incident lights with corresponding wavelengths. The spatial resolutions of these techniques are also affected with characteristics of these switchable molecules, e.g., photon numbers, blinking cycles etc. Because the properties of these molecules can easily change due to different environments or incident lights, it is important to optimize the proper parameters for each experiment. The environment parameters, such as label density and imaging buffer, which can affect the switching properties of molecules, have been extensively discussed in former studies. In this paper, we used different light powers to activate the same molecule in the same environment to obtain STORM imaging for evaluating the response of single molecule at different light power. Our imaging results demonstrated that the incident light changes led to the changes of the molecule profiles, which is reliable to figure out suitable light parameters for improving STORM imaging experiments. Then we used the optimized parameters for observing the changes of the cell cytoskeleton during C2C12 differentiation.

RECENT ADVANCES IN FAST SUPER-RESOLUTION OPTICAL NANOSCOPY

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Abstract: Super-resolution microscopy opens up a new era for visualizing the dynamic subcellular structure and interaction in a whole new scale. Here we report several advances to enable super-resolution optical fluctuation imaging (SOFI) with high spatiotemporal resolution (via JT-SOFI), better 3D imaging capability (via 3D-MUSIC), and improved in vivo imaging capability with Skylan-S.

INFLUENCE OF ABSORPTION AND SCATTERING COEFFICIENTS ON SINGLET OXYGEN LUMINESCENCE IN SKIN-STIMULATING PHANTOM

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Abstract: The influence of absorption and scattering coefficients on singlet oxygen luminescence during photosensitization in skin-stimulating phantom was quantitatively evaluated. For this, aluminum phthalocyanine disulfonic acid (AlPcS) was utilized as the model photosensitizer, and India ink and 20% Intralipid were chosen as the absorber and scatterer for optical phantom, respectively. An custom-built time and spectral-resolved near-infrared (NIR) detection system was used for singlet oxygen luminescence measurements in which spectral signal discrimination can be achieved using three bandpass-filters centered at 1230, 1270 and 1310 nm. As compared to AlPcS diluted in pure absorption solution, the intensity of singlet oxygen luminescence, and the lifetimes of AlPcS triplet state and singlet oxygen were varied significantly as the increase of absorption and scattering coefficients of skin-stimulating phantom. The results indicate that the scattering will cause evident artifact for signal detection, and the real singlet oxygen luminescence could be only determined by subtract NIR background signal from the control sample, while subtraction using NIR background signal obtained from the reference filters 1230 and 1310 nm is not reliable for skin-stimulating phantom. This study implies that NIR background signal from control sample in vitro or lesion in vivo is required to quantify singlet oxygen production during photosensitization.

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